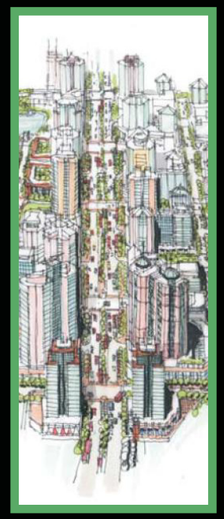
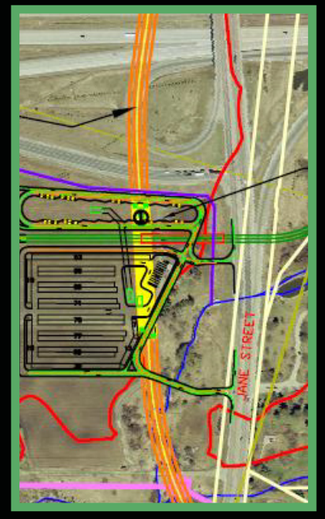
HIGHWAY 7 CORRIDOR & VAUGHAN NORTH-SOUTH LINK PUBLIC TRANSIT IMPROVEMENTS

Response to Conditions of Approval
Vaughan N-S Link Subway Alignment Optimization





York Region Rapid Transit Plan June 2007

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1. INTRODUCTION

York Region's *Official Plan* places a strong emphasis on increasing public transit use to accommodate future transportation needs and support the Plan's vision of sustaining the natural environment, optimizing economic vitality and ensuring healthy communities. The Region's 2002 Transportation Master Plan identified four (4) corridors in the Rapid Transit Network, as shown in Figure 1-1: York Region Rapid Transit Network. Transportation and environmental planning studies for the Highway 7 Corridor and the Vaughan North-South Link commenced in August 2002 and continued through 2003 and 2004. On June 30, 2004, the Ministry of the Environment (MOE) approved the Terms of Reference for the Environmental Assessment of Public Transit Improvements in the Highway 7 Corridor and Vaughan North-South Link (herein referred to as the **York Region Highway 7 & VNSL EA**). Following the Terms of Reference approval, the EA studies were continued during 2004 and 2005 and assembled to form the Region's Highway 7 & VNSL EA Report.

Figure 1-1
York Region Rapid Transit Network

1.1 MOE CONDITIONS OF APPROVAL

On September 2, 2005, the Highway 7 & VNSL EA Report was filed with the MOE. The standard EA review process followed the steps outlined in Table 1 below:

Table 1: Highway 7 & VNSL EA Review Process

Activity	Period/Date
EA Report filed with the MOE	Sept. 2, 2005
Public and Government review period	Sept. 2, 2005 to Oct.26, 2005
Proponent review of comments and preparation of responses to comments	Nov. 2005 to May, 2006
Proponent submittal of responses to comments and supplemental information to address issues about the preferred subway alignment	May 8, 2006
Ministry of Environment (MOE)'s Review (i.e. bluebook review)	May 9, 2006 to July 7, 2006
Notice of Completion of Review	July 7, 2006
Period for Public Comment on Ministry's review	July 21, 2006 to Aug. 25, 2006
MOE staff recommendation to Minister	November 2006
Minister's approval of EA	November 29th, 2006

The MOE's Approval of the the Highway 7 & VNSL EA included nine (9) Conditions of Approval. One of the conditions which pertains to the optimum alignment is the subject of this report and is recorded as follows:

"8.0: Selection of the Optimum Location for the Alignment

8.1 For the purpose of selecting the optimum location for the alignment of the subway connection to the city of Toronto and Toronto Transit Commission's Spadina Subway alignment the Proponent shall follow a public process to determine the amended location for the alignment of the subway undertaking south of Highway 407 required to tie into the Toronto transit Commissions station and rail track alignment at the York Region transit terminal site on Steeles Avenue."

This Subway Alignment Optimization Report summarizes the alternatives analysis, the public process that was carried out, the consultation with the public and agencies and the commitments made by the proponent, York Region to mitigate any effects of the final location of subway facilities. The specific MOE requirements are listed in TABLE 2, along with a reference to where that condition is met within this report. A more detailed description of the report sections is provided in subsection 1.4.

Table 2: MOE Conditions of Approval Requirements

Condition	Report Section
8.1 Determine amended location for the alignment of the subway undertaking south of Highway 407.	Entire Report
a) A description of the local existing built and natural environment through which the alignment must pass to achieve the tie-in. Sensitive natural features and constraints on the design, such as the Black creek and groundwater conditions, will be identified and documented in detail.	Section 2.1Considerations for development of Alignment Alternatives; and Section 4: Assessment of Effects
b) An analysis and evaluation of subway horizontal and vertical alignment options, both above and below ground, through the approximately 800 metre tie-in zone. The evaluation will use the methodology adopted for the EA, measuring the alternatives against the primary objectives and goals and highlighting the advantages and disadvantages of each option.	Section 2.3 Description of Alignment Alternatives; and Section 2.4: Assessment of Alignment Alternatives
c) Identification of the preferred location for future Highway 407 Station on the subway alignment and accommodation of surface facilities associated with this station to achieve intermodal transfer.	Section 3.3: Highway 407/Jane street Station
d) Finalization of the preferred functional design for Highway 7 terminal station and associated surface facilities based on the City of Vaughan's current VCC planning and including relocation of the surface rapid transit station on Highway 7 at Jane St.	Section 3.4: VCC (Highway 7/Millway) Station
e) Assessment of the effects of construction of the alignment works and operation of subway service on the environment and description of proposed mitigation and monitoring measures.	Section 4: Assessment of Effects
f) Assessment of the effects of construction and operation of Highway 407 and Highway 7 station facilities on the surrounding environment.	Section 4: Assessment of Effects
g) Meetings with a Technical Advisory Committee (TAC) to obtain input and acceptance of recommendations by key stakeholders. The composition of the TAC will be confined to municipal representatives from Vaughan only, given that the supplementary work relates only to the Vaughan North-South Link.	Section 6: Public and Agency Involvement
h) Public Consultation opportunity to obtain comment on the evaluation of alternatives and the recommended preferred design.	Section 6: Public and Agency Involvement
i) Responses to the public, stakeholder and government review team comments during review of the supplemental work.	Appendix C: action for Comments received from the Government Review Team
8.2. Preparation and submission of a report documenting the findings of the study and commitments to mitigation and monitoring of any adverse environmental effects.	All Sections of this Report
8.3 Place Report on Public Record for 30 days within 30 days of Report completion.	Will be done at the same time this Report is submitted to MOE
8.4 Shall not proceed with the construction of the subway undertaking unless the minister, having considered the Report, any public comments regarding the Report and the public interest, approves its construction.	Understood.

1.2 HIGHWAY 7 CORRIDOR & VAUGHAN NORTH-SOUTH LINK EA SUBWAY RECOMMENDATIONS (AUG. 2005)

York Region's EA study Terms of Reference included an assessment of a potential extension of the TTC's Spadina Subway from the York Region boundary north of York University to Vaughan's planned Corporate Centre at Highways 400 and 7 in response to both a request by the City of Vaughan and the Region's Centres and Corridors Strategy initiatives.

Chapter 12 of the Region's EA Report documented the development and evaluation of subway extension alternatives including an analysis of, and recommendations for, future route, alignment and station options for subway technology on the VNSL. The following provides a brief summary of the recommendations included in Chapter 12.

1.2.1 Vaughan Corporate Centre Station Location

Based on the findings of a previous VCC study (*Vaughan Corporate Centre Transportation/ Transit Planning and Functional Design Study*) the Region's EA recommended the **Millway Alignment** (see **Figure 1.2**) as the preferred alignment north of Highway 407 within which the higher order transit service could be provided. Its merits include flexibility of transit technologies and excellent coverage of the VCC node as well as acceptable inter-connection of transit service going to and from the west along Highway 7.

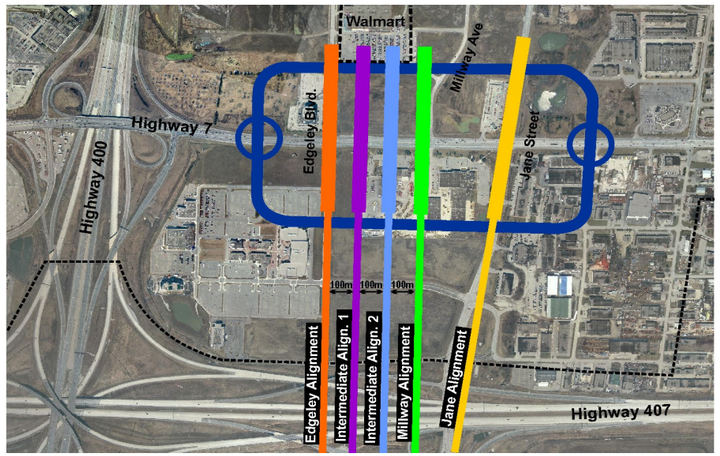


Figure 1-2
Vaughan Corporate Centre Station Location Alternatives

1.2.2 Identification of Alternative Routes

Based on existing rights-of-way opportunities identified by the City of Vaughan's Higher Order Transit Corridor Protection Study, six main routes (A, B, C, D, E, F) were adopted for further evaluation. The routes were evaluated using criteria under the following categories: transportation design, transportation service, social environment, natural environment, land use, implementation and cost. Based on this analysis, the EA recommended that both Routes A and B be considered further given that they both provided a reasonably direct link to the university and a high level of service to the future 407 Transitway. In addition, they both serve future adjacent developments well and promote further intensification opportunities.

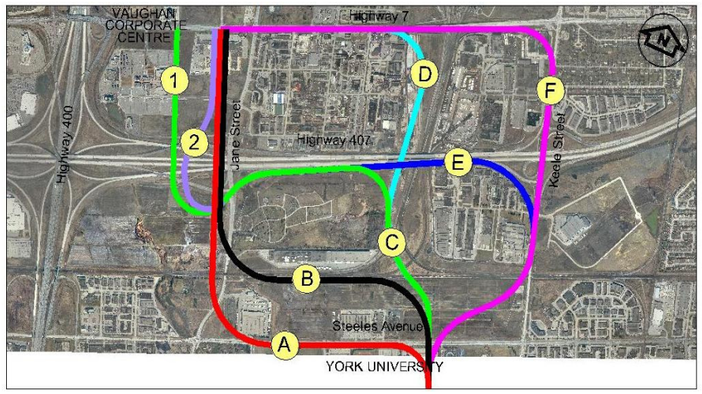


Figure 1-3
Route Alternatives between Vaughan Corporate Centre and York University

1.2.3 Analysis of Alternative Alignments

Having established that the most appropriate routes for a rapid transit service connecting the VCC to York University were routes A and B, the study then analyzed and evaluated a total of five alignment alternatives as shown in Figure 1-3:.
The alignment evaluation consisted of two stages. Stage 1 assessed the various alternatives within the two identified travel routes to select a preferred alignment within each, based on a set of key criteria. Alignment A-1 shown, was selected as the preferred Route A alignment and Alignment B-1 as the preferred Route B alignment.

The Stage 2 Evaluation compared alignments A-1 and B-1 using a full range of criteria including transportation design, transportation services, social and natural environment, land use, implementation and cost[1]. This evaluation resulted in the identification of the preferred option: **Alignment A-1**: a North-South alignment to an East-West oriented Steeles Avenue Station.

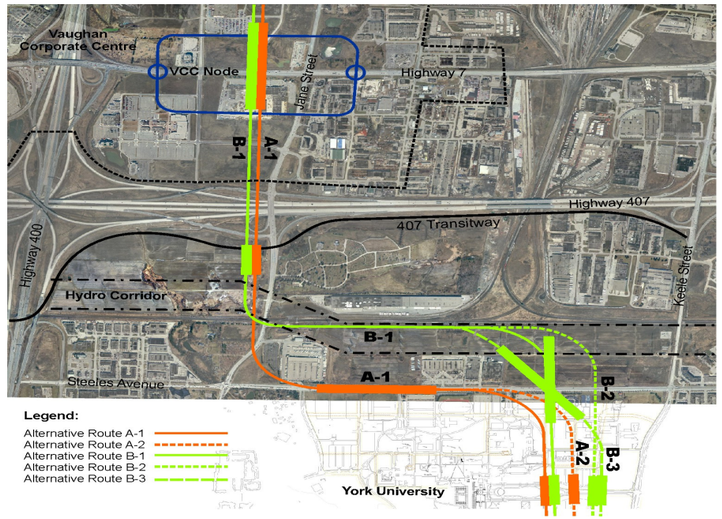


Figure 1-4
Alignment Alternatives between VCC and York University

At the time of completion of the Highway 7 Corridor EA the TTC/City of Toronto EA study had not yet identified the preferred alignment for the subway south of Steeles Avenue. Hence it was not possible to confirm that the preferred subway alignment A-1 selected in the Region's EA study and shown in **Figure 1-5** would be compatible with the alignment south of Steeles Avenue selected through the TTC/City of Toronto EA.

Subsequently, the TTC's EA study identified three potential alignments on which the subway could reach the Region's terminal site. The TTC work indicated that the preferred horizontal and vertical alignment of the Toronto subway extension would fall within the yellow shaded zone shown in **Figure 1-5** between Highway 407 and Steeles Avenue.

Therefore the York Region EA sought approval of the underground Alignment A-1 with the option of amending, where necessary, the portion south of Highway 407 to tie into the approved TTC station and tail track alignment at the York Region Transit Terminal site.

- [1] The evaluation is described in detail in the York Region VNSL EA Report, Section 12.4.2.2.

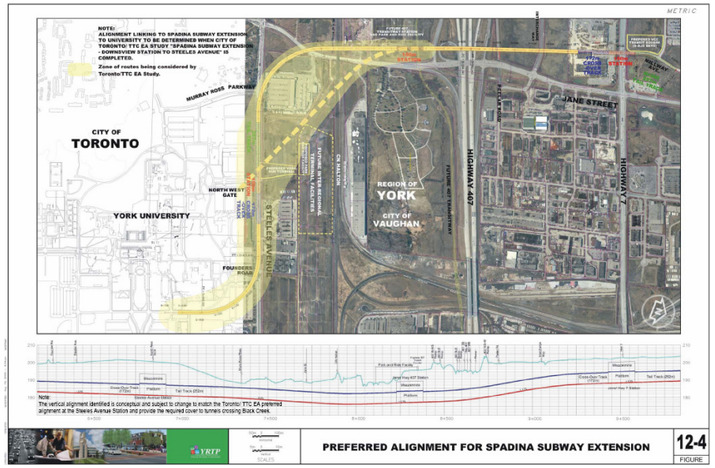


Figure 1-5
York Region EA - Recommended Subway Alignment

1.3 HWY 7 & VNSL EA CONDITIONS OF APPROVAL AND THE TTC SPADINA SUBWAY EXTENSION EA

The City of Toronto and Toronto Transit Commission (TTC) Spadina Subway Extension Environmental Assessment (herein referred to as the **TTC EA**) is a key component of the Vaughan North-South subway link, in that it sets the southern terminus and starting point for York Region's EA study. At the time the York Region VNSL EA was filed with the MOE (August, 2005), TTC's EA study had identified three potential alignments for the Spadina Subway Extension to York University shown in Figure 1-6 below.

Since the York Region VNSL EA was filed with the MOE (August 2005), the TTC completed the evaluation of the subway alignments south of Steeles Avenue. The final TTC Spadina Subway Extension EA Report (filed with the MOE in February 2006) identified the preferred alignment as alternative N3. This alignment crosses Steeles Avenue in a north westerly direction and is described in the EA Report as follows:

"Alternative N3: Runs under the Keele Street right-of-way up to The Pond Road and in a direct alignment between Keele Street and Steeles Avenue West, passes under the existing Schulich School of Business and York Lanes buildings. The proposed York University Station platform would be located at the east end of the Common between the Schulich and York Lanes buildings. Steeles West Station would be centred on Steeles Avenue, with a north-west to south-east orientation."

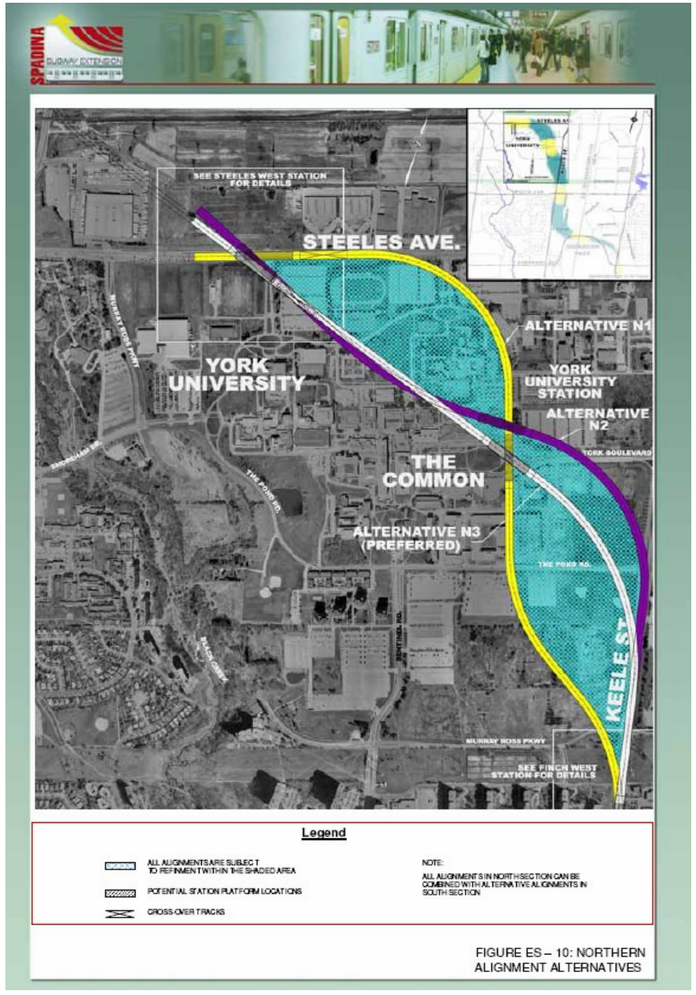


Figure 1-6
Toronto/TTC EA Alignment options

While the recommended VNSL alignment (A-1), as described in the York Region VNSL EA (August 2005) is not compatible with this alignment, due primarily to the orientation of the Steeles Avenue Station, the TTC's preferred alignment N3 is within the shaded zone (Figure 1-5) on the eastern side. As such, there is a need to develop an optimum alignment north of the Steeles West Station to achieve a tie-in to the final TTC alignment recommendation.

This report, the- *Highway 7 Corridor and VNSL EA: Subway Alignment Optimization Report* (hereon referred to as the **Subway Alignment Optimization Report**), describes the supplementary analysis that has been conducted since the completion of the TTC Spadina Extension EA, in order to develop the VNSL tie-in subway alignment.

This Subway Alignment Optimization Report should be read in concert with the York Region Hwy 7 Corridor and VNSL EA Report (August 2005). The Report is considered an extension of Chapter 12 and is intended to provide additional information pertaining specifically to the subway undertaking through the shaded zone shown in Figure 1-5 taken from Chapter 12 of the original York Region EA Submittal.

The purpose of the report is to provide a recommendation for the optimum subway alignment between the TTC recommended Steeles Avenue Station and Highway 7 (i.e. the VCC station), as well as, an update of the environmental effects of the recommended alignment. The York Region Hwy 7 Corridor and VNSL EA Report provides the necessary background information, description of high level alternatives, travel demand forecasts and analysis of alternatives for the overall corridor

1.4 SUBWAY ALIGNMENT OPTIMIZATION REPORT STRUCTURE

The remainder of this report is structured as follows:

Section 2- Analysis of Alignment Alternatives provides an overview of the subway service and operational needs that provide context for the preferred undertaking, including a list of requirements and constraints related to the affected stakeholders. Alignment alternatives are developed, as necessary, using TTC standard "alignment design criteria" (vertical and horizontal).

This section also describes the evaluation criteria and the results of the alignment evaluation. The evaluation considers the response of the alignment alternatives to the requirements and constraints and concludes with the selection of the preferred alignment.

Section 3 - Description of the Undertaking, describes the characteristics and elements of the preferred subway alignment including geometric characteristics and rail infrastructure. It also provides a description of the station requirements (operational and physical) and the proposed station components including bus facilities, parking, and station access facilities.

Section 4- Assessment of Effects includes a description of the existing environment and the evaluation of environmental effects and corresponding mitigation measures associated with the proposed VNSL subway extension. The effects are classified according to the following: pre-construction impacts; construction impacts; and operations and maintenance impacts. Effects are assessed under each of the following categories: Transportation service or mobility improvement, the social environment, the natural environment and smart growth/economic development.

Section 5, Implementation, outlines potential construction methods using standard construction equipment and techniques. Potential staging strategies are outlined and the anticipated duration of the project is discussed. This section considers design, construction, testing and commissioning. Finally, order-of-magnitude cost estimates are presented. It should be noted that this section provides recommendations for the implementation only. Recommendations will include a procedure to enable alignment refinements to be accommodated during the detailed design stage when necessary.

Section 6, Public and Agency Involvement, describes the process and results of the public and agency / stakeholder consultation effort. Additionally, all meetings with specific interest groups (for example, TTC, GO Transit, Brampton Transit, MTO, YRT, 407 ETR, TRCA, City of Vaughan and Hydro) that were held to deal with local issues, are described. The section summarizes the information that was presented at each meeting; comments, concerns, questions, and/or issues that were raised; and follow-up activities.

2. ANALYSIS OF ALIGNMENT ALTERNATIVES TO TIE INTO TTC'S PREFERRED ALIGNMENT

This section describes the analysis and evaluation of the alignment alternatives available to link York Region's preferred subway alignment across Highway 407 to the preferred alignment at Steeles Avenue identified by the TTC's EA study.

2.1 CONSIDERATIONS FOR DEVELOPMENT OF ALIGNMENT ALTERNATIVES

Key requirements that were identified for consideration in the development of VNSL alignment alternatives to tie into the TTC's preferred alignment at Steeles Ave. are discussed below.

1) Stations

A primary requirement of the VNSL alignment is that it must connect three stations along the extension:

- Vaughan Corporate Centre Station: This is the preferred northern terminus of the subway extension. It provides a connection to the core of the Vaughan Corporate Centre (VCC) and a linkage to the York Region Transit (YRT) local and BRT (Viva) bus services.
- Hwy 407 Station: This station provides a future connection to the MTO Transitway (subject of a future EA study), a GO Transit and YRT transit transfer facility and a park-and-ride facility.
- Steeles West Station: This station at the southern end of the VNSL is the link to the TTC network. The preferred concept is discussed and described in the TTC Spadina Subway Extension EA Report.

2) Triple Track

Since the Spadina Subway will extend to Highway 7, TTC requested the addition of a triple track arrangement in the vicinity of the Steeles West Station. The triple track structure allows trains to reverse direction at the station in order to operate different train headways north and south of the station. The triple track also provides storage opportunity in cases of emergency. The structure requires a tangent section of track and preferably, should be constructed using "cut and cover" construction methods. There is limited opportunity to accommodate a tangent section of triple track in the vicinity of the Steeles West station due to the proximity of building structures both north and south of Steeles Avenue. It is proposed to accommodate the Triple Track Structure between the existing York University Sports building south of Steeles Avenue and the future UPS expansion building on the north side. The triple track location and arrangement will be defined during the design phase.

3) Hydro Corridor

The alignment that follows a tangent north from the TTC's proposed Steeles West Station crosses diagonally under the Hydro Corridor which consists of two 500 kV and one 230 kV line. There is a V75 high-voltage Hydro Tower located approximately 100 meters north of the TTC's Triple Track Structure, which has a 14 metre deep foundation. North of the 75V corner tower, there are several other towers with shallower foundations fluctuating between 5 and 8 metres in depth according to the available information. Hydro One, in an August 30, 2006 letter, indicated that any impact to the Corridor should be avoided if possible.

4) UPS Facility

There is a large United Parcel Service (UPS) facility located at 2900 Steeles Ave W – the north-east quadrant of the Steeles Ave. and Jane St. intersection. UPS has submitted plans to expand their facility within the next few years. Since the VNSL subway is expected to be constructed after the new UPS facility is built, it will not be possible to use cut and cover subway construction methods under their future building expansion plans.

5) Black Creek and the Black Creek Flood Plain

All feasible alignments will require tunnelling under Black Creek. TRCA has stated that tunnelling may be feasible as long as proper construction methods and de-watering techniques are used. The cut-and- cover station should be located out of the fill regulation limit if possible, however, under extremely controlled conditions, TRCA may accept temporary excavation and backfill and reinstatement of small areas within the fill regulation limits, subject to their prior approval; nevertheless, TRCA does not support at grade construction of facilities within the flood plain; consequently at grade facilities such as park and ride/passenger pick-up/drop-off areas and bus terminals are to be located outside the estimated flood plain.

6) MTO 407 Transitway

The Ministry of Transportation (MTO) is in the early planning stages for the 407 Transitway. The Transitway Property Protection Study provided a conceptual alignment and identified recommended station locations. One of the main stations identified in this study is located in the same vicinity as the 407 VNSL subway station, and is intended to support coordinated inter-modal services. The VNSL alignment options developed in this study must assure the physical and operational integration of both facilities.

7) 407 ETR Right-of-Way

Due to both safety and legal concerns, the 407 Electronic Toll Road (ETR) opposes the construction of any subway infrastructure on the Highway 407 right-of-way (ROW). One of the concerns is the presence of ventilation shafts and/or emergency exits within the ROW. Should an emergency require evacuation, this could result in people and emergency services having to be within the ROW, which presents a safety concern.

407 ETR is also concerned with the potential for subway construction activities disrupting the traffic safety and operation of the Highway 407 and Jane Street ramps. As a result, tunnelling activity is feasible but cut-and-cover construction is not acceptable within 407 ETR jurisdiction.

8) VCC Official Plan Easement

All alignment alternatives **must respect** the 23 metre easement set out in the City of Vaughan's Official Plan Amendment for the area north of Highway 407.

2.2 ALIGNMENT DESIGN CRITERIA

Fundamental design criteria (related to both track and station requirements) employed in the development of each alignment alternative are based on the Toronto Transit Commission's (TTC) Design Manual. A summary of the horizontal design criteria is presented in Table 2-1 below.

Table 2-1: Summary Of Subway Geometric Design Criteria

Horizontal Alignment	
➢ design unbalanced speed	80 Km/h
➢ superelevation	100 mm
➢ minimum spiral length	70 m
➢ absolute minimum horizontal curve radius (used only with TTC approval in special circumstances)	300 m
➢ desired minimum horizontal curve radius	600 m
➢ minimum length of circular curve	23 m
Vertical Alignment	
➢ maximum gradient of main-line track	± 3.5%
➢ minimum gradient of main-line track (for drainage purposes)	± 0.3%
➢ gradient through stations	± 0.3%
➢ minimum length of constant profile grade	150 m.
➢ tunnel diameter inside	5.2 m
outside	5.65 m
➢ minimum depth of cover: top of box structure to grade	3.0 m
top of station structure to grade	3.0 m
top of tunnel to grade	1.5-2 tunnel dia. ~ 8 m

2.3 DESCRIPTION OF ALIGNMENT ALTERNATIVES

2.3.1 Horizontal Alignment Options

Responding to the alignment constraints and requirements, and based on the TTC horizontal and vertical design criteria listed above, several alternatives were investigated from which four alignments were selected for further consideration. These are described below and shown in Figure 2-1.

Alignment 1

This alignment begins at the north end of the Triple Track Structure and supports the required design speed of 80km/h. The proposed Hwy 407 Station ends right at the Black Creek fill regulation area border. As a result it may require a slight temporary excavation and backfill within the fill regulation limits (i.e. the southeast corner of the station) with prior approval of TRCA. This alignment option has no affect on the Hwy 407 ramps but would require tunnelling under one 500kV Hydro Tower with a relatively shallow foundation.

Alignment 2

This alignment begins at the north end of the Triple Track Structure and again supports a design speed of 80km/h. The proposed Hwy 407 Station has no effect on Black Creek; however the station would have to be under two Hwy 407 ramps. To avoid any surface openings within 407 ETR jurisdiction, the emergency exit and ventilation shafts would be routed out of the 407 ROW through underground passageway and ducts respectively, feasible but costly. This option would also require diversions that would disrupt traffic on the ramps during construction. Tunnelling near or under a Hydro tower is also required.

Alignment 3

This alignment begins at the north end of the Triple Track Structure and supports a design speed of 80km/h. Approximately 50% of the proposed Hwy 407 Station is located within the Black Creek fill regulation area. This alternative also impacts the N-E Hwy 407 ramp and has potential impacts to Jane street southbound traffic during construction. Tunnelling near or under a Hydro Tower is required.

Alignment 4

This shortest alignment begins at the north end of the Triple Track Structure shown in the TTC EA and also supports a design speed of 80km/h. The proposed Hwy 407 Station has a substantial effect on Black Creek as almost the entire station is inside the Creek's fill regulation area. Although this alternative has no impacts to the Hwy 407 ramps, it has a severe impact to Jane Street traffic during construction (as the proposed station crosses all lanes). Tunnelling near or under a Hydro tower is also required.

2.3.2 Vertical Alignment Options

The feasibility of vertical alignments (profiles) is governed by the relatively low maximum gradient for subway technology (3.5%), the maximum gradient at stations (0.3%) and the relatively short distance between the physical elements such as roads, railway lines and creeks that the alignment profile has to clear vertically. Both elevated and underground options were analyzed as well as combinations thereof. The analysis findings are summarized below.

2.3.2.1 Elevated Options

As shown on Figure 2-2, using the TTC EA's Steeles West Station track elevation as a starting point at the south end, a 3.5% grade to achieve the required clearance over CN Rail's Halton Subdivision tracks precludes insertion of a third track north of Steeles West Station for short-turning trains. Also, the rapidly rising tunnel would surface on privately-owned property south of the Hydro right-of-way. Proceeding north, the elevation required over CN tracks places the 407 Station more than 12m above grade in order to provide the required clearance over the N-W ramp on the north side of Hwy 407. After crossing the ramp, the profile grade to reach the desired elevation for an underground station at Hwy 7 would conflict with the existing Interchange Way grade and would require the Hwy 7 Station to be moved to the north side of the highway. Also, the turnback crossover would have to be moved to the less desirable location north of the station platform.

Generally, while feasible, the significant negative effects on property, Hydro One transmission lines and towers, Interchange Way and subway and station operations make this option unacceptable.

A combination of underground and elevated profile, also shown on Figure 2-2, accommodates the crossover and storage tracks but conflicts with the existing Jane Street grade after passing under CN Rail, precludes a station south of Hwy 407 and would have the same adverse impacts on Interchange Way and the Hwy 7 Station described above for the fully elevated option.

2.3.2.2 Underground Options

Given that the elevated options described above are not acceptable, the only possible vertical alignment is an entirely underground option which provides the desirable minimum vertical clearances to foundations and Black Creek. These vertical constraints are applicable to, and affect all horizontal alignment alternatives in a similar manner. As such, they do not influence the alignment selection, but only dictate the profile of the preferred option. This profile is shown on Figure 2 - 3

2.4 ASSESSMENT OF ALIGNMENT ALTERNATIVES

The subway alignments identified above were assessed and a comparative evaluation carried out based on the criteria tabulated below.

Table 1: Evaluation Criteria

Factor	Sub-factors
Transportation Design	1. Meets Horizontal alignment Design criteria 2. Meets Vertical alignment Design Criteria
Transportation Services	1. Connection to future 407 Transitway 2. Service to the Vaughan Corporate Centre 3. Overall accessibility and station location 4. Travel time 5. Commuter parking opportunities 6. Possible extension of service beyond the Vaughan Corporate Centre 7. Integration with local bus service
Social Environment	1. Effects on existing residents, businesses 2. Displacement of jobs/homes/businesses 3. Noise and vibration 4. Effects on the Beechwood Cemetery
Natural Environment	1. Loss of/disruption to the natural environment 2. Restriction of access to conservation and recreation lands
Cost Considerations	1. Length of alignment (measured from York Transit Terminal Station to VCC station) 2. Mitigation of effect on Hydro One facilities 3. Mitigation of effect on 407 facilities 4. Mitigation of effect on Black Creek 5. Mitigation of effect on existing roads/structures

2.4.1 Alternatives Evaluation

The alignment evaluation findings are presented in the table below.

Table 2.4.1: Alternatives Evaluation

Most Preferred ● ◕ ◐ ◔ ○ Least Preferred

	Alternative 1 – Preferred Alignment	Alternative 2	Alternative 3	Alternative 4
Transportation Design	Alignment complies with geometric and operational standards. ●	Alignment complies with geometric and operational standards. ●	Alignment complies with geometric and operational standards. ●	Alignment complies with geometric and operational standards. ●
Transportation Services	Allows physical and operational integration of 407 Subway Station with MTO Transitway Station. ●	Allows physical and operational integration of 407 Subway Station with MTO Transitway Station. ●	Allows physical and operational integration of 407 Subway Station with MTO Transitway Station. ●	Allows physical and operational integration of 407 Subway Station with MTO Transitway Station. ●
	Allows convenient passenger access to 407 subway station. ●	Passenger access to 407 subway station confined to south end. ◔	Passenger access to 407 subway station constrained by proximity to Black Creek. ○	Passenger access to 407 subway station constrained by proximity to Black Creek ○
Social Environment	407 Station mostly on ORC property. ◕	2/3 of the 407 Station on property under 407 ETR jurisdiction. ◔	1/4 of the 407 Station on property under 407 ETR jurisdiction. ◐	407 Station mostly on ORC property. ◕
	Jane St. and Hwy 407 interchange ramp diversion avoided. ●	Two Hwy 407 interchange ramps affected during construction ○	One Hwy 407 interchange ramp affected during construction. ◔	Hwy 407 interchange ramp diversion avoided. Requires diversion of Jane St. traffic during construction. ◔
Natural Environment	Potential for a limited temporary excavation and backfill within the Black Creek fill regulation limits. (i.e. the southeast corner of the station). ◕	Only minor impact to Black Creek due to access road construction. ◕	50% of the Station within Black Creek fill regulation limits ◔	Almost all of the Station within Black Creek fill regulation limits ○
Cost Considerations	Mitigation to permit tunneling under one 500KV Hydro tower will increase construction cost. ◐	Mitigation to permit tunneling under one 500KV Hydro tower will increase construction cost. Costly ventilation shaft and emergency corridor to avoid any openings within 407 ETR easement. Major ramp diversions will further increase cost. ○	Mitigation to permit tunneling under one 500KV Hydro tower will increase construction cost. Temporary works to protect Black Creek and divert interchange ramp will add to 407 station construction cost. ◔	Mitigation to permit tunneling under one 230 kV Hydro tower will increase construction cost. Major temporary works to protect Black Creek and divert Jane Street traffic will add to 407 station construction cost. ◔

Note: Criteria for which all alternatives scored identically, have not been included in this table.

The selection of the preferred route focussed on determining the alternative that minimizes effects on major stakeholders such as TRCA, 407 ETR and Hydro One, while complying with TTC geometric and operational standards, and reducing traffic interference during construction. Note that all proposed Hwy 7 station locations provided connectivity to the Hwy 407/MTO Transitway.

Summary of Evaluation Results

Alignment 1 was selected as the preferred alternative for the following reasons:

- Effects on the 407 facilities and right-of-way are minimized due to deep tunnelling beneath the roadway and ramps;
- Both construction and operational effects on the Back Creek watercourse can be minimized and mitigated;
- Temporary disruption of traffic during construction is minimized as roadworks are confined to construction of a new signalized intersection and a right-in/right-out access to parking for the 407 Station;
- While tunnelling beneath one Hydro tower is unavoidable for all options, the tower foundation affected by Alternative 1 is the shallowest permitting the greatest cover over the subway tunnels;
- Complies with TTC geometric and operational standards, and presents minimum traffic interference during construction.

3. DESCRIPTION OF THE OPTIMIZED VNSL SUBWAY EXTENSION

3.1 SUBWAY ALIGNMENT AND RUNNING STRUCTURE

This section describes the characteristics and elements of the undertaking developed in meeting the Conditions of Approval for the Region's Highway 7 and Vaughan North-South Link Environmental Assessment.

The Undertaking comprises the construction, operation and maintenance of the Vaughan North-South Link (VNSL) portion of the Spadina Subway Extension, from the Steeles West Station on the Toronto municipal boundary to Highway 7 and Millway Avenue intersection in the future Vaughan Corporate Centre (VCC) as illustrated in Figure 3-1.

The Vaughan North-South Link (VNSL) Subway alignment starts just north of the Steeles West Station at the northern limit of the recommended alignment developed in the City of Toronto/TTC EA of the Downsview to Steeles Avenue Spadina Subway Extension. The alignment follows a 405 m long tangent section of track in a northwesterly direction across the northeastern corner of the UPS property.

The twin tunnel subway alignment continues along an 80km/h, 460m radius horizontal curve traversing the Hydro One corridor and passing under one transmission tower. The twin tunnels then swing north under the CN Rail Halton Subdivision tracks, Jane Street and Black Creek. Immediately after the creek crossing, the tunnels enter the 407 Station located mostly within ORC land. The southern limit of the 407 Station, to be constructed underground by the cut & cover method, coincides with the western boundary of the Black Creek fill regulation area. Because of the proximity to the fill regulation limit, there may be a small amount of temporary excavation and backfill required within the fill regulation limits (i.e. for the southeast corner of the station). The detailed design and construction method for this portion will be submitted to Toronto and Region Conservation Authority (TRCA) for approval.

The alignment then continues north in tunnels under the 407ETR interchange facility and aligns with the 23 metre easement set out in the City of Vaughan Official Plan Amendment 529. The VCC Station is located on the tangent section where the alignment crosses Highway 7.

A double cross-over is located just south of the VCC Station to allow trains to enter either platform track at this terminal station. Double tail tracks, with storage capacity for one 6-car train per track, are included north of the VCC Station. The double tail track structure at the end of line follows a tangent alignment north of the VCC Station.

The total length of the VNSL subway alignment is 2.8 km.

3.1.1 Geometric Characteristics

The alignment geometry meets the TTC's horizontal and vertical design standards defined by the criteria shown in Section 2.

Figure 3-1 illustrates the preferred alignment.

Figures 3-2 to 3-6 illustrate the recommended horizontal and vertical alignment while the typical cross-sections proposed for the tunnelled running structure and stations are shown in Figure 3-7.

3.1.2 Running Structure Construction

The deep tunnel portion of the running structure will be constructed by boring two tubes using an earth pressure balanced tunnel boring machine which avoid the need for dewatering and eliminate or minimize settlement at ground level during and after the tunnel construction. The shallower sections where crossover tracks are required will be constructed using cut-and-cover methods. .

3.1.3 Track Technology

The track support system will be an assembly of running rails fastened directly to floating concrete slabs supported on elastomeric pads mounted on the tunnel invert slab to minimize the noise and vibration effects of subway operations. The Sheppard Subway and sections of the existing Spadina line were built using this technology and have achieved the desired results.

3.1.4 Stations

The two stations located on the preferred alignment comprise:

- Hwy 407 station, located west of Jane Street and south of Highway 407.
- Highway 7/Millway (VCC) station, oriented in a north-south direction at the Millway Avenue and Highway 7 intersection.

The facilities comprising the undertaking at each station are described in more detail in Section 3.2 below.

3.2 RAPID TRANSIT INTERFACE

As indicated in the Highway 7 VNSL EA Report, York Region plans to provide transit service to York University by operating Bus Rapid Transit service (BRT) on Jane Street until the Spadina Subway Extension to Vaughan is opened to the public. The BRT service will be discontinued when the subway service is provided to Highway 7. The Viva Purple line will continue to operate on Jane Street to the Highway 407 Station allowing students to get to the University using the subway as described in Sections 3.3 and 3.4.

3.3 HIGHWAY 407/JANE STREET STATION

3.3.1 Operational and Physical Requirements

The Highway 407/Jane Street Station is located approximately midway along the VNSL alignment immediately south of the 407ETR Jane Street interchange. This location will provide convenient park-and-ride access for passengers originating from north of Highway 407 and east or west along the 407 ETR. Consequently, the station parking is planned to accommodate a large number of vehicles through incremental expansion to fulfil the role of a primary transfer station for commuters. In addition it will become an important intermodal station for passengers transferring from the future MTO transitway as well as from other regional bus services such as Viva, YRT, GO Transit, and Brampton Transit. For the purpose of this environmental assessment it is assumed that a 600 space at-grade park and ride lot will meet the combined needs of the transitway and subway.

As noted, the Highway 407 Station is configured to provide operational integration with the planned MTO 407 Transitway station (southwest corner of the Jane St. and Hwy 407 Interchange) while protecting ORC property allocated for the future MTO 407 Transitway facilities based on currently available plans and conceptual layouts.

The station bus transfer facilities include the anticipated capacity to accommodate the requirements of the MTO Transitway, YRT, GO Transit and Brampton Transit. The facilities provide pick-up/drop-off and layover space for the corresponding transit Authorities.

Access to the station will be provided from Jane street with an acceptable level of service (Note: the Region of York is proposing to widen Jane Street to 6 lanes). The access road from the Station to Jane Street will have to cross Black Creek. The bridge crossing will be designed to meet TRCA requirements and recommendations. The intersection at Jane Street will be

integrated with Beechwood Cemetery entrance into a single signalized intersection.

3.3.2 Assessment of Station Location Options

There are several physical constraints that limit the choice of alternatives for the 407 Station location/orientation in the area designated for the 407/Jane Station. The general location of the station on the west side of Jane Street and South of Highway 407 was determined in the York Region VNSL EA. The location zone boundaries are defined by the following:

- Highway 407 to the **north**
- Black Creek Fill Regulation Limit to the **south**
- MTO Transitway limits to the **west** – as defined in the 407 Transitway Corridor Protection Study
- Jane Street, Black Creek Fill Regulation Limits, and Beechwood Cemetery to the **east**.

In parallel with the York Region VNSL EA, the City of Vaughan negotiated a 23 m easement for the subway alignment north of Highway 407 and set out this easement in OPA 529. The station alternatives must be consistent with this easement.

The constraints identified above, limit the 407 station to only one feasible station location on the preferred alignment as illustrated in Figure 3-8.

3.3.3 Subway Platform

This station has a centre platform configuration in which passengers board and alight trains via a single platform between the two tracks. Centre platforms provide greater utilization of vertical circulation, convenient cross-platform transfer where required and greater capacity to accommodate surges in traffic flow, especially during service interruptions. Some rooms, such as ancillary rooms, signal rooms and service rooms are provided at the platform level.

3.3.4 Station Concourse

The concourse level is located directly above the platform and is connected to the platform through stairs, escalators and an elevator. The concourse permits transfers between the entrances and bus platforms at ground level and subway platforms below. There will also be direct access from the MTO Transitway Station that will be located above the subway station, but below surface (as shown in Figure 3-9). Other rooms, such as staff rooms, electrical rooms, and service rooms are also housed at this level located at both ends of the platform.

3.3.5 Station Entrances

Station entrances are provided for access to / egress from the station. The following two entrances have been proposed for the 407 Station. Entrance locations and requirements will be reviewed to confirm functionality during the design phase:

1) Main Entrance – located on an island to the east of the commuter parking and southwest of the PPUDO facility. The main entrance will be equipped with stairs, escalators and an elevator in order to accommodate higher pedestrian volumes. The station entrance will be enclosed with the collector's booth located at the concourse level.

2) Bus Platform Entrance – located towards the west end of the bus terminal platform. The entrance will be equipped with stairs, escalators and an elevator. The station entrance will be enclosed.

3.3.5.1 Paid/Unpaid Access

It is assumed that all transit agencies accessing/serving the station (bus and subway) will be participating in the Regional Fare Collection / Smart Card Program and that the program will be operational prior to the VNSL subway extension being complete. Therefore, once the station is in operation, any existing fare agreements/transfers/discounts between agencies will be accommodated by installing fare card transaction processors at the turnstiles located at the bus platform entrance. The main entrance will be to an "unpaid" zone. Payment can be made at a collector's booth or at turnstiles. It is possible that the main entrance will be automatic (i.e. an unstaffed station entrance, which is equipped with token vending equipment and high turnstiles to allow passengers to pay their fare before entering the subway station). If this is assumption is not correct adjustments to the location of the entrances and pedestrian accesses will be revised.

3.3.6 Ventilation Shafts

Ventilation shafts are incorporated into the subway station in order to balance air pressure within the tunnels and stations and to provide for emergency exhaust and fresh air supply in case of an underground fire. Ventilation fans can also be used to alleviate high summer temperatures in the underground stations. The ventilation shafts will be equipped with high capacity emergency fan systems to remove smoke in the event of a fire in the station or on a train. To mitigate the safety and legal issues, the ventilation system will be designed such that the shafts emerge outside of the 407 ROW. This will be achieved through the utilization of underground ducts as shown in Figure 3-9.

3.3.7 Feeder Transit Facilities

Passenger transfers between buses and the subway are expected to represent a large proportion of passenger movement at this station. The Station will provide transfer service to the following bus authorities:

- MTO / Hwy 407 Transitway
- YRT and Viva
- GO Transit
- Brampton Transit

A central platform bus terminal has been provided at the north end of the 407 station. Direct access to the subway and the MTO transitway platforms will be provided from the bus loading/unloading platform. 18 bus-bays have been identified to accommodate both regular and articulated buses. The bus driveway provides for one-way (clockwise) circulation around the platform.

MTO 407 Transitway

In 1998 MTO undertook a corridor protection study for a transitway running parallel to Highway 407 from Highway 403 to Markham Road. The Study includes a station in the same quadrant where the Subway 407/Jane Station is planned (ORC lands north of the Hydro Corridor, east of Highway 400, south of Highway 407 and west of Jane Street).
The 407 transitway will use BRT technology initially but may eventually be converted to LRT when the demand requires. The 407/Jane Street Station Facility was developed considering an integrated facility responding to the needs of the Subway, the MTO Transitway, the other transit authorities and the commuter's requirements as shown in Figure 3-8. The Transitway Corridor Protection Study Report identifies the conceptual alignment for the 407 Transitway. MTO began the 407 Transitwayplanning and preliminary in early 2007. Slight adjustments to the conceptual alignment of the MTO 407 Transitway may be done to optimize a functional arrangement for the multi-modal facility.

GO Transit Bus Services

For GO Transit the 407/Jane Station will be a primary transfer facility to the Subway, to the 407 Transitway and to local and regional bus services such as VIVA, YRT and Brampton Transit. GO Transit passenger loading/unloading and layover operations will occur in the proposed bus-facility. A bus layover location will be identified and will be integrated with the adjacent transitway storage and maintenance facility.

The Highway 407/Jane Street station will serve as the hub for GO's 407 BRT service. It is anticipated that, while new markets will take advantage of the transit network connections to be provided, the core market of the BRT service at this location will continue to be York University students. As such, the viability of GO's operations at this location depends on the development of a fare concession that allows students to transfer between the bus and subway and travel to/from the York campus at a reduced cost.

It is recognized that a comprehensive and integrated fare management system will have to be developed that addresses the needs of commuters and Transit agencies at this multi-modal transit facility. A Regional Fare Collection and/or SMART card program, which is anticipated to be in operation at the time of the subway opening, will facilitate this fare management integration.

Brampton Transit

Brampton Transit runs route 77 which currently interlines services with YRT. Their intention is to connect to YRT local and VIVA buses, the Subway, GO Transit Services and MTO 407 Transitway at the 407/Jane Station.

YRT

YRT anticipates re-routing their local routes 20 and 360 and VIVA Purple Line to connect to the other transit services at the 407/Jane Station. YRT buses access and circulation path at the 407/Jane Station is illustrated in Figure 3-10.

3.3.8 Park-and-Ride Facilities

Based on the preliminary results obtained from the demand model, and considering the importance of this multi-modal facility and the multiple use planned by MTO in the ORC land west of Jane Street for their transitway (station parking, maintenance/ storage yard and other facilities), MTO and York Region agreed on the following parking strategic plan.

For the purpose of this environmental assessment it is assumed that a 600 space at-grade park and ride lot will meet the combined needs of the transitway and subway. The need for additional parking will be determined through the 407 Transitway environmental assessment/preliminary design study based on the transitway site requirements including operations/control centre and maintenance and storage yard requirements. During the design phases of both subway and transitway projects, adjustments to the proposed parking layouts maybe carried out.

3.3.8.1 Access Roads

In this study, two access roads to the facility are being proposed, both from Jane Street. MTO and Region of York are considering undertaking further studies to evaluate the feasibility of providing other access means to this facility.

The most northerly access will be a right-in/right-out from southbound Jane Street immediately south of the Highway 407 Eastbound exit ramp. This entrance does not impact on Black Creek. This access does not cross Black Creek flood plain. The intersection will be controlled by signage/paving marking only.

The second access will also be from Jane Street through a four leg-all movement signalized intersection which will be integrated to the Beechwood Cemetery entrance. This access will cross Black Creek with a bridge. The exact location, size and type of bridge will be defined during the design phase. The bridge will be designed in accordance with TRCA requirements and recommendations. The location of piers will be based on hydraulic analysis, erosion control evaluation and physical considerations. The structure span will be confirmed by a meander belt/100-year erosion limit analysis during the design phase.

3.3.9 Passenger Pick-Up/Drop Off (PPUDO) Facility

A 20 - 30 space PPUDO will be provided. The size has been estimated based on preliminary travel demand requirements considering and comparing with the potential demand of the PPUDO facilities at both adjacent stations and traffic conditions in the area. The size of this facility will be reviewed during the environmental assessment/preliminary design of the 407 Transitway to assure enough capacity for users of both transit modes. Passengers from the PPUDO will access the station via the entrance located approximately 20 metres southwest of the PPUDO site.

3.3.9.1 Bicycle Facilities

Facilities for cyclists (i.e. bicycle lock-ups) will be provided at this station. The final location and configuration will be determined during the detailed design.

3.3.9.2 Taxi Facilities

It is intended that designated taxi stands be provided at this station. The final location and configuration will be determined during the detailed design.

3.3.10 Stormwater Management Facility

The development of the site from its current greenfield condition will result in increased volume and degraded quality of runoff during storm events. A permanent wet pond facility or equivalent method of treatment will be provided to attenuate flows to predevelopment levels, protect the Black Creek from increased erosional forces and provide enhanced quality treatment for the runoff release.

MTO anticipates an important stormwater management facility to be located in the same quadrant (south of HWY 407, west of Jane Street, north of the Hydro Corridor, east of HWY 400) and an integrated solution of both facilities is recommended.

The design of the wet pond facility, including the location and approximate capacity, will be defined during detail design, after the MTO Transitway Study has defined their facility in the area and assessed their own requirements. The detailed design of the Spadina Subway Extension will also take into consideration the recommendations obtained from the stormwater management plan study being undertaken by the City of Vaughan, which will re-examine stormwater management and flooding conditions in the Black Creek Corridor. The runoff management strategy will also incorporate recommendations of a water balance study for the EA study area, to be carried out at the detailed designed phase. Note: there are a number of options available to achieve a water balance on site including the installation of green roofs, bio-swales, infiltration systems/basins, rain water harvesting techniques, porous paving, perforated pipes, wet ponds, etc.

3.4 VCC (HIGHWAY 7/MILLWAY) STATION

3.4.1 Operational and Physical Requirements

The Highway 7/Millway (VCC) station is the northern terminus of the proposed Spadina line extension. It serves the Vaughan Corporate Centre (VCC) and the rapidly growing northern developments of Vaughan. The station is conveniently located to serve local YRT and VIVA routes. It is expected that this will become the primary station for local feeder bus service.

In addition to walk-in ridership from development at the VCC, the VCC Station will mainly serve transit users transferring from VIVA and local YRT routes, users being picked-up and dropped-off by private vehicles and people coming from Toronto to the future VCC. This Station zone must incorporate facilities for pick-up/drop-off operations by YRT services connecting to the subway, as well as layover parking for routes terminating

at VCC. These facilities are to be designed respecting the VCC Streetscape and Open Space Master Plan Study recommendations.

The station will include a passenger pick-up/drop-off facility and ideally, a limited parking facility, recognizing the City of Vaughan vision set out in the VCC Official Plan.

3.4.2 Assessment of Location Options

The east-west location is defined by the easement previously negotiated by the City of Vaughan and the Developers of the area. The extension of Millway Avenue south of Highway 7 will be aligned to coincide with the subway alignment.

In terms of the north-south location, there is more flexibility; however, in order to respond best to operational requirements, it should be located under Highway 7, as convenient as possible for people using the pick-up/drop-off bus and car facilities.

3.4.3 Platform

This station has a centre platform configuration in which passengers board and alight trains via a single platform between the two tracks. Some rooms, such as the ancillary room, signal room and service room will be provided at the platform level.

3.4.4 Concourse

The concourse level is located directly above the platform and is connected to the platform through stairs, escalators and an elevator. The concourse permits transfers between the bus platforms and parking areas at ground level and subway platforms. The staff room, electrical room, and service room will be housed at this level.

3.4.5 Station Entrances

At least three station entrances are proposed for this station to provide adequate ingress/ egress from/to the station. These are summarized below. Note, entrance locations and requirements will be reviewed and optimized within the surrounding built environment during the design phase:

1) Highway 7 Entrances – Two entrances will be provided from Highway 7 – one at the northeast corner and one at the southwest corner. Both these entrances will be equipped with stairs, escalators and an elevator in order to accommodate high pedestrian volumes. The station entrances will be enclosed – opportunities to provide integrated entrances that are located within existing buildings will be pursued. It is expected that the collector's booth will be located at the concourse level.

2) PPUDO Entrance – This entrance is located towards the north end of the station and is intended to serve mainly PPUDO customers and customers from the north half of the VCC. The entrance will be equipped with stairs, escalators and an elevator. The station entrance will be enclosed.

3.4.6 Feeder Bus Facilities

This station will serve the following bus services:

- YRT local routes (10, 20, 35, 77, 360)
- YRT VIVA service (Purple, Orange)

The schemes proposed for the transit connections to the VCC station are based on the ultimate road network scenario for the area, as presented in the City of Vaughan's Streetscape and Open Space Draft Report and the intended bus routing provided by YRT. These schemes will work if the following roads of the Official Plan are built by the time the Subway opens operation:

- Millway Avenue from Doughton Road to AppleMill Road.
- Applemill Road extended to Jane Street as a minimum -Route 10 could turn south at Jane Street unless ring road is extended to Highway 7.
- East-West local road between Highway 7 and Applemill Road from Edgeley Boulevard to Jane Street.

The two VIVA routes will pick-up/drop-off passengers at their median stations. The Orange Line is scheduled to terminate the route at the VCC Station, while the Purple Line at the 407/Jane Station. The HWY 7/Millway signal must provide an advance left for the eastbound Orange Line to allow a safe operation.

Far-side bus stops will be provided for the local YRT routes at the corners of Highway 7, and Millway Avenue. The MobilityPlus service will have layby stops on the corners opposite those stops for the local YRT buses on Highway 7.

A 4 bus layby stop is being provided for short lay-overs during peak periods on the south side of the future local road parallel to Highway 7, east of Millway Avenue. Peak period buses which are not used during off-peak periods are sent back to their respective divisional garages, as per current practice.

Figure 3-11 illustrates the proposed bus facility arrangement at the VCC Station. Figure 3-12 illustrates the proposed YRT bus routing in the area. .

In case none of the VCC road network is built before the subway extension is operating, an interim feasible arrangement is included and illustrated in Figure 3-13.

3.4.7 Park-and-Ride Facilities

As indicated in Chapter 9 of the Highway 7 and VNSL EA Report, York Region is committed to undertake a strategic study of parking for transit users. This study will assess opportunities for commuter parking in a highly developed area as VCC is expected to be and will be reflected in development plans for the VCC. This study will explore the potential for additional commuter parking opportunities. This will be investigated further during detailed design and reviewed when a transit parking policy is developed during the above-mentioned transit parking study.

3.4.8 Passenger Pick-Up/Drop Off Parking

As part of this station a 20-24 space PPUDO will be provided. This size has been estimated based on preliminary travel demand projections. The proposed PPUDO location was developed considering the City of Vaughan's development plans as included in the Streetscape and Open Space Draft Report. The PPUDO facility will utilize part of the triangle formed by Applemill Road (ring road), the existing and the future Millway Avenue. The PPUDO layout will be defined during the design phase in coordination with the City's streetscape design of the Transit Square and possible participation of the developers.

3.4.8.1 Bicycle Facilities

Facilities for cyclists (i.e. bicycle lock-ups) will be provided at this station. The final location and configuration will be determined during the detailed design.

3.4.8.2 Paid/Unpaid Access

The general criteria assumed is described in Section 3.3.5.1. All entrances will be to the "unpaid" zone. Payment will be made at a collector's booth or at turnstiles prior to entering the fare zone. Passengers transferring from a bus and destined to a free station on the subway will be able to use fare card transaction processor equipped turnstiles to take advantage of transfer fares.

3.4.9 Ventilation Shafts

Ventilation shafts are incorporated into the subway station in order to balance air pressure within the tunnels and stations and to provide for emergency exhaust and fresh air supply in case of an underground fire. Ventilation fans can also be used to alleviate high summer temperatures in the underground stations. The ventilation shafts will be equipped with high capacity emergency fan systems to remove smoke in the event of a fire in the station or on a train. These are shown in Figure 3-14.

3.5 ANCILLARY FACILITIES

3.5.1 Electrical Power

The subway will obtain traction power through electrical substations fed by high voltage connections from the Hydro One Regional Distribution. The substations are equipped with transformers, switches and circuit panels to support the different systems (traction power, lights, equipment and safety).

Based on TTC traction power requirements, substations are typically 2.0 kilometres apart but cannot exceed 2.5 km in spacing. Since subway stations require power for lights and equipment, TTC usually locates the electrical substations near subway stations. Following this criteria the only proposed substation along the Vaughan Link will be located at Millway Avenue just south of Avenue 7, near the VCC Station, north of the substation proposed by TTC near the Steeles West Station.

Although conceptually the substation is identified in Figure 3-6, the final location and configuration of the electrical substation will be refined during the design phase.

3.5.2 Emergency Exit Buildings

Emergency exit buildings are structures that extend from the underground tunnels to above grade and are designed to provide an emergency exit for passengers and an emergency access for fire fighting crews. They can also provide emergency ventilation and secondary power sources.

The below grade portion of the structures includes a central vertical access/egress shaft with a spiral ramp or walkway leading from the tunnel to the surface. At grade, the typical structure is one-storey building about 10 square metres in area and 3 metres in height.

NFPA130 stipulates that the maximum walking distance in case of fire should not exceed 381 m, which equates to a maximum distance from emergency exit to emergency exit or emergency exit to station of 762 m.

Although conceptually the emergency exit buildings are identified in Figure 3-1, the final location and configuration of the emergency exits will be refined during the design phase.

3.6 SUBWAY VEHICLE REQUIREMENTS

The subway cars will have the following characteristics:

- Train consists of 6 cars
- Car length = 22.8 m.
- Car width = 3.1 m.
- Car rated capacity = 250 passengers
- Electric motors utilizing 600VDC.
- Trains manually controlled.

In support of the VNSL subway extension, additional subway fleet will be required. TTC is contemplating an expansion of the Wilson Yard to provide maintenance and storage to the additional fleet. The EA approvals for these works were secured in 1994 through the New Subway Storage and Maintenance Facility EA.

3.7 ASSOCIATED ROAD IMPROVEMENTS

Aiming to provide additional capacity to the transportation network in the area, in addition to the capacity that by the Vaughan Link Subway Extension will provide, improvements to the road network are in various stages of the approval process as indicated below.

1. Widening Jane Street to three lanes per direction. York Region. – EA Approved.
2. East-West Collector Road, from proposed Street “C” (West Gate Road north extension) to Jane Street. York Region. - EA approved as part of the Highway 7 & VNSL study.
3. East-West Collector Road, from Keele Street to proposed Street “C” (West Gate Road north extension). City of Vaughan – Approved by Municipal Councils and under appeal at the OMB.
4. Millway Avenue from Doughton Road to AppleMill Road. City of Vaughan – status unknown at this time.
5. Applemill Road from Millway Avenue to Jane Street. City of Vaughan – status unknown at this time.
6. East-West local road between Higway 7 and Applemill Road from Edgeley Boulevard to Jane Street. – City of Vaughan – status unknown at this time.

3.8 FUTURE ALIGNMENT REFINEMENTS

The functional details presented in this report illustrate the intended concept of the undertaking for EA purposes; however changes to these concepts may be required during design and construction. The Steeles West station, the southern origin of the Vaughan North South Link, is included in the TTC/Toronto Spadina Subway Extension EA. Section 9.10 of the TTC EA describes the process for EA Amendments. The TTC EA provides an amending boundary around the station. Should there be modifications to the station location or layout, the VNSL tie-in alignment will need to be altered accordingly. Figure 3-1 exhibit provides a shaded area that delineates the TTC amending boundary, within which alignment modifications can be made without necessitating an EA amendment.

As part of the Subway Alignment Optimization Report, an amending boundary has also been identified as shown on Figure 3-1.

This amending boundary is required to provide during the future design phase, the opportunity to allow for alignment adjustments/refinements. These adjustments may be recommended to optimize the design and/or minimize the impact to third parties, to address the following issues:

- The exact arrangement and location of the triple track structure.
- A detail assessment of the hydro towers sub-structure and the sub-soils conditions at the hydro corridor crossing.
- A review of the operational and physical integration of the Highway 407 Station with The Highway 407 MTO facility, once their needs are defined.
- Impacts to Black Creek.

Alignment variations within the amending boundary limits identified during the following design phase, would be handled without a formal approval requested from the MOE EA Branch. These minor adjustments will be addressed on the site plan approval, following the required permits and approvals of the affected agencies and landowners.

4. ASSESSMENT OF EFFECTS OF OPTIMIZED DESIGN ON ENVIRONMENT

4.1 ASSESSMENT METHODOLOGY

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 implementation of the optimized subway design. Generally, the evaluation criteria and indicators established during the alternatives evaluation process for the original Highway 7 & VNSL EA Report surface rapid transit components were used as the basis for assessing the environmental effects of the preferred design.

As in the previous assessment professional experience, analysis, simulation and judgement formed the basis for identifying environmental effects and mitigation measures. The analysis was based primarily on comparing the existing environment condition with the anticipated future environment, prior to, during, and after construction.

4.1.1 Project Related Effects and Mitigation

Using the methodology described in **Chapters 10 and 12 of York Region's Highway 7 & VNSL EA Report**, the evaluation of project-related effects was performed using the primary Rapid Transit Plan objectives and related goals developed for the evaluation of alternatives in selecting the preferred alignment. These objectives are:

- 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
- To promote smart growth and economic development in the corridor

Goals defined by professionals in the study team are subsets of these objectives and refer to an environmental value or criterion. The effect of the proposed undertaking in terms of each environmental value was rated using a qualitative scale ranging from a positive or beneficial effect through negligible to a potentially significant negative effect as described in the above methodology.

4.1.2 Assessment Results

An environmental effect requires consideration of all project activities and their interaction with the environment. Pre-construction, construction and operational activities were assessed. This section describes the project activities for the subway components of the rapid transit undertaking and their interaction with the environment, their location, the potential effects, mitigation measures, residual effects and their significance, and monitoring recommendations.

4.1.3 Assessment Categories

The assessment that is summarized below is organized according the following main headings:

Environmental Value/Criterion: The objective that is being addressed by the project activity.

Project Activity/Issue: Any potential issues associated with the physical work, any proposed construction, operation, modification, or other undertaking in relation to the proposed project.

Project Phase: Project stages are coded as follows:

P – Pre-construction
C – Construction
O – Operation

Location: A description of the location where the project activity/issue has impact**.**

Assessment of Effect on the Environment: A description of any change that the project may cause in the environment, health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes by aboriginal persons, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or any change to the project that may be caused by the environment.

Built-in Positive Attributes and/or Mitigations: In respect of the project, the elimination, reduction or control of the adverse environmental effects of the project, that includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

Potential Residual Effects: Residual effects that may occur even with the mitigations described above**.**

Further Mitigation: Additional mitigation measures that may be deemed necessary in order to mitigate the environmental effect.

Level of Significance after Mitigation: The level of impact to the project, as a result of the undertaking, after mitigation activities have taken place.

Monitoring and Recommendation: Recommendations and suggestions for future activities to monitor and track on-going or potential future impacts. These activities may be conducted by the project proponent or by other stakeholders who are impacted by the undertaking.

Sections 4.1.4 to 4.1.7 describe the environmental assessment for four objectives: to improve mobility by providing a fast, convenient, reliable and efficient rapid transit system; 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.

4.1.4 OBJECTIVE A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service

The effects analysis for Objective A is tabulated in **Table 4-1**. Generally, a subway extension from York University to the Vaughan Corporate Centre (VCC), has the ability to significantly improve mobility within the western portion of the Highway 7 corridor and provide good connectivity with all inter- and intra-regional transit services. It provides a direct connection to the City of Toronto subway network via York University and it also provides a direct connection to the future Highway 407 transitway near Jane Street. From this point of view, the optimized subway service will have an overall positive effect on transit ridership in the region. The planned alignment characteristics and geometry will provide a fast, convenient and reliable service in all respects. Station locations will support near- and long term development in the Vaughan Corporate Centre and the Steeles Avenue Corridor area where high residential density, high employment numbers or a combination of the two will capitalize on the effectiveness of implementing the subway system extension. The strategic locations of stations generally achieve the goal of increasing the attractiveness of the rapid transit service and make a positive contribution to maximizing ridership. In order for all members of society to have access to the system, all stations, ancillary facilities and the transit system itself will be accessible for the mobility impaired providing ramps, elevators, etc. Attractiveness of the rapid transit service is implicit in the design of both sub-surface and surface components of the undertaking, by achieving the desired transit speed, providing efficient, convenient transfer facilities and a implementing a key link between a designated major Regional Centre (VCC) and the future expanded GTA transit network.

Table 4-1
Effects and Mitigation for Improved Mobility

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service												
A1	Maximize Inter-regional and local transit connectivity	Connections to inter-regional services and future gateways	✓	✓	✓	407 Station Facility	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.	407 Station is proposed to be a multimodal facility to serve transfer and layover needs for all user transit authorities. .	Some potential for infill commercial development around this transfer point.	Transit transfer facility must recognize proximity to Black Creek	Positive effect	MTO will review Hwy 407 transitway needs as part of their future EA study.
		Connections to inter-regional services and future gateways	✓	✓	✓	VCC Station Facility	Opportunity to connect to various YRT local routes as well as two Viva routes.	VCC Station Facility will provide bus bays for pick-up/drop-off of transferring passengers and short layovers in the station area.	High potential for mixed-use development around this transfer point.	None	Positive effect	Monitor the ridership and VCC land use and road network development.
		Connections to inter-regional services and future gateways	✓		✓	York University	Opportunity to connect to the City of Toronto and improve ridership on these transit services.	Vaughan North-South Link will provide a direct connection to the York University and to the TTC rapid transit system via the Spadina subway extension.	High potential for infill mixed-use development around this transfer point.	None	Positive effect	Monitor the ridership and the performance of the connection to Toronto.
		Compatibility with proposed local network	✓		✓	Entire Corridor	Inconvenient transfer between local transit and Highway 7 Rapid Transit may discourage growth in transit ridership.	Steeles Avenue and VCC Stations will be served by local YRT and TTC transit routes ensuring convenient transfers between services. Integrated fare system proposed.	Project will require a change to the configuration of local transit.	Review effectiveness and adjustment to local service routes	Positive effect	Ongoing review of effectiveness of local service plans.
A2	Maximize speed and ride comfort and minimize safety risks and maintenance costs	Alignment geometry	✓		✓	Entire Corridor	Minimum geometric standards would limit service speed, increase travel time and reduce ride comfort and system safety.	Alignment for subway extension was designed to TTC standards (operational speed of 80 km/h)l	Minimum travel time will attract ridership at frequent headways.	None	Positive effect	None required.
A5	Locate stations to maximize ridership potential and convenience of access for all users	Residents/Employees within walking distance of station locations. Accessibility of stations/transit system.			✓	VCC Station Facility	Station at location with automobile-oriented land use could discourage rapid transit use.	Station location will serve supportive land use. Facilities and access can be integrated into future high density developments adjacent to the station. Facilities will be weather protected, barrier-free attractive designed streetscapes within surrounding mixed-use neighbourhoods. VCC urban design will promote a pedestrian and transit-user friendly environment,.	Continued dependence on automobile if land use objectives not achieved	Greater emphasis on supportive land use particularly in VCC. Future high density development at VCC can be built around transit based transportation infrastructure (instead of automobile)	Positive effect	Regular review of land use and new or infill development potential during detailed design phases for subway extension.
					✓	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.			Positive Effect	None required

Table 4-1
Effects and Mitigation for Improved Mobility

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1]			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							
OBJECTIVE A: To improve mobility by providing a fast, convenient, reliable and efficient rapid transit service												
								Draw commuters out of automobiles and into transit				

Notes: **P** – Pre construction, **C** – Construction, **O** – Operation

4.1.5 OBJECTIVE B: To protect and enhance the social environment in the corridor

Overall, the various goals set to protect and enhance the social environment can be achieved. 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 and benefits for the existing and future communities served by the route can be maximized. The assessment for Objective B is tabulated in **Table 4-2**.

In general, the subway extension will improve community mobility, in particular, access to commercial and community facilities planned at the end of the extension, the VCC and Steeles Avenue Corridor environs. The effect on the current road capacity and traffic operation will be mitigated by the Region undertaking the widening of Jane Street from four to six lanes as planned. Additionally the Region is planning early implementation of the East-West Collector road running parallel to the Hydro Corridor from Jane Street to Keele St. The planned road system improvement will address the vehicular traffic operational and capacity needs associated with accessing the station facilities. Additional traffic generated from the future land development at VCC, will be addressed as part of the road network improvements planned by the City of Vaughan as part of the Vaughan Corporate Centre infrastructure. Also, a reduction in north-south vehicular demand is anticipated when the subway extension is placed into service. In summary, the impact on traffic is not expected to be significant; however, further analysis will be carried out using up-dated volumes and ridership figures during the design phase to confirm the effectiveness of the associated, planned road improvements.

Preserving and improving public safety and security along the route was an important consideration in development of the design concept. While fulfilling its role as a major transit interchange node in VCC, the features of the VCC Station are compatible with a pedestrian-friendly environment as planned in the recently-completed VCC Streetscaping Study. In addition, noise and vibration studies at representative sensitive receptors (performed as part of the original Highway 7 and VNSL EA study) have demonstrated that the use of the TTC's standard floating slab track support system will mitigate any noticeable increase in noise or vibration levels for residents of future developments that may be implemented along the route. Cultural heritage work will be completed at detailed design in order to assess the impact of the proposed works including the construction of Steeles West Station and the subway alignment on TRCA buildings at Black Creek Pioneer Village, and at the northwest corner of Jane Street and the railway tracks. In particular the affects of noise, vibration, dust, and traffic flow on these buildings and the operation of the village both during construction and operation of the subway will need to be considered.

A Stage 1 Archaeological Assessment, conducted during the study, indicated the absence of archaeological sites within the project impact area. As is usually the case, a Stage 2 archaeological study will be conducted during the design/construction phase for the subway extension. Finally, the predominantly underground subway infrastructure, even in a highly developed urban context, will have no effect on the visual aesthetics of the route. In consultation with the municipalities and the public, a concerted effort will be made to incorporate landscaping and streetscaping principles developed for the VCC in the station area design.

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
B1	Minimize adverse effects on, and maximize benefits for, communities in corridor	Potential displacement of community features.		✓	✓	Entire route	Potential displacement or loss of unique features.	Avoids known distinct community features. To minimize impact; incorporate landscaping and furniture into streetscape to enhance corridor community environment.	None expected	None expected	Negligible	Future municipality and VCC community consultation
		Potential displacement of community features.		✓	✓	VCC planned Transit Square urban park at Millway Ave.	Potential displacement or loss of planned unique features by transit infrastructure (passenger pick-up/drop-off (PPUDO)).	PPUDO will be incorporated into a future urban park (Transit Square) that will include significant landscaping.	None	None expected	Negligible	Future municipality and VCC community consultation
		Community facility utilization			✓	VCC area	Improved transit access could increase demand on facilities and services within the VCC.	Municipality can expand services and facilities and recoup cost from development charges	None expected	None expected	Positive effect	Monitoring of activity levels at the various facilities.
B2	Maintain or improve road traffic and pedestrian circulation	Reduction in overall road capacity			✓	407 Station Facility	Reduced capacity at Jane Street/Access Road Intersections.	Jane St./Main Access Road Intersection improvements will be built in advance of the subway construction when Jane Street is widened 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 widening construction phase.	Monitor traffic volumes and intersections operation to confirm assumptions

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
					✓		Reduced capacity at Jane Street	After widening to six lanes, Jane Street will have the capacity to support traffic generated by the subway extension. New intersection will operate at acceptable levels of service. Implementation of subway should reduce north-south traffic volumes.	None expected	None expected	Positive effect	Monitor traffic volumes to confirm assumptions
					✓	VCC Station Facility	Reduced road capacity in the area of influence.	In preparation for the VCC development, the City of Vaughan has prepared a plan to address the needs of the VCC including road network expansion.	Potential for delays in the construction of portions of the road network expansion.	Local transit routes in VCC may need to be re-routed.	Neutral	Vaughan should construct the minimum road links (part of City's road network expansion plans) indicated in Chapter 3 prior to commencement of the subway operations.
					✓		Traffic impact on road network resulting from the operation of the Passenger Pick-Up and Drop-off.	To be further examined during the design stage – potential mitigation measures could include changes to entrance/exit locations or road improvements.	None expected	None expected		
				✓			Traffic congestion during construction	A Comprehensive traffic management plan will be prepared during the detail design phase addressing the needs to manage and maintain traffic movements and access during construction..	None expected	None expected	Moderate effect during construction	
					✓	Northwest Gate (Steeles Avenue)	Under 2021 considerations, the intersection will operate at capacity during the AM peak hour.	None required.	Intersection will continue to operate at capacity.	None expected	Moderately Significant	None required.
		Pedestrian Crossings			✓	Jane St./ Hwy 7;	Due to the width of the proposed "main street" at the intersection, pedestrians may not be able to cross the inter-section in one signal phase based on the standard pedestrian walking speed.	These intersections may require two-stage crossing in the future to accommodate heavy main street traffic. The decision to implement these special provisions should be deferred until post-operation conditions are monitored and the need is identified.	None Expected	None Expected	Moderately Significant	Monitoring is required to determine if the implementation of two-stage is a necessity.
B4	Minimize adverse noise and vibration effects	Noise effects due to construction and operation of subway extension		✓		Portions of route where alignment is in the proximity of future development.	Subway may result in increased noise levels	Control of noise during construction by use of: soundproof enclosures for any noise producing machinery; use of exhaust mufflers and silencers on combustion engines and air equipment, lining material on hoppers and storage bins. Abide by local noise by-laws.	None expected	None necessary	Insignificant	For all noise effects, under-take confirmation monitoring to verify compliance once the subway extension is fully operational.
					✓			Ambient noise level increase due to future subway operations will not exceed the 5dB threshold with TTC floating slab track support and double tie (used in sections of straight track) systems	None expected	None necessary	Insignificant	
					✓	Electrical substations	Noise level produced by transformers	Proper enclosure and orientation of the transformers will mitigate the effect.	None expected	None necessary	Insignificant	

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
					✓	VCC Station Facility	Ventilation Shafts noise impact	The fans are not located in a noise-sensitive area and the noise effect will only be occasional. During the design phase the exact location of the fans will be defined and any necessary noise mitigation measure will be identified.	None expected, it will be re-addressed during design phase	Depending on the findings.	Very occasional	
					✓			In general, sound level increases in future adjacent developments can be limited to acceptable levels by conditions during site plan approvals;				
		Vibration effects due to construction and operation of subway extension		✓	✓	Tunnel sections of the subway where alignment is in the proximity of future development.	Subway operations may result in increased vibration levels particularly for an optics company located north of Highway 407.	The use of double ties and a floating slab track will mitigate any vibration effect. Modeling of future subway operations indicates that expected vibration increases will not exceed the protocol limit of 0.1 mm/sec.	None expected	None necessary	Negligible	Undertake confirmation monitoring to verify compliance once the subway extension is fully operational.
B5	Minimize adverse effects on stakeholders and property owners directly affected by the subway	Effects on structural integrity of existing or planned facilities		✓		Crossing under UPS facilities	Portion of the subway may be built under part of a future building	In the event that the expansion of the UPS plant occurs prior to subway construction, tunnelling under the finished building would be possible without major disruption to the UPS operations. The tunnelling could be undertaken using EPB-TBM's for each track as used for the main lines, or by using other proven tunnelling techniques, such as NATM, or Sequential Excavation Techniques (SEM). In either case, provision could be made in the design and construction of the building expansion footings and foundations to allow for the maximum potential settlement that may occur during the later tunnelling construction. Alternatively, pre-construction of the future subway structure walls could be undertaken during the building expansion construction, to allow for future top-down cut-and-cover subway construction under the new building. Extensive soils investigation, co-ordination of designs, a continuous monitoring program, and negotiations between UPS and the subway Program Manager would be undertaken to minimize disruption to either party during all construction phases. In case of tunnelling it is recommended that cover of 1.5 to 2 diameters be provided from the tunnel crown to the underside of the foundations; if this envelop is less than desirable, special settlement control measures will be taken to ensure stability of the building while building the tunnels.	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.
				✓		Crossing under the Hydro Corridor.	Potential effects of tunnelling beneath or near transmission towers.	Tunneling with EPB-TBM's, in conjunction with continuous monitoring, can be successfully undertaken in close proximity to tower foundations, on either spread footings and/or on piles or caissons. The recommended clearance envelope from the tunnel crown to the underside of the foundations is 1.5 to 2 tunnel diameters (approximately 9m to 12m in this situation). Not being able to meet this desirable envelope in one 540 KV tower, special settlement control measures will be taken to ensure stability of the tower during the construction of the tunnels. Depending on the results of detailed soils investigation in the vicinity of the tower foundations, ground improvement techniques may also be undertaken in advance of tunnelling to prevent potential ground	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.

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
								loss and subsidence.				
				✓		Crossing under CN Halton Subdivision tracks.	Potential effects of tunnelling under the tracks	The depth of cover from top of tunnel excavation to top of rail is approximately 13.5m. Tunnelling with EPB-TBM's in conjunction with continuous monitoring should not produce 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.
				✓		Crossing under Toromont light equipment maintenance building	Cut and cover special track section is sited at the location of the existing building.	The Region will negotiate with the owner to address concerns regarding removal of building.	None expected	Use of special construction techniques if necessary, suitable to overcome unexpected ground conditions.		
				✓		Tunnel crossing near Bentall buildings north of Highway 407.	Potential structural effect tunnelling near existing buildings.	It is recommended that clearance of 1.5 to 2 diameters from the tunnel crown to the underside of the foundations be provided; if this envelop is less than desirable, special settlement control measures will be taken to ensure stability of the building while building the tunnels.	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.
				✓		VCC Station north of Highway 7 crossing near a Future Shop Store.	Potential structural effect building a cut and cover station near an existing building.	Based on the prevailing ground conditions, temporary cuts for open-cut construction may be made with side slopes in the range of 1H:1V to 1.5H :1V. However, in this situation, due to space restrictions, vertical excavation sides are expected. To provide horizontal support during construction some form of temporary shoring is anticipated along with internal braces or drilled anchors that extend into the ground behind the supporting walls.	None expected			
						Crossings under Jane St., Hwy 407, Interchange Way.	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 in unlikely. The use of EPB-TBM's in conjunction with continuous monitoring should prevent settlement problems.	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.
				✓		Highway 7 Crossing	Potential effects of cut and cover construction on utilities.	Alternate access and temporary re-arrangement of the vehicular and pedestrian circulation as well as the internal parking operation will be addressed during the design phase, based on the up-dated status of the VCC road network expansion and surrounding development plans.	None expected	None necessary	Rare	Make sure that the design phase of the subway extension addresses temporary arrangements to mitigate the operation of the Toromont's facilities
		Effects to the operations of industrial/commercial facilities during construction		✓		Crossing under Toromont facilities	Impact on the entrance to the facility, internal circulation roads and parking during construction.	The Region discussed with Toromont the potential construction site boundary, worksite area and liner segment storage area, as well as potential options of temporary access for Toromont users as well as construction access. The location of accesses and construction sites will be negotiated and defined between the Owner, the Contractor, Project Manager and the regional and local municipalities once the implementation phase is contracted, responding to all parties interests.	Mutual agreement required			

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
				✓		Crossing under Smart Centres facilities	Impact to Future Shop Millway Ave. access to main entrance.	Potential temporary access options were discussed with Smart Centres. The selected option will be negotiated and defined between the Owner, the Contractor, the Project Manager and the regional and local municipalities once the implementation phase is contracted.	Mutual agreement required			
				✓		Crossing under UPS facilities.	Partial impact to the existing circulation area and the future parking expansion on the north side of their facility, during construction.	Temporary measures to provide access around the affected open area of UPS will be developed with UPS and included in the project during the design phase.	None expected	None necessary	Minor	Make sure that the design phase of the subway extension addresses temporary arrangements to mitigate the operation of the UPS facilities.
		Effects to private property (at grade facilities)	✓	✓	✓	VCC Station area	PPUDO for VCC Station will require property acquisition south of future Ring Road.	Land required for the PPUDO will be acquired.	None expected	None necessary	None	
				✓	✓	Hydro Corridor	Future East-West Collector Road to be built along the south edge of the Hydro easement east of Jane Street.	Maintenance access to all Hydro Facilities will be maintained. An area around the towers for parking and manoeuvring of maintenance vehicles will also be respected.				
		Effects to business activities		✓		VCC Station area	Possible disruption of business activities during construction.	Appropriate temporary measures and construction techniques will maintain access and circulation in the vicinity of the station work.	None expected	None necessary	Minor	
		Effect to Ontario Realty Corporation (ORC) lands	✓	✓	✓	407 Station area	407 Station and station facilities (PPUDO, Parking etc) will require property acquisition west of Jane Street between the Hydro Corridor and the 407.	The Region will negotiate with the ORC to address concerns regarding removal of ORC tenant (i.e. farmer) and any associated buildings, and land acquisition. Note, depending on timing, and the status of the MTO transitway design/study, MTO will be invited to participate in discussions and identification of land requirements.	Mutual agreement required		Minor	
		Effect to Beechwood Cemetery activities	✓			Beechwood Cemetery	Possible disruption of business activities during construction.	The subway alignment is outside of the cemetery property and as such no negative effects are expected. Jane St./Main Access Road Intersection improvements will be built in advance of the subway construction when Jane Street is widened 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 widening construction phase.	Monitor traffic volumes and intersections operation to confirm assumptions
B5	Minimize adverse effects on cultural resources	Disruption of Built Heritage Features (BHF)		✓			The potential introduction of rapid transit operation may cause changes in visual, audible and atmospheric environment around built heritage features.	None required – Subway facilities will be integrated with existing streetscape and VCC road network.	None expected	None necessary	Insignificant	None required

Table 4-2
Effects and Mitigation for Social Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE B: To protect and enhance the social environment in the corridor												
B5	Minimize adverse effects on cultural resources	Disruption of Cultural Landscape Units (CLU)		✓			The potential introduction of rapid transit operation may cause changes in visual, audible and atmospheric environment to the cultural heritage features in the Cultural Landscape.	None required – Subway will be integrated with existing streetscape and road traffic operations.	None expected	None necessary	Insignificant	None required
B6	Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	Visual Effects	✓		✓	VCC Station	Introduction of surface transit facilities serving the VCC station may reduce visual aesthetics of Highway 7.	Transit intermodal facilities are being developed in consultation with Vaughan Municipality. A preliminary short-stay bus lay-over location has been identified on a local minor road,	None expected	None necessary	Insignificant	Monitor VCC planning and development applications and acquire property for facilities and streetscape enhancement through redevelopment applications
		Landscaping	✓		✓	Station precincts	Landscaping species may not survive in winter months.	Choose appropriate species for both winter and other months to maintain greenery throughout corridor. Where necessary, place landscaping in planters and incorporate buried irrigation systems.	Species may still not survive	Change species', irrigation patterns, etc.	Insignificant	Monitor health of landscaping continuously

Notes: **P** – Pre construction, **C** – Construction, **O** – Operation

4.1.6 OBJECTIVE C: To protect and enhance the natural environment in the corridor

The limited natural environment along the subway extension route can be protected and enhanced in a small way. Most of the preferred subway extension alignment is set in a developed urban environment 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 of Jane Street and swings under Jane street south of Highway 407. Black Creek also crosses the proposed subway alignment south of Highway 407. North of Highway 407, the subway tunnel, station and surface works will be remote from the watercourse and outside the floodplain. South of Highway 407 the tunnel profile will be designed to allow the subway to pass under Black Creek. The only potential to effect to the watercourse and related natural vegetation would come from the Hwy 407 station surface elements, bus transfer facilities, park and ride, PPUDO and construction cut and cover operations. Wherever possible the project will aim to achieve a net environmental gain.

The optimized alignment to tie-into the diagonal Steeles Station selected by the Toronto/TTC study, enables all underground Highway 407 station works to be constructed south of the Highway 407 ramps without directly impacting the Black Creek meander belt and most of the valley lands. Works in the valley lands will be limited to the new creek crossing structure to provide access to the station facilities and construction of the south-eastern corner of the station underground structure. All potential adverse effects of these works can be mitigated by built-in design attributes or specific construction techniques to mitigate temporary effects.

In terms of all other environmental components to be considered, effects on aquatic and terrestrial ecosystems are either negligible or insignificant when built-in mitigation measures are implemented or sensitive construction and operation methods are respected. The lengthening of existing culverts or installation of new culverts along the subway extension will incorporate mitigation measures where required to preserve or enhance the aquatic habitat, however, a fluvial geomorphological assessment and plan of action as required will be conducted in the design phase . Future air quality is generally expected to be better than current air quality mainly due to improvements in engine technology and fuels but also with some contribution from the diversion of car and diesel bus trips to electric subway. While PM levels can be expected to increase as traffic increases, rapid transit will slow the rate of increase. Green house gas emissions will be reduced due to the energy efficiency of an improved public transit alternative. Wherever possible the project will aim to achieve a net environmental gain.

Note that the statements indicated above will be revised and verified during the detail design phase through a comprehensive Environmental Management Plan.

The assessment for Objective C is tabulated in **Table 4-3**

Table 4-3
Effects and Mitigation for Natural Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE C: To protect and enhance the natural environment in the corridor												
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.		✓	✓	Entire Route	Fish kills due to chemical spills resulting in short term population decline.	▪ No refuelling within 30 m of a watercourse or catchbasin. ▪ Emergency Response Plan. ▪ Oil & grit separators on stormwater drainage from station site. ▪ Inspection and maintenance control at all times. ▪ Construction will be performed in the dry.	▪ Short term population decline. ▪ Some contaminants within storm-water system.	None practical	Insignificant	None required
		Sediment laden stormwater entering watercourses during construction.		✓		Entire Route	Fish kills and loss of aquatic habitat resulting in short term population decline.	▪ Minimize the duration and extent of soil exposure. ▪ Manage surface water to prevent contact with exposed soil surfaces. ▪ Implement erosion and sedimentation control measures on-site to prevent sediment migration off-site. ▪ Erosion and Sedimentation Control Plan.	Short term population decline.	None practical	Insignificant	None required
		Sediment laden stormwater entering watercourses during operation.			✓	Entire Route	Loss of aquatic habitat resulting in population decline.	▪ Stormwater management facilities such as grassed swales, oil and grit separators, stormwater ponds.	Short term population decline.	Clean-out facilities as required.	Insignificant	Normal monitoring of drainage facilities.

Table 4-3
Effects and Mitigation for Natural Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE C: To protect and enhance the natural environment in the corridor												
	Minimize adverse effects on Aquatic Ecosystems (cont'd)	Loss of site-specific habitat.		✓		Black Creek and tributary watercourses within route.	Potential loss of fish habitat as a result of watercourse realignment, new culverts/bridges, culvert/bridge extensions and/or culvert/bridge replacements or repairs.	▪ Design subway works to avoid modifications at culverts/bridges. ▪ Any new structure will be sized in accordance with TRCA's criteria for spanning watercourses and floodplain following appropriate further studies. ▪ Avoid in-water work to the extent possible. ▪ Minimize the area of in-water alteration to the extent possible. ▪ Follow in-water construction timing restriction. ▪ Perform all in-water work in the dry using a temporary flow bypass system.	An improvement to fish habitat may result from channel modifications at Black Creek watercourses that support fish habitat.	Consultations with regulatory agencies during detail design to confirm no harmful alteration of fish habitat.	Insignificant	On-site environmental inspection during in-water work. Post-construction monitoring of fish habitat recovery measures.
C1-Cont'd		Fish mortality		✓		Black Creek and tributary watercourses within route.	Fish may be injured or killed by dewatering.	▪ Design subway works to avoid modification of water quantity and quality in watercourses. ▪ Avoid in-water work to the extent possible. ▪ Perform all in-water work in the dry using a temporary flow bypass system. ▪ Capture fish trapped during dewatering of the work zone and safely release upstream. ▪ Prohibit the entry of heavy equipment into the watercourse.	None expected.	None	Negligible	On-site environmental inspection during in-water work.
		Barriers to fish movement.		✓	✓	Black Creek and tributary watercourses within route.	Subway and station works may create a barrier to fish movement.	▪ Use open footing culverts or countersink closed culverts a minimum of 20% of culvert diameter. ▪ Span the watercourse, meander belt or floodplain with new structures where warranted by site conditions.	New bridges or culverts and culvert modifications will be designed to avoid the creation of a barrier to fish movement.	Negotiations with regulatory agencies during detail design.	Negligible	On-site environmental inspection during in-water work.
		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.	None	Negligible	▪ 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.	▪ Minimize the area of stream bank alteration to the extent possible. ▪ Use stormwater management practices that encourage infiltration and recharge of groundwater.	Shading provided by culvert/bridge offsets shading lost through removal of riparian vegetation.	Restore riparian areas disturbed during construction with native vegetation.	Negligible	▪ Post-construction inspection of stormwater management facilities to evaluate their effectiveness. ▪ On-going maintenance as required. ▪ Post-construction inspection of riparian plantings to confirm survival.
		Disturbance to rare, threatened or endangered species		✓	✓	Black Creek and tributary watercourses within route.	▪ No rare, threatened or endangered species have been recorded in Black Creek.	▪ No species-specific mitigation required.	None expected.	None required.	Negligible	None required.

Table 4-3
Effects and Mitigation for Natural Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE C: To protect and enhance the natural environment in the corridor												
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 to the extent possible. ▪ Minimize grade changes to the extent possible. ▪ Delineate work zones using construction fencing/tree protection barrier. ▪ Clear vegetation during non-breeding seasons.	None expected.	Restore natural areas disturbed during construction with native vegetation, where feasible.	Negligible	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.	▪ Channel realignment or culvert/bridge extension, repair or replacement may create a barrier to wildlife movement. ▪ Insertion of subway station surface facilities may create an additional impediment to wildlife movement and increase the potential for wildlife/vehicle conflicts.	Enhance wildlife passage around facilities, where feasible through culvert/bridge modifications and re-vegetation along boundaries.	Design of new bridges or culvert extensions to provide access to station facilities will not impede wildlife passage.	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.
		Disturbance to vegetation through edge effects, drainage modifications and road salt		✓	✓	Station surface facilities.	▪ Clearing of new forest edges may result in sunscald, windthrow, and invasion of exotic species. ▪ Ditching, grading and other drainage modifications may alter local soil moisture regimes.	▪ Minimize the area of vegetation removals to the extent possible. ▪ Minimize the grade changes and cut/fill requirements to the extent possible. ▪ Delineate work zones using construction fencing/ tree protection barrier. ▪ At detailed design an inventory of the vegetation to be removed during construction will be performed and a restoration or compensation plan will be provided.	▪ Vegetation communities within the study area are primarily cultural in origin and have been impacted by Highways 7 and 407. ▪ Subway stations represent a minor incremental encroachment into these already disturbed communities.	Re-vegetation along watercourses and landscape treatments.	Insignificant	None required.
	Minimize adverse effects on Terrestrial Ecosystems (cont'd)	Disturbance to rare, threatened or endangered flora		✓		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.	Trees may be removed by the construction of the subway and its associated facilities.	None required.	Insignificant	Monitor clearing activities to ensure that minimum work zones are used to avoid any unnecessary tree removal.

Table 4-3
Effects and Mitigation for Natural Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE C: To protect and enhance the natural environment in the corridor												
C3	Improve regional air quality and minimize adverse local effects	Degradation of existing local and regional air quality when compared to MOE standards			✓	VCC, Hwy 407 and Steeles Avenue Station areas	Situation expected to be unchanged or marginally better than 2001	The fleet average emissions will drop significantly due to technological improvements balancing the increase in traffic volumes. The subway extension will divert commuters from individual highly polluting sources (single occupancy automobiles). The design of the station will also involve landscape and streetscape design which will result in the planting of new trees and vegetation which will improve air quality in those areas.	Improvement of about 4% in all pollutants except PM. Subway availability will slow the rate of increase of PM.	None required	Positive Effect	None recommended
		Increase in emissions of Greenhouse Gases (GhG)			✓	Entire route	GhGs emitted may not be improved	Compared to the status quo (no rapid transit) there will be far less GhGs emitted per commuting person.	Net decrease in CO_2-equivalent emissions of 4-5 kilotonnes	None required	Positive Effect	None recommended
		Degradation of air quality during construction		✓		Entire route	Some dust may be created during the construction period.	Regulations require that all possible pollutant emission mitigation steps possible be taken during construction activities.	Some PM emissions locally.	None required.	Negligible	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 park-and-ride lots 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.	Dilution and other natural processes will attenuate elevated parameters in groundwater.	▪ 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.	Moderately Significant	None required. Water quality effects are anticipated to remain acceptable.
		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 along route	Minor increase in quantity of surface runoff. Minor decrease in quantity of groundwater.	Storm water management facilities such as grassed swales and storm water ponds will be designed to meet current TRCA stormwater management criteria for quality, quantity and erosion control.	▪ None. The pond will be designed to mitigate all effects.	None	-	None required

Table 4-3
Effects and Mitigation for Natural Environment

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE C: To protect and enhance the natural environment in the corridor												
	Minimize adverse effects on corridor hydro-geological, geological and hydrological conditions.	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

Notes:
P – Pre construction, **C** – Construction, **O** – Operation

4.1.7 OBJECTIVE D: To promote smart growth and economic development in the corridor

One of the main purposes of the Rapid Transit System is to support the smart growth policies in the Region and simultaneously encourage economic development. From this perspective, the early implementation of the Vaughan N-S link as subway technology strongly supports Provincial, Regional and Municipal planning policies, such as the "Places to Grow" and "Centres and Corridors" urban form. In many respects, the undertaking will contribute to the intensification of underutilized sites and encourage transit-oriented development at infill locations and vacant land along the corridor. At the same time, several built-in design characteristics are aimed at reducing the potential for adverse effects on business or access to social and community facilities.

The transit system will support the overall structure of the Region's Planning Policies by ensuring that form follows function and creating a sustainable environment that will increase development leading to increased business activity along the corridor. Through the increase in business activity, infill locations and vacant land can be developed, maximizing the density of development and leading to greater benefit from investment in rapid transit in York Region. The assessment for Objective D is tabulated in **Table 4-4**.

Table 4-4
Effects and Mitigation for Smart Growth and Economic Development

GOAL	Environmental Value/ Criterion	Project Activity/ Issue	Project Phase[1] P	C	O	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
OBJECTIVE D: To promote smart growth and economic development in the corridor												
D1	Support Regional and Municipal Planning Policies and approved urban structure	Need for pedestrian-friendly streets and walkways for access to stations		✓	✓	VCC and Steeles Ave. Stations	Pedestrian access to the proposed subway stations could be degraded by increased vehicular traffic generated by development around the planned stations.	▪ The VCC Streetscaping Study recommendations and York Region's streetscaping policies applied to the Steeles Avenue precinct will create a pedestrian-friendly station environment. ▪ Signalized pedestrian crosswalks will be provided at all station locations and an appropriate number of intersections; Pedestrian safety will be considered in the design of station precincts and road signage will be highly visible to both pedestrians and automobiles.	Potential for jaywalking in vicinity of stations, which could lead to increased in number of vehicle/pedestrian incidents.	Streetscaping treatment will discourage illegal access by defining pedestrian paths to signalized intersections	Negligible	Monitor traffic accidents involving pedestrians to establish whether cause is transit related.
		Locating higher density and transit-oriented development where it can be served by transitway			✓	New and redevelop-ment/infill locations	Current landowners could object to implementation of changes to existing land use pattern around subway stations.	▪ Regional/Municipal land use controls and approval processes to encourage transit-oriented development or re-development in support of OP objectives.	Redevelopment pressure on surrounding areas	Apply Municipal Site Plan approval process	Insignificant	Monitor re-development activity to control overall increase in development density
D2	Provide convenient access to social and community facilities in corridor	Potential barrier effects during construction and operation		✓	✓	VCC and York University stations	Subway construction works could be perceived as a barrier in access to future community centres, hospital(s), malls, parks, etc.	▪ Construction Traffic and Pedestrian Management Plan will avoid wherever possible, barriers to entrances/exits to large attractors along Highway 7.	Alternative access routes to facilities may affect adjacent properties	Mark detours and alternative access points clearly	Insignificant	Monitor congestion levels during construction and traffic patterns during operations.
D3	Minimize adverse effects on business activities in corridor	The potential for an increase in business activity.	✓	✓	✓	Entire route	Increased pedestrian traffic via the implementation of a rapid transit system will increase the potential for business activity.	▪ A higher density of development on underutilized sites, infill locations and on vacant land should increase the market for some business activity.	Increase in vehicular traffic; increase in workforce/ population.	Encourage intensification meeting urban form objectives.	Insignificant and positive	Monitor building applications/ permits, economic influences (employment rate, etc.)
		The potential for a decrease in business activity.		✓	✓	Entire route	Modification of road access could lead to displacement and/or business loss.	▪ Implement procedures to address requests of affected businesses; incorporate design solutions and construction methods to minimize number of businesses affected.	Decrease in traffic; decrease in workforce/population	Encourage alternative compatible development	Moderately significant	Cooperative response to business loss concerns addressed to municipalities.

Notes: **P** – Pre construction, **C** – Construction, **O** – Operation

4.2 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED)

Leadership in Energy and Environmental Design (LEED) criteria will apply where feasible during the detail design phase, following the recommendations and guidelines of the TRCA document *"The Living City - Supporting Green Building Initiatives across the Greater Toronto Region"*. LEED emphasizes state-of-the-art strategies aiming to obtain:

- ✓ **Sustainable site development** through erosion and sedimentation control; optimum transit connections; avoiding excessive parking and encouraging preferred parking for car-vanpooling; protecting and restoring the open space; providing adequate stormwater management; minimizing site lighting where possible.
- ✓ **Water savings** through water efficient landscaping; innovative wastewater technologies; water-use reduction
- ✓ **Energy efficiency** through optimization of energy performance; use of renewable energy; reduction in chlorofluorocarbons (CFC); and fundamental building systems commissioning specs.
- ✓ **Materials selection** through storage and collection of recyclables; resource re-use; usage of regional material; reduction of the use of finite raw materials.
- ✓ **Indoor environmental quality** through identifying potential problems and minimizing Indoor Air Quality (IAQ) performance; monitoring the presence of Carbon Dioxide; providing effective ventilation; reducing the quantity of indoor air contaminant materials; among others.

5 IMPLEMENTATION

The previous sections of this report describe the development of alignments and the assessment of associated effects on the environment. This section provides an overview of alternative construction methodologies and recommendations for construction of the double track 2.8 km subway extension from Steeles West station to the VCC Station.

This implementation section is intended to provide technical insight into activities that will occur during the design and construction phases. Additional research and analysis during design will confirm the ultimate construction methodology, which will be finalized in consultation with the Region, TTC, and other major stakeholders.

The section discusses the following:

- **Implementation Plan**: issues and recommendations pertaining to the VNSL Subway extension implementation process;
- **Tunnelling Construction;**
- **Cut and Cover Construction;**
- **Dewatering**;
- **Additional Implementation Activities Required** (geotechnical investigations, pre-construction surveys, and instrumentation and monitoring); and
- **Construction Staging**.

5.1 IMPLEMENTATION PLAN

The implementation of the subway will consist of design, construction, system installation and testing and commissioning phases.

In support of the original Environmental Assessment Study, and this supplementary Conditions of Approval Report, the preferred subway alignment design has been developed to a functional planning level of detail including both horizontal and vertical geometry of the preferred subway alignment. Also, preferred locations for the 407 and VCC (Highway 7) Stations have been identified and conceptual layouts of the facilities have been developed. The infrastructure planning undertaken during the study is considered adequate to identify the effects of implementation and operation of the undertaking and establish whether any mitigation is needed and what form it should take. .

5.1.1 The Design Phase

Following approval of the EA by both provincial and federal agencies, further preliminary design and subsequently, detailed design will constitute the first stage of the implementation plan.

The expectation is that the subway design and construction will take place in stages. The timing and extent of each stage of construction will depend on the availability of funding and the period required.

Once these factors have been determined, a work plan to carry out the detailed design will be developed. Multiple design components for the subway infrastructure will be completed simultaneously. Each design phase will allow sufficient time for post-EA approvals prior to the scheduled start of construction. Besides the MOE and CEAA approvals of the EA itself, examples of these approvals are:

- Municipal Building Permits, for the stations and associated Facilities;
- TRCA permits;
- Federal DFO authorization;
- Permits under the Lakes and Rivers Improvement Act for alternations to the watercourses and/or stream crossings; and
- Any Ontario MNR approvals.

Design efforts are anticipated to continue for up to 4 years, with construction beginning less than two years after the commencement of the design activities.

5.1.2 The Construction Phase

The timing of construction of the subway extension is influenced primarily by the requirements of the ”Move Ontario Trust”. The terms of the trust dated March 24, 2006 require that construction begin no later than April 1, 2008 (or 365 days from the receipt of Final Provincial Environmental Assessment Approval – whichever is earlier). The term of the trust is ten (10) years terminating on March 24, 2016. Construction should be completed by this date.

Because of the aggressive schedule requirements, it is expected that the design, tender award and construction of various elements will occur in parallel. The construction efforts will include all subway extension components between Sheppard West Station and the VCC Station. As such, significant coordination between TTC/Toronto and the Region of York is expected. The exact schedule will be developed and formalized by the selected contractor.

5.1.3 System Installation, Testing and Commissioning

System Installation (trackwork, power, communications) is expected to require approximately 42 months (3.5 years). These activities can be performed in parallel with facilities construction activities. Initial system installation activities will commence once portions of the subway (tunnel or stations) are built and accessible. System installation could reasonably begin as early as 2011.

The installation of station and tunnel finishings will commence upon completion of each the construction phases. The installation of finishings is typically completed within 6 months. System testing and commissioning follows installation of each component and concludes with trial running on the completed facilities and systems.

5.2 TUNNELLING CONSTRUCTION

5.2.1 Construction Methods

The ground conditions along the proposed alignment are considered to be favourable for machine-bored tunnelling, provided that groundwater is adequately controlled. Therefore the construction of the VNSL subway between stations is anticipated to consist of twin bored tunnels, for independent northbound and southbound tracks, of approximately 6m diameter and at 12m Centerline (C/L) spacing. Tunnel crown to surface distances vary from 10m to 20m.

All tunnelling operations will be advanced from one station site to the next with the stations constructed using the cut-and-cover method. Construction will be initiated from a working site, at an access shaft, (typically near a cut and cover station location), for tunnelling equipment installation and removal (typically 1000m to 2000m minimum). Little, if any, access to the tunnels from the surface is required at any other locations along the tunnel drives.
.
Based on the geotechnical investigation conducted for this study (see Appendix A for the complete Geotechnical/Hydrogeological Assessment Report), the anticipated ground conditions along the proposed alignment should be favourable to tunnel construction.

The Geothechnical Report describes feasible tunnelling techniques. For relatively long lengths of tunnel, generally greater than about 600 m as anticipated for this proposed alignment, it is considered feasible and likely economically suitable to use a tunnel boring machine (TBM). Tunnel boring machines are generally not suited to construction of underground transit stations. The recently-built Sheppard Subway was constructed using TBMs specifically designed for and purchased by the TTC. These TBMs were designed as earth-pressure-balance (EPB) machines so as to assist in controlling ground displacements in potentially difficult ground conditions below groundwater levels.

A permanent tunnel lining is installed directly behind the TBM in a one pass tunnelling operation. The fully bolted, waterproof, pre-cast concrete liner is

continuously grouted in place as the TBM advances to minimize the opportunity for any ground movement or subsidence, and prevent ground water from infiltrating into the finished tunnel.

Removal of excavated earth material, and input of materials such as liner segments and grout components, is all conducted from the single operating shaft location for the duration of the complete tunnel drives.

Where the tunnels pass directly beneath existing structures (e.g. Jane Street, CN Halton Subdivision, Highway 407, Hydro towers), additional ground control measures may be necessary as discussed in Section 4 (Assessment of Effects).

Appendix A discusses in detail possible methods to be used for groundwater control and lining.

5.2.2 Preferred Tunnelling Method

It is proposed that tunnelling would be undertaken by Tunnel Boring Machine(s) (TBM), using the Earth Pressure Balance (EPB) technique. This technique maintains a positive pressure at the excavation face at all times to minimize or eliminate the release of in situ earth pressures and subsequent surface subsidence during the tunnelling process. The EPB TBM technique also controls underground water pressures, eliminating ground water inflows without the requirement for external dewatering procedures.

5.3 CUT AND COVER CONSTRUCTION

Construction of the 407 and VCC Stations will be performed using cut and cover construction methods. Special track structures such as cross-overs and tail tracks are also expected to be built and installed using cut and cover construction methods. Although initial hydrological investigations were carried out as part of this study, it is expected that additional, more detailed groundwater investigations will be conducted prior to the detailed design. The initial investigations resulted in the following findings:

- Though the Highway 407 Station is located in close proximity to Black Creek and two of its tributaries, distinct sand and silt deposits were not encountered at the investigation locations.
- On the basis of the subsurface conditions encountered to date at the Highway 407 Station, water-bearing deposits that would require extensive dewatering systems are not anticipated to be present.
- In the vicinity of the VCC Station, several significant granular layers are present over the depth of the station excavation (Upper Sand/Silt).
- The recent sinkhole incident at the intersection of Highway 7 and Jane Street indicates that a significant thickness of sand and silt exists at the location. This may constrain the proposed VCC Station excavation and require that groundwater control be provided.

5.3.1 Cut-and-cover Excavation Construction Methods

It is expected that in most instances, vertical excavation will be required, particularly in the Highway 7/VCC Station area. These excavations will require temporary shoring. Shoring could consist of soldier-piles and wood lagging, drilled secant pile (caisson) walls, or soil-nail ground supports, depending on the requirements for groundwater control and the need to limit ground movement adjacent to the shoring system.

Based on previous construction for Toronto subway projects, station excavations or dewatering may be accomplished using deep wells, eductor well systems or well-points installed from within the excavation. The influence of dewatering on settlement of the surrounding ground should be relatively minimal. Based on the subsurface information gathered during the recent investigations, groundwater will have to be controlled for the Highway 7 Station. The recent investigations suggest that the Upper Sand/Silt is not present in significant thicknesses in the vicinity of the Highway 407 Station, indicating that extensive dewatering may not be necessary in this area.

Based on the prevailing ground conditions, temporary cuts for open-cut construction may be made with side slopes in the range of 1H:1V to 1.5H :1V. It is expected, however, that in most instances, vertical excavation sides will be required and that these excavations will require some form of temporary shoring. Horizontal support may be provided by internal braces or drilled anchors that extend into the ground behind the supporting walls.

Where temporary or permanent easements can be obtained from neighbouring property owners, it may be assumed that ground anchors or soil nails will extend horizontally (or at some shallow angle) into the ground a distance of up to twice the depth of the excavation. For soil nail supported excavations, this distance may be less (approximately equal to the excavation depth) but for planning purposes, the greater extent should be used since the actual or likely support systems are unknown at this time.

Cut and cover construction effects on existing structures and facilities are addressed in Section 4.

5.3.2 Temporary Ground Support Systems Construction Methods

For temporary ground support during deep excavations, soldier pile and lagging walls are typically used where groundwater conditions are favourable or where dewatering is carried out and wall and ground displacement are permitted to some degree. Where ground displacement must be minimized and the ground support system must be closely controlled, contiguous bored and cast-in- place concrete pile (secant pile) walls are often used. In some instances, depending on cost and ground/groundwater condition considerations, soil nail walls or concrete diaphragm walls may also be appropriate.

5.4 DEWATERING

Dewatering of the interstadial granular soils (Upper Sand/Silt) will be necessary for cut-and-cover stations, tail track, or crossover track structures. In addition, it is anticipated that dewatering may be required for the start and end shafts for tunnels constructed with tunnel boring machines, and for ventilation/emergency exits. Based on previous construction for Toronto subway projects, such dewatering may be accomplished using deep wells, eductor well systems or well points installed within excavations. It is anticipated that active dewatering for lengths of tunnel constructed using closed-face tunnel boring machines would not be required. It is expected that significant groundwater dewatering will be required for the proposed VCC station as the mezzanine and the upper portion of the platform occurs within a water-bearing interval. Also some groundwater dewatering will likely be required for the proposed Highway 407 station. More detailed sites specific geotechnical and hydrogeological studies will be required during detailed design to confirm both groundwater control requirements, estimated dewatering quantities, the zone of influence (ZOI), and potential impacts to any watercourses (i.e. Black Creek and its tributaries). Additionally, the need for any permits (Permit to Take Water) for VCC or Highway 407 stations will be identified.

For the purpose of this study, an outline assessment of potential dewatering conditions was conducted. This dewatering assessment, considered the following:

- Station construction was assumed to be completed using conventional cut-and-cover methods without implementation of any groundwater control measures except for dewatering using wells or well-points.
- The permeability (hydraulic conductivity) of the granular deposits around Highway 7 station was assumed to be between 5x10-3 and 5x10-5 cm/s.

Based on these assumptions, it is anticipated that nominal dewatering is expected at the site of the Highway 407 Station to control the stormwater and residual flows during construction. The lateral extent of the

groundwater drawdown at the site of Highway 7 Station could be on the order of 500 m to 1,500 m from the dewatering system to where the drawdown is on the order of about 1 m.

Where groundwater taking is carried out near potentially contaminated sites or at the Highway 407 site where there had been ongoing agricultural activities, the groundwater extracted during dewatering may require treatment prior to disposal.

Further discussion of dewatering is included in Appendix A.

5.5 ADDITIONAL IMPLEMENTATION ACTIVITIES

5.5.1 Geotechnical Investigations

Prior to tunnel design and construction, an extensive Geotechnical Investigation will be undertaken to determine to the best extent possible the expected ground conditions to be encountered, and assist in the design of tunnelling equipment and final lining design components. It will be necessary to complete more boreholes in the areas where variation may be important for determining aquifer continuity characteristics for dewatering or groundwater cut-off. The investigations and analyses will better define estimated dewatering quantities and drawdown radius values for final design and final permitting. The investigation and supporting documents would be undertaken by a geotechnical specialist experienced in this type of work.

In general, the investigation program would be phased to encompass preliminary data, followed by subsequently more detailed work phases to refine the information, until the most likely interpretation of existing conditions along the entire alignment can be made.

Work would consist of exploratory bore-holes at regular intervals, followed by more extensive drilling and sampling at specific locations mandated by the type of construction anticipated, or to clarify any apparent anomalies from the initial investigations. Extensive laboratory testing and analysis, core samples, and written reports would be available to designers and constructors for determining the final tunnel methodology and design parameters. A typical arrangement for this phased investigation is summarized in the table below:

Investigation Phase	Maximum Borehole Spacing
Phase 1	450 m
Phase 2	150 m
Phase 3	50 m Stations 75 m Tunnels

5.5.2 Pre-Construction Surveys

Typically, an initial survey is undertaken of all existing structures, above and below the ground surface, within the envelope of influence from the anticipated tunnel construction. This report can be used to confirm any changes occurring as a result of construction activity.

5.5.3 Monitoring Program

A monitoring program will be established to provide a continuous record of any movement during all phases of construction activity.

Special instruments will be installed on sensitive structures, such as hydro towers or railway tracks, to provide “continuous” and “immediate alert“ monitoring of these structures for potential movement.

Additional monitoring devices will be installed on the surface, extending below the frost line at relatively close spacing along the centre-lines of both tunnel alignments. (For example, the ground monitoring program for the Sheppard Subway project consisted of settlements points installed about 2 m below the ground surface at 10 m intervals along the centrelines of each tunnel). Each settlement point will consist of a sleeved steel rod with the bottom 0.3 m grouted into a borehole. Other instruments including deep settlement points (installed every 100 m) and probe extensometers will be installed at other locations along the alignments as secondary measures for judging overall patterns of ground response and construction workmanship.

Perpendicular arrays will be provided at larger intervals (e.g. 200 m) to extend beyond the expected envelope of influence from the anticipated tunnel construction and monuments are installed on structure or building foundations.

Utilities will be monitored by strain gauges or settlement points at critical locations. All buildings within the zone of influence will also be regularly monitored for settlement.

Vibrating wire and open standpipe piezometers will be installed at critical points around braced excavations or tunnelled cross-passages to observe the effectiveness of dewatering systems within the multiple aquifers present. Vibrating wire strain gauges will be installed on selected struts within braced excavations to monitor strut load.

5.6 CONSTRUCTION STAGING

As described in Section 5.3, only the stations and special track structures will be built using cut-and-cover methods, the rest of the subway will be tunnelled. The twin tunnels will have no surface effect; consequently their construction will not require a specific staging sequence.

To minimize the impact on traffic circulation, decking is anticipated in the cut-and-cover sections under existing roadways, complemented by a traffic management plan, which will be developed during the detail design phase.

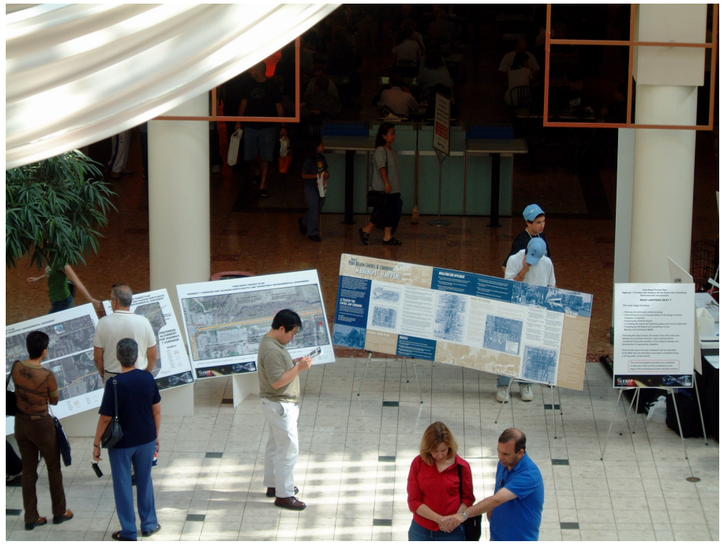
Areas where traffic circulation will be impacted, are Millway Avenue including the intersection with Highway 7 affected by the VCC Station, and Jane Street (south of Highway 407) affected by the access to the 407 Station.

6. PUBLIC AND AGENCY INVOLVEMENT

6.1 THE ORIGINAL EA PUBLIC CONSULTATION PROCESS

Five features that are key to successful planning under the Environmental Assessment Act are described in the "Interim Guidelines on Environmental Assessment Planning and Approval, Ministry of Environment, 1989" are:

- Consideration of reasonable alternatives;
- Consultation with affected parties;
- Consideration of all aspects of the environment (i.e., natural, social, economic, cultural and technical);
- Systematic evaluation of net environmental effects; and
- Clear and complete documentation of the planning process.



The consultation process developed for the Highway 7 and Vaughan North-South Link EA was designed to contribute to the achievement of each of these key features. As such an extensive public involvement program was followed during this process. The process consisted of:

- Seven Technical Advisory Committee (TAC) meetings;
- A number of meetings with individual technical agencies and key stakeholders including,
  - York Regional Health Unit,
  - Ontario Realty Corp,
  - York Regional Fire Coordinator,
  - York Region Police Chief,
  - Municipal Emergency Response Services
  - CN North America,
  - GO Transit,
  - Rouge Park,
  - Environment Canada,
  - Canadian Environmental Assessment Agency – Ontario Region,
  - Ministries of Environment, Culture, Education, Health, Municipal Affairs and housing, Natural Resources, Solicitor General, and Transportation,
  - First Nations,
  - Property owners, and
  - Beechwood Cemetery.
- Preparation and distribution of Fact Sheets
- Development of a website to inform the public of the project process.
- General presentations to a wide variety of stakeholders, opinion makers and community groups;
- Four rounds of Public Consultation centres (each PCC was conducted in at least 3 different venues in order to maximize the number of people from the general public that had access to the data). The following table summarizes the information that was presented at the PCCs.

PCC #	PCC Purpose	Dates
1	Familiarize the public with the YRTP program, to provide the public with an opportunity to review and provide input regarding the collection of background data and to summarize the findings of the previously completed Need and Justification Study.	February 6th, 7th and 12th 2003.
2	Provide the public and opportunity to review and provide input regarding the comparative assessment of the alternatives, the determination of the preferred undertaking, potential environmental effects, and proposed mitigating measures, and to obtain feedback on specific concerns or preferences.	April 24th, 25th and 26th 2003.
3	Present to the public the preferred route for a median transitway and describe its main characteristics as the recommended undertaking.	September 18th, 19th, 20th, and 23rd 2003.
4	Provide an opportunity for the public to review the findings of all steps in the EA process including an overview of the findings of the analysis of both alternatives to the undertaking (alternative transportation solutions) and alternative methods of carrying out the undertaking (routes and technologies).	September 9th, 11th, 17th, and October 28th, 2004.

6.2 CONDITIONS OF APPROVAL PUBLIC CONSULTATION PROCESS

The VNSL Subway Alignment Optimization study followed a similar process to the original EA with an emphasis on ensuring that interested parties were:

- Informed throughout the study by the use of various communication channels and techniques including individual meetings with stakeholders, two Technical Advisory Committee (TAC) Meetings; and a Public Consultation Centre,
- Involved throughout the study period and as well notified of appropriate milestones;
- Provided access to current information in an efficient manner;
- Provided sufficient time to respond to question and data request; and
- Encouraged to participate in an issue identification and resolution process.

The process ensured that concerns and issues were brought forward early and addressed appropriately during the course of the study.

6.2.1 Technical Advisory Committee and Technical Agencies

The majority of the agencies that were members of the Technical Advisory Committee (TAC) for the Region's Highway 7 and VNSL EA process was reconvened for the Conditions of Approval process as shown in the table below. Municipalities such as Markham and Richmond Hill decided not to participate since the limits of the supplementary VNSL Alignment Study were set outside of their jurisdiction; on the other hand 407 ETR was invited and participated in the TAC meetings.

TAC Member	HWY 7 & VNSL EA Process	COA Process
York Region (including York Region Transit)	✓	✓
Town of Markham	✓	
Town of Richmond Hill	✓	
City of Vaughan	✓	✓
City of Toronto	✓	✓ (*)
TTC	✓	✓
GO Transit	✓	✓
Ministry of Natural Resources (MNR)	✓	✓ (*)
Ministry of Transportation	✓	✓
Ministry of Culture	✓	✓ (*)
Toronto and Region Conservation Authority	✓	✓
407 ETR		✓

(*) – Were invited but did not attend the TAC meetings.

Two meetings conducted with the TAC were the following:

- May 5, 2006: to present and review the scope that would be carried out as part of the Subway Alignment Optimization Report, as dictated by the Conditions of Approval. Additionally the group discussed the feasibility and necessity for alternate accesses to the 407 Station (i.e. from Highways 407 and 400).

- October 26, 2006: held prior to the Public Consultation Centre (PCC), to present to TAC members the material for the PCC and obtain their feedback.

At each meeting TAC representatives were given the opportunity to express any concerns their agencies may have with regards to the project and to highlight any issues that may need to be addressed during the project process.

6.2.2 Technical Agencies

Participating technical agencies continued to be involved during the study and were actively involved in scoping the issues, developing and assessing alternative alignments, and developing mitigating measures for unavoidable impacts. In addition to the TAC meetings, consultation with agencies was held through individual meetings, site visits, and email/telephone correspondence. Individual meetings were conducted with the following agencies:

- 407 ETR/MTO: to focus on the 407 Station location restrictions. It was agreed that the selected alternative must avoid any at-grade facility or potential of encroachment (passengers or employees) on the Hwy 407 right of way for safety and legal reasons. The Hwy 407 station was located outside of the Highway 407 right of way.

- TRCA (three meetings): focusing on impacts to Black Creek and its fill regulation limits as a result of the subway tunnel and Hwy 407 station facility construction. The following concerns were raised:
  a) Need to address measures to mitigate any possible ground water effects.
  b) Run-off water from the Station parking facility and the future MTO parking and maintenance facility may have to be treated by two ponds located on either side of the Creek's tributary. This will be re-visited when both projects are at the design stage.
  c) The backwater effect on ORC land will need to be addressed prior to development of associated services with the anticipated facilities of the Highway 407 Transitway such as the service yard and parking lot.
  d) Any road access crossing the Creek's valley should be on bridge structure spanning the meander belt and erosion limits.

- City of Vaughan (several meetings): to discuss the integration of the station facilities into the VCC land-use and road network plans. It was agreed that:
  a) The optimized subway alignment would continue to respect the easement negotiated by the City with the developers that own the land north of Peelar Road.
  b) In principle, the proposed location of the VCC Station and the associated PPUDO, bus stops/layover bays, bus circulation patterns and other station facilities were acceptable to the City of Vaughan.
  c) The proposals will be reviewed during the detail design phase, considering any variation of the VCC future plans that may have been occurred at that time.

- York Region Transit (YRT): YRT provided input to the project through the internal project team. Feeder service routing (considering the location of the subway station facilities), bus stops and layover options were discussed and agreed upon, for scenarios in which the VCC road network would be at least partially implemented when the subway commenced operation and the case where the planned development of VCC has not yet started.

- MTO (several meetings): discussions focused on the coordination between the subway and MTO's planned Hwy 407 Transitway. Specific issues covered included parking requirements, horizontal and vertical alignment coordination, bus terminal location, and Hwy 407 Station surface amenities. In principle, MTO agreed with the functional layout of the facilities described in Section 3 of this Report and concluded that close coordination will be required during the MTO Transitway Study (scheduled to start in early 2007) and the design phase of the subway extension.

- TTC (several meetings): discussions with TTC addressed operational and technical issues and requirements, alignment coordination (specifically at the Steeles West Station), and special track requirements; It was concluded that:
  a) The alignment should comply with TTC design standards and permit the maximum system service speed of 80 km/h
  b) The alignment must match TTC EA's preferred alignment at Steeles West Station.
  c) A triple track, as shown in the TTC EA should be included just north of the Steeles West Station.

- GO Transit: discussions addressed bus facility requirements at 407 Station. In principle, the facility, as described in Section 3, complies with the bus stop and layover requirements discussed.

- Brampton Transit: Their potential bus requirements at 407 Station were provided and accommodated in the proposed arrangement for transfer facilities.

- Hydro One: During this study process, alignment and construction effects on Hydro One infrastructure were being evaluated by TTC and discussed with Hydro One. The Region's Study Team received input from Hydro One/TTC in the fall of 2006. After reviewing this input, the study team requested a meeting with Hydro One (December 2006) to present the preferred alignment and to discuss effects and potential mitigation measures.

6.2.3 Other Stakeholder Consultations

During the course of the study, the team consulted with several owners of property, either developed or in the process of being developed, along the routes under study. These consultations took the form of meetings, exchange of draft options analysis material and/or attendance at presentations. Consultations held, and the property involved in each discussion included:

- Smartcentres: lands north of Highway 7 in VCC;
- Toromont: lands south of Highway 7 in VCC;
- Bentall: lands south of Toromont, north of Highway 407, and west of Jane;
- United Parcel Service (UPS): UPS facility located at 2900 Steeles Avenue West – the north-east quadrant of the Steeles Avenue and Highway 400 Interchange;
- Ontario Realty Corp (ORC): lands between Steeles Avenue and Highway 407, west of Jane Street;
- Beechwood Cemetery.

6.2.4 Public Consultation Centre

A Public Consultation Centre (PCC) was conducted on Tuesday November 28th, 2006 to allow the general public to review and comment on the alignment alternatives and recommendations. A notice for the PCC was advertised to area residents and interested parties in the local newspaper (Vaughan Citizen). Additionally, the notice was mailed or emailed to: members of the public who signed in at the previous Highway 7 & VNSL Study PCCs and agreed to received project information; members of the public who requested to be put on the project mailing list; First Nations

groups; relevant municipal, provincial and federal agencies (i.e. the government Review team – GRT); and local property owners.

The material on display consisted of 13 presentation boards. Attendance at the PCC was approximately 25 people, with 12 participants signing-in. Attendees included those who were familiar with the project from previous PCCs, members of the public who were previously unaware of the project, and several stakeholders and property owners. Some of the stakeholders attended to confirm that mitigation discussed at prior meetings was being incorporated in the recommended design. Representative comments made by attendees included the following:

- Effects on UPS operations need to be addressed and construction coordination (between UPS and the Region) is essential;
- The delay, to customers destined for York University, associated with the transfer from the bus to the subway at the 407 Station could result in customers deciding to drive their car instead. It was noted that any delay associated with the transfer would be alleviated by the decreased travel time on the subway.
- Vibration effects of subway operation in the tunnel adjacent to the planned new Bentall development (optics manufacturing) north of Hwy 407 need to be assessed.
- Effects on Black Creek and valley lands.

The PCC presentation materials and notice were also made available on the Viva project website at www.vivayork.com.

6.2.5 MUNICIPAL APPROVALS

At important decision points in the study, formal presentations were made to the Region's Rapid Transit Steering Committee to summarize the assessment of alternatives, the recommended alignment and major recommendations of the study, including the final submission of this report.