RELIEF LINE SOUTH

Environmental Project Report

Section 6 - Detailed Assessment of Impacts, Proposed Mitigation and Monitoring of the Transit Project

TORONTO

METROLINX

HDR

6 Detailed Assessment of Impacts, Proposed Mitigation and Monitoring of the Transit Project

6.1 Introduction

The implementation of the Relief Line South subway will have both positive and negative impacts. Efforts to avoid negative impacts and enhance the benefits of the Transit Project have been integrated from the identification and evaluation of alignment and station options (with the City of Toronto's Rapid Transit Evaluation Framework), through to the development of the conceptual design. For any project, however, some negative impacts cannot be fully avoided. In these cases, mitigation measures will be required. The Transit Projects Regulation (Ontario Regulation 231/08) Section 9(2) requires the preparation of an Environmental Project Report (EPR) that contains the following information, among other requirements:

- An assessment and evaluation of the impacts that the preferred method of carrying out the transit project and other methods might have on the environment and criteria for assessing and evaluating these impacts;
- A description of any measures proposed by the proponent for mitigating any negative impacts that the preferred method of carrying out the transit project might have on the environment; and
- A description of the means the proponent proposes to use to monitor or verify their effectiveness, if required.

All impacts described below are a result of the implementation of the Relief Line South project only; they do not account for cumulative effects (with the exception of that which is documented in **Section 6.2.4**) due to the overlap of effects with other current / future projects in the area. Given the nature of the Project, cumulative effects are not anticipated to be considerable. The purpose of this Section is to document the above requirements for the Relief Line South (the "Project" or "Transit Project").

6.1.1 Interactions between Project Activities / Facilities and the Environment

The environmental impacts of the Transit Project can be classified under three categories:

- **Displacement of Existing Features by the Transit Project** - These include existing features within the Study Area which will be directly affected by the introduction of the subway tunnels, stations, commuter facilities and ancillary facilities. These are permanent impacts;
- **Construction Impacts** - These are short-term potential impacts resulting from construction activities; and
- **Operational Impacts** - These are ongoing, long-term effects arising from the operation and maintenance of the Transit Project.

The level of interaction between an activity/component and an area of potential environmental impact includes: none, weak, moderate and strong. These terms were defined as follows:

- **None** = no probability of an interaction. As a result, no additional discussion and documentation is required in support of this project;
- **Minor** = a low probability of an interaction. A general discussion is provided in this section, but given the anticipated low probability and/or significance, no additional commitments or follow up actions are required;
- **Moderate** = a medium probability of an interaction. A more detailed discussion is provided, and may require supporting supplemental analysis, mitigation measures and commitments.
- **Significant** = a strong probability of an interaction. These issues are usually regulated or closely monitored by government agencies and will require detailed analysis to quantify the potential impact and the anticipated effect of mitigation measures. Future commitments for elements with strong interactions are addressed by this project.

Table 6-1 is an "Interactions Matrix" developed to identify the interactions, and thereby potential impacts, between the proposed Project components / activities and key environmental features (listed as the sub-sections that follow containing more detail).

Table 6-1: Interactions Matrix

	Facilities / Activities \ Environmental Features	Natural								Emissions					Socio-Economic			Culture		Transportation			Utilities
		Fisheries & aquatic habitat	Vegetation, Wildlife, & terrestrial habitat	Wetlands	Species at risk	Soils & bedrock	Groundwater	Drainage & stormwater management	Contaminated Property	Climate change	Air quality	Noise & Vibration	Electromagnetic interference	Stray current	Buildings & property	Aesthetics	Human health & safety	Built heritage & cultural landscapes	Archaeology	Automobile traffic & transit services	Pedestrians & cyclists	Rail	Utilities
Displacement of existing features due to Project facilities	Tail Tracks W of Osgoode Station					○	○	○	○						●	●		●	◐				●
	Osgoode Station					○	○	●	○						●	●		●	◐				●
	Crossover #1					○	○		○						●			◐	◐				◐
	Yonge Station					○	○	●	○						●	●		●	◐				●
	Tunnel (Yonge Station to Sherbourne Station)					○	○		○						●			○	●				●
	Sherbourne Station					○	○	●	○						●	●		●	●				●
	Tunnel (Sherbourne Station to Sumach Station)					○	○		○						●			○	●				●
	Sumach Station					○	○	●	○						●	●		●	●				●
	Tunnel (Sumach Station to Don Valley Parkway)					○	○		○						●			○	●				◐
	Crossover #2					○	○		○						●			◐	◐				●
	Broadview Station					○	○	●	○						●	●		●	●				●
	Tunnel (Broadview Station to Carlaw Station)					○	○		○						●			○	●				●
	Carlaw Station					○	○	●	○						●	●		●	●				●
	Tunnel (Carlaw Station to Gerrard Station)					○	○		○						●			○	●				●
	Gerrard Station					○	○	●	○						●	●		●	●				◐
	Tunnel (Gerrard Station to Cavell Avenue)					○	○		○						●			○	●				◐
	Crossover #3					○	○		○						●			◐	◐				◐
	Tunnel (Hazelwood Avenue to Pape Station)					○	○		○						●			○	●				◐
	Pape Station					○	○	●	○						●	●		●	●				◐
	Tail Tracks N of Pape Station					○	○		○						●			●	◐				◐
	NW Wye Track					○	○		○						●			◐	◐				○
	NE Wye Track					○	○		○						●			◐	◐				○
	Emergency Exit Buildings (EEB) & Ventilation Shafts					○	○	○	○						●	●		◐	◐				◐
	Traction Power Substations (TPSS)					○	○	●	○						●	●		◐	◐				◐
Construction Impacts	Building demolition								◐		●	●			●	●	●	●	◐	◐	◐			○
	Contaminated site clean up					●	◐		●		○	●					●	●	●	◐	◐			○
	Above ground utility relocation										○	●			●	◐		●	●	◐	◐			●
	Subsurface utility relocation					○	○					◐			●	◐		●	●	●	●			●
	Cut-and-cover construction (station, EEB, ventilation shafts & tailtracks)		○			●	◐				●	●			●	●	○	●	●	●	●	◐		●
	Construction work sites (TPSS, work shafts & laydown areas)	○	○			◐	◐				●	●			●	●	○	●	●	●	●			◐
	Tunnelling	◐				◐	◐		◐			◐			○		○	●	●	◐	○	◐		●
	Soil removal and disposal					●			●		◐	●					○	●	●	◐	○			○
	Dewatering					◐	●		◐			●						●	◐	○	○			○
	Reinforcement of existing buildings and structures					●						●			●		○	●	◐	○	◐	●		○
	Erosion and sediment control	◐						●			○	●						●	◐					○
	Heavy equipment operations and maintenance	○					○		○		●	●					○	●	◐	◐	○			
	Material import / storage / stockpiling								○		◐	●				●		●	◐	◐	○			
Operations and Maintenance	Subway operations								○	◐	○	◐	○	◐				○	○					
	Track and structure maintenance											○						◐	○					
	Stormwater management							●		◐		○						○	○					◐
	Station Maintenance (cleaning, deliveries, state of good repair)											○					◐	○	○					
	Testing of emergency equipment											◐						○	○					
	Ancillary facilities maintenance (cleaning, deliveries, state of good repair)											○						○	○					

Extent of Impacts

None ○ Minor ◐ Moderate ● Significant

6.2 Permanent Impacts to Existing Features and Mitigation Measures

This section outlines the permanent displacement impacts associated with the built form of the Transit Project. This includes tunnels, station entrances, emergency exit buildings (EEBs), substations, ventilation shafts, passageways, and easements.

6.2.1 Natural Environment

Permanent impacts to the natural environment may include the physical alteration or displacement of existing features by the built form of the Project (tunnels, stations, etc.)

Fisheries and Aquatic Habitat

The only watercourse crossing associated with the Project is the crossing of the Lower Don River. As the infrastructure will be drilled underneath of the Lower Don River there are no anticipated permanent physical impacts to fisheries and aquatic habitat within the crossed section of the river as a result of this project.

Vegetation, Wildlife and Terrestrial Habitat

The construction of some facilities have the potential to directly affect surface features (i.e. open cut construction of stations). As part of the constructability review, options to use an open cut construction or a mined construction method for the development of the subway stations is being assessed for the Project. The mined construction method would minimize surface impacts as construction of the station would be performed underground thereby minimizing surface disturbance. However, if open cut construction of the stations need to be used there will be impacts to surface features within the footprint of the excavations. With respect to the natural environment this may mean that some vegetation will be cleared prior to construction. Based on existing information, approximately 7% of the cultural meadow (CUM) in Corktown Commons will be cleared during construction. This will likely only be street trees (landscaped) which are limited in use as wildlife habitat. However, they do hold the potential to be used by wildlife such as breeding birds for nesting. Therefore, the required clearing of vegetation for the construction of the Project has the potential to impact some vegetation and wildlife habitat.

Mitigation

Clear vegetation outside of the breeding bird window (i.e. April – August) or have the vegetation checked for active bird nests by an environmental monitor prior to clearing. A permit will be required from the City of Toronto in order to remove trees. Any vegetation that is adjacent to the construction disturbance but is not being removed will be protected with tree protection fencing.

Wetlands

The Project will exist underground and is not anticipated to alter any wetland areas. There are no wetlands located within the footprint of proposed surface infrastructure, such as the stations.

Species at Risk

Of ten species at risk (SAR) with potential to occur in the study area, only two were identified to have potential to be directly impacted by the proposed Project. Monarch and yellow-banded bumble bee may use the open areas, such as meadows, roadsides and the Don River riparian corridor for foraging or to build nest sites. The monarch, and its food plant, common milkweed, were observed along the Don River corridor and at Corktown Common during the 2017 field investigation.

Potential impacts to habitat for monarch and yellow-banded bumble bee are expected to be temporary in duration and local in scale. There is abundant similar habitat in the study area and surrounding region, and the Project is not expected to have an adverse effect on the local population of monarch or yellow-banded bumblebee. In addition, special concern species do not receive individual or habitat protection under the Endangered Species Act.

The remaining eight SAR with potential to occur in the study area are not expected to be directly impacted by the Project as potential habitat is outside of the Project footprint. The urban forest in Corktown Common may provide maternity roost habitat for the provincially endangered little brown myotis and northern myotis, as well as growing habitat for the provincially threatened white wood aster. The small ponds/marshes at Corktown Common may also provide suitable habitat for the federally threatened western chorus frog. Although potentially suitable nesting structures for the provincially threatened chimney swift and barn swallow and special concern species peregrine falcon may occur within the study area, none are expected to be removed or altered as a result of the Project.

Although potential habitat was identified within the study area for the provincially endangered butternut, no individuals were identified during the 2017 field investigations. It is unlikely that butternut would occur as a boulevard tree within the study area, but any individuals would be identified as part of the arborist report required for the detailed design of the Project.

Mitigation

Clear vegetation outside of the active season for wildlife to avoid harm to individuals. Additionally, vegetation will be replanted/restored when construction period is over to replace the habitat for monarch and yellow-banded bumble bee.

Implementation of best management practices during site preparation and construction will also prevent adverse indirect effects (e.g. dust or debris settlement) on the ponds/marshes and urban forest in Corktown Common.

Soils and Bedrock

The existing soil and bedrock conditions along the proposed tunnel alignment are described in the Conceptual Geotechnical Design Report (**Appendix 3-4**). Tunneling and station/shaft construction activities will cause displacement of the soils and bedrock. This may result in ground movement and settlement during construction activities and will require mitigation measures, as described in **Section 6.3.1**. Permanent impacts are not anticipated.

Groundwater

The existing groundwater conditions along the proposed tunnel alignment are described in the Conceptual Geotechnical Design Report (**Appendix 3-4**). It is anticipated that all underground tunneled and box structures will be designed as “water-tight” structures and that no permanent dewatering systems will be required. Therefore, no permanent impacts on the groundwater regime are anticipated as a result of the project.

Drainage and Stormwater Management

Given the urban nature of the corridor, the project will not add significant impervious areas. All the proposed stations will be below grade and the surface runoff due to the proposed work will be mainly associated with station entrances and Traction Power Substation (TPSS) structures. Consideration will be taken to ensure any drainage towards the residential properties is minimized.

The corridor is mostly urbanized and there are generally limited opportunities to provide stormwater management for runoff associated with the Transit Project. The details of new stormwater management facilities to be included as part of the Transit Project will be developed during the detailed design phase and will be discussed with the appropriate approval agency (City of Toronto and TRCA).

Most of the run-off in the area is currently captured through the municipal storm sewer system. Under proposed conditions, storm runoff will be generated mainly from the roofs of the station entrances and TPSS structures. As a best management practice, it is recommended to provide stormwater treatment measures where feasible to promote water balance and peak flow reduction through infiltration.

The potential impacts associated with construction and the proposed mitigation and monitoring requirements are outlined in **Section 6.3.1.**

The following outlines the stormwater mitigation proposed for permanent facilities.

<u>Mitigation</u>

Overall, the following Low Impact Development (LID) alternatives for storm water management treatment are recommended to be considered when preparing the storm water management plan during detailed design:

- Bio-retention – where the station entrances or substations are near open spaces such as parks. Bio-retention cells can provide water balance as well as quality and quantity control for the storm runoff;
- Tree Planter – along sidewalks and parking lots, connected to storm sewers for overflow. Tree planters can mainly provide water balance and quality control for the storm runoff for small catchments; and
- Soakaway Pit – below grade at parking lots. Soakaway pits can mainly provide water balance and quality control for the storm runoff for small catchments.

Runoff from the roof of the station entrances and TPSS structures will be directed through roof leaders to the appropriate LID for treatment before discharging into the municipal storm sewer.

There will be no anticipated additional drainage towards residential properties as a result of the proposed works associated with entrance structures. At station locations, mitigation is proposed where applicable:

- Osgoode Station: The proposed entrances at University Avenue and York Street will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The area is completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;
- Queen Station: The proposed entrance at Bay Street will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The area is completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;
- Sherbourne Station: The proposed entrance west of Sherbourne Street will be constructed within existing pervious areas. Additional runoff from the structure roof is expected at this location. There exist opportunities to implement a bio-retention cell to meet water balance as well as quality and quantity control objectives. The proposed entrance east of Sherbourne Street will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system at this location. The area is completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;
- Sumach Station: The proposed entrance at King Street East will be constructed within existing pervious areas. Additional runoff from the structure roof is expected at this location. There exist opportunities to implement a bio-retention cell to meet water balance as well as quality and quantity control objectives. The proposed entrances at Eastern Avenue and Richmond Street East will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system at these locations. The areas are completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;
- Broadview Station: The proposed entrances will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The areas are completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;
- Carlaw Station: The proposed entrances will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The areas are completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives;

- Gerrard Station: The proposed entrance will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The area is completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives; and
- Pape Station: The proposed entrance will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new station development. The area is completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives.

There are a total of five TPSS structures throughout the study area. Four of these structures (TPSS 1, 2, 4, and 5), will be constructed within existing impervious areas. There will be no negative impact on the existing drainage system by the new structures. There will be no anticipated additional drainage towards residential properties as a result of the proposed works associated with TPSS structures. The areas are completely urbanized and tree planters or soakaway pits can be considered for use to meet water balance objectives. TPSS 3 will be constructed within existing pervious areas. Additional runoff from the structure roof is expected at this location. There exist opportunities to implement a bio-retention cell to meet water balance as well as quality and quantity control objectives.

Design criteria for stormwater management measure has been established by the City of Toronto in accordance with the Wet Weather Flow (WWF) Management Policy (2003) and Sewer Use By-law (Toronto Municipal Code Chapter 681, 2016) and interim objectives to address water balance, water quality and water quantity. TTC's Design Standards, Volume 1 has also established criteria to address both surface water quantity and quality. If a new station discharges directly and/or in proximity (within 100 m) of natural watercourses, the proponents are required to complete an Erosion Analysis Report to determine the erosion control criteria for the sites.

Stormwater management strategies will conform to the City of Toronto Wet Weather Flow Management Guidelines, City of Toronto Design Criteria for Sewers and Watermains and Toronto and Region Conservation Authority (TRCA) guidelines, Ministry of Environment and Climate Change (MOECC) Stormwater Management Planning and Design Manual (2003), and the Low Impact Development Stormwater Management Planning and Design Guide (2010) by TRCA. Stormwater management proposals for stations to meet the WWFM guidelines will be evaluated during detailed design.

To offset potential impacts, lot level controls will be implemented to improve water balance and quality and to reduce peak run-off where practicable. The proposed approach to stormwater management at each station and TPSS location is summarized in **Table 6-2**: Stormwater Management for Subway Station Entrances (1 of 2) and **Table 6-3**.

Table 6-2: Stormwater Management for Subway Station Entrances (1 of 2)

Station	Entrance	Recommended Quantity Control Design	Recommended Quality Control Design	Recommended Water Balance Design
Osgoode	University Ave. & York St.	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Queen	Bay St.	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Sherbourne	Sherbourne St.	Lot level control, bio-retention	Bio-retention	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Sumach	King St	Lot Level control, bio retention	Bio-retention	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Sumach	Eastern Ave. & Richmond St. E.	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Broadview	All	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Carlaw	All	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements

Table 6-3: Stormwater Management for Subway Station Entrances (2 of 2)

Station	Entrance	Recommended Quantity Control Design	Recommended Quality Control Design	Recommended Water Balance Design
Gerrard	All	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
Pape	All	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements
TPSS 1,2,3,4, and 5	N/A	System-wide stormwater quantity control measures will be provided	Tree Planters/ Soakaway Pits	City of Toronto's Wet Weather Flow Management Master Plan Water Balance Requirements

Contaminated Properties

A study of potentially contaminated properties was completed for the proposed tunnel alignment and 250 m on either side of the proposed tunnel alignment. The purpose of this study was to identify the presence of potential sources of soil and/or groundwater contamination that could affect the project. The study involved a review of federal, provincial and private database search results obtained from Ecolog ERIS and included search results for databases relating to current and former landfill sites, waste generator databases, polychlorinated biphenyl (PCB) storage sites, underground storage tanks (USTs) and spills. The study results are provided in the Draft Conceptual Geotechnical Design Report (**Appendix 3-4**).

Mitigation

Additional site-specific investigations will be performed prior to construction to further assess the potential presence of contaminated soils, bedrock and/or groundwater along the tunnel alignment, and to establish excess materials management measures during construction, as described in **Section 6.3.1.**

6.2.2 Emissions

Climate Change

The impacts of climate change on the Transit Project and vice versa are summarized in the Operations and Maintenance Impacts and Mitigation Measures in **Section 6.4.**

Air Quality

There are no anticipated impacts to air quality due to the permanent displacement of existing features as a result of the Transit Project. There are potential transient impacts that relate to the construction of the Transit Project and operational impacts related to the operation and maintenance of the Transit Project. Details are provided in **Section 6.4.2**.

Noise and Vibration

There are no anticipated noise and vibration impacts due to the permanent displacement of existing features as a result of the Transit Project. There may be transient impacts that relate to the construction of the Transit Project and operational impacts related to the operation and maintenance of the Transit Project. Details are provided in **Section 6.3.2** and **Section 6.4.2** respectively.

Electromagnetic Interference

There are no permanent impacts associated with the Transit Project. There may be localized impact that relate to the operations of the subway as described in **Section 6.4.2**.

Stray Current

There are no permanent impacts associated with the Transit Project. There may be localized impacts that relate to the operation of the subway as described in **Section 6.4.2.**

6.2.3 Socio-Economic Environment

Buildings and Property (Property Acquisition)

Properties identified for acquisition are categorized into five groups, or tiers, for the purposes of communication of potential impacts to impacted property owners and occupants along the corridor. Tiers 1-3 relate specifically to permanent impacts associated with the Transit Project. Tiers 4 and 5 relate to the property temporarily required for construction of the Project. The tiers are summarized in **Table 6-4**.

Table 6-4: Summary of Property Impact Tiers

Tier	Description
1	Permanent property requirement for a new surface structure (e.g., EEB, entrance, vent shaft). This can result in a partial or full taking, to be determined as part of detailed design.
2	Permanent underground easement for new underground structure (e.g. tunnel, underground passageway, etc.)
3	Permanent easement preferred by the TTC for above and below ground TTC structures. The general requirement is a 3 m lateral easement with the following exceptions: • 1 m around a proposed vent or fan shaft when on private property • No easement required for substation buildings except when not located along the public right-of-way; then a 4.5m easement must be provided to allow for an access road
4	Temporary property requirement (partial taking, surface or underground easement)
5	Temporary property requirement (full take) (e.g., a proposed staging area occupying a majority of a property including any structures)

There are a total of 749 affected properties identified for a Tier 1, 2, and/or 3 property taking. A complete list of properties is provided in **Appendix 6-1** with a breakdown summary provided below in **Table 6-5**: Summary of Permanent Property Impacts**.**

Table 6-5: Summary of Permanent Property Impacts

Tier	Number of Properties Impacted
1	31
2	427
3	291

Mitigation

Property acquisition required for the Transit Project will be conducted by the City of Toronto on behalf of the project proponent. In acquiring property, The City balances community need with the rights of individual property owners, including tenants and business owners. The City's objective is to ensure that the individual's rights are respected and protected, and to provide fair compensation within the framework of the Expropriations Act (Ontario, 1990). The goal is to arrive at a mutually acceptable agreement between parties; however, if necessary in order to protect the ability to proceed with the Transit Project, expropriation may be considered.

The steps leading to property acquisition are as follows:

1. City of Toronto contacts the property owner to indicate its interest in the property and to identify issues and concerns.
2. City of Toronto conducts necessary surveys, appraisals, and other property related assessments.
3. An offering price is discussed. If a tentative agreement is reached, an Offer to Sell is signed by the owner. The offer is then sent through Toronto City Council for approval.
4. In order to protect the schedule of the Transit Project, the expropriation process may begin concurrently with negotiations.

Compensation includes the following three factors:

1. Market Value;
2. Damages attributed to the disturbance; and,
3. Damages for injurious affection.

The total property acquisition process and resulting compensation is intended to leave the affected parties "whole" and thereby mitigating negative impact.

Conceptual Structural Protection Requirements

The following is a discussion of the requirements for structural protection of adjacent properties and structures due to construction of the Relief Line South. This is only intended to serve as a conceptual overview of the potential impacts due to the construction, and it is anticipated that during the Detailed Design stages, a much more in-depth assessment of the risks will be incorporated and provided for, through adequate design and construction requirements.

Structural protection requirements for construction of the Relief Line South project arise from the potential risk of ground settlement, vibrations and groundwater draw-down. Considering that the majority of the Relief Line South is proposed to be situated at a much lower alignment depth, and in the shale bedrock layer, the settlement of existing buildings at the surface may not be a major concern for the majority of tunnel construction, especially when TBM's are employed.

However, the depth of the alignment increases the risk from settlement wherever open-cut excavation is required, for example at station sites. Socketing the toes of the piles into the bedrock during construction of the temporary shoring can be considered as possible design measures to address this risk. Properly designed and implemented settlement monitoring systems are recommended.

Overview of Settlement Risk

Settlement risk for the Relief Line South will arise due to the tunnelling activities, which naturally requires the excavation and support of open tunnel faces during construction.

Risk of settlement due to tunnelling by TBMs is not a significant factor for the majority of the Relief Line South, due to the fact that the alignment is within the shale bedrock. However, there are 3 locations where the TBMs transition from the hard-rock to soft ground, where the risk of settlement is more pronounced. These are at the Don River crossing and towards the north end of the alignment on Pape Avenue (near Dingwall Avenue). Construction at these locations will need to account for the transition into softer soils, and will have to rely on earth-pressure balanced excavation by the hybrid TBMs, and ground improvements by jet-grouting.

Additionally, settlement will need to be considered for open-cut structures such as launch and extraction shafts, station boxes etc. During the Detailed Design phases, geotechnical

investigations will be required to understand the stratigraphic profiles of the soil and the level of the ground water. The detailed design is expected to mitigate settlement risk.

Additional design requirements will have to be taken into consideration when proposed station boxes impede on property lines of high rise buildings. Station footprints may need to be altered to avoid impacting on existing high rise structures and where this is not possible, underpinning or mining may be required. Note that underpinning will have to be dependent on approval by property owners. Parts of stations can be mined underground to avoid piling and exposing foundations of high rise structures (e.g. proposed Osgoode Station).

High rise structures which include tiebacks as a component of their foundation will also have to be assessed to determine if the tiebacks are critical to existing structural designs, or if the tiebacks were abandoned-in-place after the permanent structures and are no longer required as the temporary supports during construction. Where these existing tiebacks interfere with the tunnelling or open-cut excavation sections of the Relief Line South, these will have to be removed so as to not impede in tunnelling progress using the TBMs.

While the risk to tunnelling progress due to tiebacks in its path is significant in general, the deeper alignment of the Relief Line South, especially in the heavily urbanized downtown Toronto core, can be considered as a mitigating factor, as the TBMs may be tunnelling at a much deeper elevation, thereby possibly avoiding these tieback anchors completely. In any case, investigations must be undertaken to identify, locate and remove tiebacks in the way of tunnelling or temporary shoring to be installed for the Relief Line South.

Sequential excavation method (SEM) can eliminate the need to impose onto existing structures and property lines, SEM work can take place under existing streets and smaller structures (houses, low rises) without having to install shafts. The majority of areas where stations will impose and impede under structures are located between James Street and Yonge Street. Mining using SEM method is highly recommended for the stations located in this area, in order to avoid above utilities and not affect the right-of-way on Queen Street West.

Aesthetics

Transit facilities will alter the visual setting of communities within which they are located. The changes brought about by the construction of a station, ventilation shafts, and ancillary structures can either enhance or impair the visual setting of a community.

Mitigation

Particular attention will be paid to the location and design of stations, EEBs, and other ancillary structures during the detailed design phase of the project to ensure that these facilities will not have negative impacts on residential or commercial areas, parks and other public spaces. All plans are subject to municipal approvals. The aesthetic impact of stations and other structures will be addressed at the design phase with consideration given to the surrounding context. Site Plan Approval is a form of development control authorized under Section 114 of the City of Toronto Act (Ontario, 2006), and implemented by the City of Toronto. The Site Plan Approval process will apply for all project components that are at or above ground (i.e. underground structures such as tunnels and the below grade portions of stations are not subject to this process). The Site Plan Approval process will provide information on:

- The overall site layout;
- The grading and servicing plan;
- The details of any landscaping; and,
- Elevation and floor plans for buildings.

The Site Plan approval process for above-ground project components will include review by the City of Toronto's Design Review Panel. The Panel advises City Planning staff on site plan issues within a framework developed by the City. It is composed of private sector design professionals – architects, landscape architects, urban designers, and engineers – who provide independent, objective advice to City staff aimed at improving matters of design in the public realm.

Prior to Site Plan Approval the Proponent may undertake additional public consultation to allow the public and key stakeholders to provide additional input into the design of stations, EEBs, and other ancillary structures.

Human Health and Safety

There are no permanent impacts associated with the Transit Project. Impacts are either transient and relate to the construction of the project, or are related to the operations and maintenance of the project (see **Section 6.3.3** and **Section 6.4.2**).

6.2.4 Cultural Environment

Built Heritage Resources and Cultural Heritage Landscapes

The Cultural Heritage Assessment Report (CHAR) determined that the Transit Project will potentially result in permanent impacts to two protected heritage properties and one listed heritage property, as listed below. The CHAR is detailed in **Appendix 6-2**.

- City Hall and Nathan Phillips Square, 100 Queen Street West (designated under Part IV of the ***Ontario Heritage Act***)
  - Construction of 14 m by 12 m vent shafts in the southwest corner of the property and a 19 m by 12 m station entrance and vent shafts in the southeast corner of the property will potentially result in adverse alterations and visual impacts.
- 250 Queen Street West/155-161 John Street (designated under Part V of the ***Ontario Heritage Act***)
  - Construction of the 30 m by 20 m Substation #1, 8 m by 5 m EEB#1, and vent shafts will require acquisition and partial demolition of the property, resulting in partial loss and widespread and permanent alteration to the built heritage resource that contributes to the Queen Street West Heritage Conservation District (HCD). Construction vibration from

below-grade and surface excavation will potentially impact the retained portions of the built heritage resource.

  - Without mitigation, the above grade and exterior elements of the proposed new construction will result in adverse visual impacts to the Queen Street West HCD.

- 250 University Avenue/180 Richmond Street West (listed on the City of Toronto Heritage Register)
  - Although currently the site of the existing Osgoode Station, construction of a 32 m by 7 m station entrance will require acquisition and partial alteration of the property, resulting in widespread and permanent alteration to the built heritage resource

Above-ground components will also potentially result in permanent impacts to the Queen Street West HCD, designated under Part V of the ***Ontario Heritage Act.***

Additionally, there is potential for permanent impacts to nine properties of potential cultural heritage value or interest:

- 229 Langley Avenue, 231 Langley Avenue, 233-235 Langley Avenue, 237-239 Langley Avenue, and 241-243 Langley Avenue
  - Open cut-and-cover excavation (requiring partial construction easement) will permanently alter the rear (south) yards of these properties, potentially requiring demolition of fences or outbuildings, and resulting in widespread and temporary vibration impact to the potential built heritage resources. 233-235 Langley Avenue will be the most impacted, with excavation extending as much as 15 m from the south property line.
- 180 Carlaw Avenue
  - This property will be partially acquired for construction of the 8 m by 5 m EEB#4 and Laydown Area #12.
- 972-978 Queen Street East
  - 972-974 Queen Street East will be acquired for construction of a 42 m by 9 m station entrance and vent shafts, requiring partial demolition (972 and 974 Queen Street East) and widespread and permanent alteration of a building that forms the potential built heritage resource of 972-978 Queen Street East. The design and massing of above ground elements for the proposed station may result in adverse visual impacts to the remaining sections at 976-978 Queen Street East.
- 507 King Street East
  - Construction of 8 m by 6 m vent shaft in the east corner of the property (approximately 8 m east of the building footprint) requires the property to be acquired.
- Sir Adam Beck Memorial Park
  - Construction of a 10 m by 6 m vent shaft in Memorial Park will potentially result in adverse visual impacts to the Sir Adam Beck Memorial.

<u>Mitigation</u>

Property-specific recommendations have been made to ensure impacts from adjacent excavation and construction, as well as installation of below and above grade project components, will be mitigated during detailed design, including first and foremost seeking ways to avoid the impact. Where avoidance is determined to not be a feasible option, then additional evaluation may be needed.

As currently proposed, the project will permanently impact two protected heritage properties, one listed property, and thirteen properties of potential cultural heritage value or interest, resulting in alteration or attrition of irreplaceable cultural heritage resources. Alterations proposed for 250 Queen Street West/ 155-161 John Street will also result in permanent alteration and residual visual impact to the Queen Street West Heritage Conservation District. Further studies such as heritage impact assessments and conservation plans are recommended for these impacted properties during detailed design to identify measures for long-term conservation of the resources and reduce adverse visual effects.

In particular, and as noted on the following pages, if impact to the properties at 250 Queen Street West/ 155-161 John Street and 972-978 Queen Street East cannot be avoided, then evaluation using the criteria prescribed in both O. Reg. 9/06 and O. Reg. 10/06 will be undertaken, in consultation with MTCS (**Table 6-6** and **Table 6-7**).

Table 6-6: Property Specific Mitigations for Permanent Impacts to Protected and Listed Heritage Properties (1 of 2)

Resource type & civic address	Conservation/ mitigation recommendations
100 Queen Street West (City Hall and Nathan Phillips Square, designated, Part IV)	Conduct a Heritage Impact Assessment (HIA) during detailed design compliant with the City *Terms of Reference* to determine the appropriate mitigation for direct and indirect visual impacts to the property and specifically Nathan Phillips Square from construction of vent shafts and station entrance and vent shafts at the southwest and southeast corners of the property. The HIA should also determine if monitoring the built heritage resources for vibration impact during construction is required. All alterations to the property will require heritage permit approval from the City.
250 Queen Street West/ 155-161 John Street (designated, Part V)	Consider options during detailed design to move Substation #1, EEB#1, and vent shafts to a nearby, non-contributing property. If moving the project components is not technically feasible, conduct a property specific HIA during detailed design in accordance with the City *Terms of Reference*, and the criteria prescribed in both O. Reg. 9/06 and O. Reg. 10/06, in consultation with MTCS. The HIA should identify any additional external or internal heritage attributes and recommend mitigation measures to avoid or reduce adverse impacts to all identified heritage attributes, especially those on the exterior, such as the two-storey massing, mansard roof with dormers and symmetrical fenestration. Any alterations or new construction visible from the exterior must comply with design guidelines outlined in the Queen Street West HCD Plan, and all alterations to the property will require heritage permit approval from the City. A heritage conservation plan should also be completed to ensure the property's heritage attributes are protected during construction, and guide future use and long-term maintenance.
250 University Avenue/ 180 Richmond Street West (listed on the City Heritage Register)	Since the property is currently used as a station and currently proposed for a 54-storey condominium development above the existing building, it is not recommended that options be considered to move the project components to a less sensitive property. However, a property specific HIA should be conducted during detailed design in accordance with the City's *Terms of Reference* to confirm the property's heritage attributes and recommend appropriate mitigation measures. A heritage conservation plan should also be completed to ensure the property's heritage attributes are protected during construction, and guide future use and long-term maintenance.

Table 6-7: Property Specific Mitigations for Permanent Impacts to Protected and Listed Heritage Properties (2 of 2)

Resource type & civic address	Conservation/ mitigation recommendations
Queen Street West HCD (designated, Part V)	Any permanent above-ground project components within Queen Street West HCD must comply with the design guidelines of the ***Heritage Conservation District Plan*** (HCD Plan, 2007). Section 5.7 (Circulation) of the HCD Plan specifically identifies that a surface transit route along Queen Street West is a heritage attribute that must be protected, while service access, access to parking and other non-public uses must continue to be relegated to non-visible areas. Section 5.6 (Public Realm) of the HCD Plan prescribes that the public realm must maintain existing mid-block connections, encourage new mid-block pedestrian connections when appropriate, and should protect public spaces for street vendors and artists. Confirm the location and extent of cut-and-cover excavation during detailed design. If adjacent cut-and-cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the City's *Terms of Reference.* Any new construction on the property must comply with design guidelines outlined in the Queen Street West HCD Plan and will require heritage permit approval from the City. Monitor for vibration impact during cut-and-cover excavation and immediately cease work if vibration thresholds are exceeded.

Property-specific mitigations for permanent impacts to properties of potential cultural heritage value or interest are provided below in **Table 6-8** and **Table 6-9**.

Table 6-8: Property Specific Mitigations for Permanent Impacts to Cultural Heritage Properties (1 of 2)

Resource type & civic address	Conservation/ mitigation recommendations
Potential built heritage resources: 229 Langley Avenue 231 Langley Avenue 233-235 Langley Avenue 237-239 Langley Avenue 241-243 Langley Avenue	Conduct a Cultural Heritage Evaluation Report (CHER) during detailed design to determine if these properties meet the criteria prescribed in ***Ontario Regulation 9/06*** (O. Reg. 9/06). If any of the properties are found to have cultural heritage value or interest (CHVI), an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to recommend appropriate mitigation measures. This may include measures such as monitoring the built heritage resource for vibration impact during construction or documenting cultural features such as fences and outbuildings prior to their removal. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent construction and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: 180 Carlaw Avenue	The City should be consulted to determine whether a CHER is required for the property. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in O. Reg. 9/06. If the CHER finds that the property has CHVI, conduct an HIA during detailed design in accordance with the City ***Terms of Reference*** to determine the appropriate mitigation. Monitor the school building for vibration impact during adjacent construction and immediately cease all work if vibration thresholds are exceeded.
Potential built heritage resource: 972-978 Queen Street East	Consider options during preliminary design to move the station entrance and vent shafts to a nearby property that does not have known or potential built heritage resources. If moving the project components is not technically feasible, conduct a CHER during detailed design to determine if the building on the combined properties meets the criteria prescribed in both O. Reg. 9/06 and O. Reg. 10/06, in consultation with MTCS. If the combined properties are found to have CHVI, an HIA should be conducted during detailed design in accordance with the City Terms of Reference to recommend appropriate mitigation measures. A structural assessment should also be undertaken during detailed design to determine whether the remaining sections at 976-978 Queen Street East will be vulnerable to vibration impacts during adjacent excavation and construction. The HIA may also need to consider if the above ground elements of the proposed station will indirectly impact the remaining sections at 976-978 Queen Street East by introducing incompatible massing or design. In addition to any other mitigations that may be recommended in an HIA (if required), monitor the remaining sections of 976-978 Queen Street East for vibration impact during adjacent construction and immediately cease work if vibration thresholds are exceeded.

Table 6-9: Property Specific Mitigations for Permanent Impacts to Cultural Heritage Properties (2 of 2)

Resource type & civic address	Conservation/ mitigation recommendations
Potential built heritage resource: 507 King Street East	Conduct a CHER during detailed design to determine if the property meets the criteria prescribed in O. Reg. 9/06. If any of the property is found to have CHVI, an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to recommend appropriate mitigation measures. This may include measures such as monitoring the built heritage resource for vibration impact during construction or documenting cultural features on the property that may require removal. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during tunnel boring and vent shaft construction and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resources (monument): Sir Adam Beck Memorial	The City should be consulted to determine whether a CHER is required for Sir Adam Beck Memorial Park. The CHER should evaluate if the property meets the criteria prescribed in *O. Reg. 9/06.* If the CHER finds that for Sir Adam Beck Memorial Park has CHVI, conduct an HIA during detailed design in accordance with the City Terms of Reference to determine the appropriate mitigation. The HIA should also assess whether the above grade construction will result in adverse visual impacts to the Sir Adam Beck Memorial.

Cumulative effects

Property-specific recommendations have been made to ensure impacts from adjacent excavation and construction, as well as installation of below and above grade project components, will be mitigated during detailed design. However, as currently proposed, the project will permanently impact two protected heritage properties and thirteen properties of potential cultural heritage value or interest, resulting in alteration or attrition of irreplaceable cultural heritage resources. Alterations proposed for 250 Queen Street West/ 155-161 John Street will also result in permanent alteration and residual visual impact to the Queen Street West HCD. Further studies such as heritage impact assessments and conservation plans are recommended for these impacted properties during detailed design to identify measures for long-term conservation of the resources and reduce adverse visual effects.

Archaeological Resources

The Stage 1 Archaeological Assessment has determined that there is no potential for the presence of significant archaeological resources to be preserved within the following portions of the Relief Line South alignment:

a. Osgoode Station: all above ground infrastructure footprints (see Map 19-A of **Appendix 6-3**);
b. Queen Station: all above ground infrastructure footprints (see Map 19-B of **Appendix 6-3**); and
c. Subterranean Tunnel and Stations: corridor alignment and station infrastructure tunnelled 25-40 metres below ground except where open-cut shafts or cut-and-cover construction areas are proposed at ground surface level above (see Maps 19-A–I of **Appendix 6-3**).

As such, it is concluded that these areas have no archaeological potential and may be considered free of further archaeological concern. No further archaeological assessment of these portions of the Project Area is required.

This Stage 1 Archaeological Assessment has also determined that there is potential for the presence of archaeological resources to be preserved within all or part of the following portions of the Relief Line South alignment:

a. Sherbourne Station: above ground infrastructure footprints encompassing greenspace/paved area northwest of where Sherbourne and Queen Streets intersect as well as paved area in northeast corner of Seaton and Queen Streets (see Map 19-C of **Appendix 6-3**);
b. Sumach Station: above ground infrastructure footprints encompassing greenspace northeast of King and Sackville Streets (Sackville Park) as well as greenspace west of the Richmond Street East/Eastern Avenue merger (see Map 19-D of **Appendix 6-3**);
c. Broadview Station: all above ground infrastructure footprints (see Map 19-E of **Appendix 6-3**);
d. Carlaw Station: above ground infrastructure footprints encompassing paved area in southwest corner of Carlaw and Colgate Avenues as well as greenspace in southwest corner of the schoolyard for Morse Street Junior P.S. (see Map 19-F of **Appendix 6-3**);
e. Gerrard Station: above ground infrastructure footprints in paved area north (1) and northeast (2) of Riverdale Shopping Centre (see Map 19-G of **Appendix 6-3**);
f. Pape Station: above ground infrastructure footprint (northern street entrance) west of Pape Avenue (see Map 19-H–I of **Appendix 6-3**);
g. Cut-and-cover construction areas: ground surface (pavement) disturbances located along Pape Avenue (encompassing Launch Shaft 3 and Extraction Shafts 2 and 3), along Queen Street West (encompassing Extraction Shaft 1), as well as within Queen Street East encompassing the subterranean station footprint for Sherbourne Station and within Carlaw Avenue encompassing the subterranean station footprint for Carlaw Station (see Map 19-A–I of **Appendix 6-3**);
h. Launch Shafts 1 and 2: ground surface (pavement) disturbances located within the Broadview Station subterranean station footprint (see Map 19-E of **Appendix 6-3**);
i. Wye track connections: ground surface (greenspaces and residential structures on periphery) disturbances located within Logan Avenue and Langford Parkettes (see Map 19-H of **Appendix 6-3**);

As such, it is recommended that these areas have archaeological potential requiring further archaeological assessment in the form of Stage 2-3 property survey and assessment as described in the Stage 1 Archaeological Assessment (**Appendix 6-3**).

Mitigation

Archaeological Stage 2-3 survey methods in deeply buried conditions are outlined in Section 2.1.7 (p.36) and Section 3.3.3 (p.55) of the *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011). Standards include:

a. Test pitting where viable to carry out survey surface methods to identify any archaeological sites or determine the extent of disturbance;
b. On-site monitoring where construction excavation is extending to a depth that warrants concern;
c. Mechanically excavate trenches at maximum intervals of 10 m;
d. Excavate within the core of archaeological resources; and
e. Gain understanding of the full depth and extent of archaeological resources.

Monitoring

Despite best efforts and all due diligence, no archaeological assessment can necessarily account for all potential archaeological resources. Should deeply buried archaeological resources be identified during ground disturbance activity associated with future development of the Project Areas, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the Ministry of Tourism, Culture and Sport (MTCS) notified.

The Stage 1 Archaeological Assessment can be found in **Appendix 6-3**.

6.2.5 Transportation

Automobile Traffic and Transit Service

There are no permanent displacement impacts associated with the Transit Project. There are transient impacts that relate to the construction of the Transit Project and localized impacts associated with bus and automobile operations at the proposed stations. Discussion is provided in **Section 6.3.5.**

Pedestrians and Cyclists

There are no permanent displacement impacts associated with the Transit Project. All impacts are transient and relate to the construction of the Transit Project. Discussion is provided in **Section 6.3.5**.

Rail

There are no permanent displacement impacts associated with the Transit Project. All impacts are transient and relate to the construction of the Transit Project. Discussion is provided in **Section 6.3.5**.

6.2.6 Utilities

Impacts to the existing utilities will be avoided to the greatest extent possible. Minor utilities that are not in direct conflict with the Relief Line South alignment or stations will be supported and protected during construction where possible. Any utilities that are in direct conflict with the Relief Line South will require relocation. Due to the complexities of relocating large trunk storm sewer systems or large sanitary and/or combined brick sewers, it is recommended that these relocations will be permanent. For all utilities that will be relocated, relocation plans and construction activities will be undertaken in accordance with the City of Toronto and the utility owner's regulations.

There are a number of utilities located within the vicinity of the Relief Line South project (refer to Section 3.5 for details on the utility locations and sizes). Impacts to these existing utilities will be avoided to the greatest extent possible during the design and construction phases. However, utilities such as municipal services (watermains, storm and sanitary sewers), Toronto Hydro, Enbridge Gas and telecommunications companies (Bell, Rogers, Cogeco and Telus) will be impacted by cut-and-cover construction. Any utilities that are in direct conflict with the Relief Line South tunnel alignment will require relocation.

Evaluation of other critical and non-critical municipal services (watermains, storm sewers and sanitary sewers) located primarily in the road rights-of-way will also be conducted along the preferred alignment. Privately owned services located primarily within private properties will also be investigated along the running structure. As noted previously, the deep running structure will not impact the willow depth of utilities but will be investigated through further evaluation during the detailed design phase of the Project.

The Enwave steam tunnels on Queen Street West are in direct conflict with the tunnel and station boxes and will require relocation. There will be a series of meetings held with Enwave regarding the chill water/steam systems. During detailed design, further discussions will be required to work with Enwave to develop relocation and upgrade solutions.

Based on the proposed alignment of the Relief Line South, three potential conflicts were identified in January 2017:

1. Existing Hydro One transmission underground cables along Carlaw Avenue between Dundas Street East and Gerrard Street
2. Hydro One Carlaw Transformer Station at Carlaw Avenue and Gerrard Street
3. Existing transmission structure immediate west of the Don River, north of Eastern Avenue

Hydro One has received the revised drawings from TTC and will undertake a standard detailed technical review upon receipt of the full submission with adequate details. Comments on these potential conflicts will be available upon the review process.

Due to the complexities of relocating large trunk storm sewer systems or large sanitary and/or combined brick sewers, it is recommended that these relocations will be permanent. Large gravity sewers are considered critical and will be further analyzed during detailed design to determine the level of impact. **Table 6-10** to **Table 6-12** lists the major utility conflicts identified at this stage and the proposed solutions for mitigation. Data for the West Donlands area is not available at this time.

Table 6-10: Major Relief Line South Utility Conflicts and Proposed Solutions (1 of 3)

Utility Conflict	Depth	Location	Proposed Solution
2100mm Toronto District Heating corporation (TDHC) Steam Main	7.20m (cover) 9.83m (to invert)	Crosses Queen St W at Simcoe St	Remain in place – protect during construction
Utility Conflict	Depth	Location	Proposed Solution
3550mm Steam Tunnel	10.00m (cover) 30.35m (bottom of tunnel)	Runs along York St, Queen St W, and ends at James St	Relocate
3550mm Steam Tunnel	26.0m (cover) 34.65m (bottom of tunnel)	Crosses Queen St W at Bay St	Relocate
990mm Combined Sewer	7.00m (cover) 9.00m (to invert)	Bay St (south of Queen St)	Relocate
1500mm x 1350mm Concrete Combined Culvert over 600mm Vitrified Pipe Combined Sewer	4.10m (cover) 6.83m (to invert)	Crosses Queen St at Victoria St	Remain in place – protect during construction
1500mm Egg Shaped Concrete Sanitary Sewer	14.00m (cover) 17.60m (to invert)	Crosses Queen St E at Victoria St	Reconstruct / Remain in place – protect during construction
1500mm to 1650mm Concrete Pipe Storm Sewer	4.40m (cover) 9.50m (to invert)	Queen St (from Victoria St to Don Valley Parkway overpass	Reconstruct / Relocate at Station Box locations
800mm x 1200mm ES Brick Combined Sewer	5.00m (cover) 6.50m (to invert)	Crosses Queen St E at Church St	Remain in place – protect during construction
2325mm Circular Brick Combined Sewer	4.00m (cover) 7.00m (to invert)	Crosses Queen St E at Ontario St	Remain in place – protect during construction
1650mm Concrete Storm Sewer	4.90m (cover) 8.47m (to invert)	Queen St (from Booth Ave to Jones Ave)	Remain in place – protect during construction
Concrete Storm Sewer (size varies from 1350mm to 1500mm)	5.60m (top of sewer) to 10.50m (bottom of sewer).	Runs along Langley Ave, turns onto Pape Ave and runs along Pape Ave to Strathcona Ave. At Strathcona Ave, the concrete storm sewer turns and continues along Strathcona Ave.	Remain in place – protect during construction

Table 6-11: Major Relief Line South Utility Conflicts and Proposed Solutions (2 of 3)

Utility Conflict	Depth	Location	Proposed Solution
1050mm x 1050mm Horseshoe Storm Sewer	7.40m (top of sewer) to 8.81m (bottom of sewer).	Runs along Danforth Ave and crosses Pape Ave	Remain in place – protect during construction
1350mm ø Concrete Storm Sewer	3.93m (cover) 5.18m (to invert)	South on Pape Ave and west along Langley Ave	Relocate
3000mm Mid Toronto Interceptor Sanitary Sewer	Unknown on DMOG – Approx. 12m deep.	On Gerrard St East, crossing Pape Ave.	Remain in place – protect during construction
2700mm Circular Brick Sanitary Sewer	3.50m (cover) 7.23m (to invert)	On Dundas St East, crossing Pape Ave	Remain in place – protect during construction
Two 115kV cables Hydro-Electric Power Commission of Ontario (OH)	Approx 1.5m (cover)	On Carlaw Ave, north of Dundas Street East	Remain in place – protect during construction
1325 x 1275mm Concrete Culvert Storm Sewer	1.24m (cover) 3.2m (to invert)	Carlaw Ave south of Colgate Ave (proposed Queen Station)	Relocate
1050 x 1200mm Concrete Culvert Storm Sewer	1.07m (cover) 2.65m (to invert)	Carlaw Ave, north of Colgate Avenue	Relocate
900 x 1175mm Concrete Culvert Storm Sewer	1.3m (cover) 2.86m (to invert)	Carlaw Ave, near the CN Bridge at Dundas Street East	Relocate
1050 x 1475mm Concrete Culvert Storm Sewer	1.32m (cover) 3.24m (to invert)	Carlaw Ave, north of the CN Bridge (north of Dundas St East)	Relocate
600 x 900mm Egg-shaped brick Combined Sewer	0.73m (cover) 2.07m (to invert)	Carlaw Ave south of Colgate Ave (proposed Queen Station)	By-pass and Relocate
600 x 900mm Egg-shaped brick Combined Sewer	1.74m (cover) 3.15m (to invert)	Carlaw Ave near the CN Bridge at Dundas Street East	By-pass and Relocate
600 x 900mm Egg-shaped brick Combined Sewer	2.82m (cover) 4.25m (to invert)	Carlaw Ave north of Dundas Street East	By-pass and Relocate
600 x 900mm Egg-shaped brick Combined Sewer	7.3m (cover) 8.78m (to invert)	Carlaw Ave, south of the CN Bridge at Gerrard Street East	By-pass and Relocate

Table 6-12: Major Relief Line South Utility Conflicts and Proposed Solutions (3 of 3)

Utility Conflict	Depth	Location	Proposed Solution
1800mm ø Circular Concrete Sanitary Sewer	16.9m (cover) 19.2m (to invert)	Carlaw Ave south of Colgate Ave (Proposed Queen Station)	Reconstruct 1800mm sewer and realign. Temporary bypass system is required.
1800mm ø Circular Concrete Sanitary Sewer	16.15m (cover) 18.45m (to invert)	Carlaw Ave south of the CN Bridge at Dundas Street East	Reconstruct 1800mm sewer and realign. Temporary bypass system is required.
1800mm ø Circular Concrete Sanitary Sewer	17.98m (cover) 20.28m (to invert)	Carlaw Ave north of Dundas Street East	Reconstruct 1800mm sewer and realign. Temporary bypass system is required.
1800mm ø Circular Concrete Sanitary Sewer	21.3m (cover) 23.9m (to invert)	Carlaw Ave south of the CN Bridge at Gerrard St East	Reconstruct 1800mm sewer and realign. Temporary bypass system is required.

Mitigation

By utilizing deep tunneling construction for the majority of the Relief Line South alignment that is within road rights of way and private lands, impacts to utilities are largely minimized. Temporary support and protection of the affected utilities will be sought where possible; however for utilities that will be in direct conflict with the permanent works or for large utilities that cannot be temporarily braced, these utilities will be permanently relocated. In locations where open cuts and station boxes are required for construction of the alignment or stations, utilities in conflict will need to be suspended in place or relocated.

Utilities that are willow, small in diameter, and/or are located to the edge of the right-of-way will have fewer challenges associated with relocation or suspending in-place. On Queen Street East, there is a 1500mm Egg Shaped (ES) Concrete Sanitary Sewer that runs along Victoria Street and crosses Queen Street East at a depth of 14.00m (top of sewer) to 17.60m (bottom of sewer), a 1800mm Circular Concrete Sanitary Sewer that runs along Carlaw Avenue and crosses Queen Street East at a depth of 14.02m (top of sewer) to 19.20m (bottom of sewer), and a 2700mm Concrete Storm Sewer that runs along Larchmount Ave (south of Queen Street East) at a depth 20.12m (top of sewer) to 23.50m (bottom of sewer). These municipal sewers will be challenging to suspend in place due to their size and locations underground. These utilities may require temporary by-passes or permanent relocations prior to construction.

For all utilities that will be relocated, relocation plans and construction activities will be undertaken in accordance with the City of Toronto and the utility owner's regulations and design requirements. All relocation and replacement of the City infrastructure will be designed to convey at least the same capacity of the flow as the existing system. If additional flows are introduced to the new system, the new system will be designed in accordance with the City's design requirements to convey the total flow without surcharging the system. Utility impacts and relocation strategies will be confirmed during the detailed design phase of the project.

The major utilities located in the vicinity of the Relief Line South alignment have been identified through direct contact with the respective companies or providers and through a review of the Toronto Digital Map Owners Group (DMOG). During detailed design, sub-surface utility engineering investigations will be conducted to provide further information on the type, size and location of all utilities to support the impact evaluations.

These disruptions will be minimized through continual discussions with the utility companies and careful planning and considerations for customers and services. Disruptions to utility customers are to be expected when switching customer connections to and from temporary services.

6.3 Temporary Construction Impacts and Mitigation Measures

6.3.1 Natural Environment

Fisheries and aquatic habitat

The proposed work at the Lower Don River crossing involves tunnel boring under the river. The Constructability Report (WSP 2017) and the preliminary geotechnical investigation of the crossing area indicate there is both shale bedrock and soft soils under the Don River. Therefore, the preferred construction option is to use ground conditioning treatment for the soft soils and then tunnel bore through it. The hydrostatic pressures under the Don River at this location will be considered to develop the most suitable tunnel design and boring method for the construction of the Project at this location. Additional studies of the hydrogeological and geotechnical conditions under the Don River will be undertaken to determine the best method of ground conditioning at this location. These additional studies and considerations of the conditions to be encountered under the river act to minimize the potential risk of impacts to the fishery and aquatic habitat in the river and into Lake Ontario from the construction of the project.

Tunneling under the river has the potential to introduce sediment and/or foreign materials (e.g. jet-grout spoils, process fluids) into the watercourse which can be harmful to aquatic organisms (Canadian Association of Petroleum Producers et al. 2005, Canadian Council of Ministers of the Environment (CCME), 2002). Possible direct and indirect effects of introduced sediment include: fish habitat degradation, changes in substrate composition, reduced amount of habitat for macroinvertebrates and fish, smothering of benthic communities and fish eggs, and abrasion of respiratory surfaces for macroinvertebrates and fish (CCME 2002).

The Project is not exempt from review under Fisheries and Oceans Canada's self-assessment criteria; therefore, a Request for Review by Fisheries and Oceans Canada will be required during the detailed design of the Project.

<u>Mitigation</u>

For the purposes of monitoring the Don River during the construction of the tunnel to avoid or minimize the discharge of contaminants to the watercourse, a comprehensive monitoring regime will be conducted in the river. In situ water quality measurements (i.e. turbidity, dissolved oxygen, temperature, pH and specific conductivity) will be recorded immediately downstream of the

crossing, two to three times per day using an YSI multi-meter. Environmental conditions will be assessed in the river including a preliminary characterization of the habitat immediately downstream of the crossing and documentation of conditions throughout the monitoring program, such as, but not limited to, descriptions of changes observed in wetted width and depth, riparian and instream vegetation, visual observation of water clarity and colour, and observed velocity. Photographs of typical watercourse conditions will be taken and documented to highlight changes in environmental conditions.

Water quality guidelines and objectives are intended to provide protection of freshwater life from anthropogenic stressors such as chemical inputs or changes to physical components (CCME 2002) and to act as an integrated ecosystem approach for the protection and preservation of water resources (MOEE 1994). Guideline values are meant to protect all forms of aquatic life and all aspects of aquatic life cycles. The federal guidelines for total particulate matter in freshwater include levels for turbidity (Nephelometric Turbidity Units). Therefore, turbidity levels will be recorded during Project construction and compared with the CCME guideline for total particulate matter (CCME 2002). There are no provincial turbidity guidelines for flowing waters in Ontario (MOEE 1994). The federal guidelines (CCME 2002) and provincial objectives (MOEE 1994) include values for dissolved oxygen (milligrams per litre [mg/L]) and pH. Therefore, dissolved oxygen concentrations and pH levels recorded during Project construction will be compared to both the federal CCME guidelines (CCME 2002) and PWQO (MOEE 1994). There are no provincial or federal guidelines or objectives for temperature or specific conductivity.

For construction activities adjacent to the Don River, mitigation will include installation of appropriate sediment barriers to prevent surface runoff carrying disturbed soils into the watercourse. In addition, a fuel spill response plan will be developed for use in the event of a fuel spill to prevent the transfer of contaminants to the river.

Contingency

Per the Fisheries Act (Government of Canada 1985b), federal and provincial/territorial authorities should be notified without delay if an environmental event (e.g. deposit of deleterious substance in water, exceedance of water quality guidelines) occurs that is outside of the normal course of events. The Canadian environmental notification system uses provincial 24-hour authorities as the first point of contact. In turn, these authorities inform Environment and Climate Change Canada of the notifications.

Vegetation, Wildlife and Terrestrial Habitat

The construction of some facilities have the potential to directly affect surface features (i.e. open cut construction of stations). As part of the constructability review, options to use an open cut construction or a mined construction method for the development of the subway stations is being assessed for the Project. The mined construction method would minimize surface impacts as construction of the station would be performed underground thereby minimizing surface disturbance. However, if open cut construction of the stations needs to be used there will be impacts to surface features within the footprint of the excavations. With respect to the natural environment this may mean that some vegetation will be cleared prior to construction. Temporary staging areas and construction access may also result in clearing of vegetation. This will likely be limited primarily to boulevard trees (landscaped), which are limited in use as wildlife habitat. However, they do hold the potential to be used by wildlife such as breeding birds for nesting. Therefore, the required clearing of vegetation for the construction of the Project has the potential to impact some vegetation and wildlife habitat. Specific locations in which the temporary construction footprint may disturb or remove vegetation is shown in **Table 6-13** to **Table 6-16**.

Table 6-13: Locations at Risk of Disturbance due to Construction Activity (1 of 4)

Station/ Location	Component	Description of Surface Disturbance	Potential Impact/ Wildlife Receptor
Osgoode Station	Station	Located adjacent to a small naturalized park associated with the University of Toronto campus, on the north side of Queen Street West. Trees lining the street are generally mature with high canopy cover that may provide nesting habitat for birds.	Breeding Birds
Osgoode Station	Station Entrance	The footprint associated with the station entrance east of University Avenue may require removal of a small boulevard tree contained in a planter. May provide nesting habitat for birds.	Breeding Birds
Osgoode Station	Ventilation Shafts	The ventilation shaft located in the middle of University Avenue may disturb areas of manicured lawn. Unlikely to have any impacts on wildlife habitat or terrestrial features.	None
Queen Station	Station	The construction footprint may disturb areas of manicured lawn on the north side of Queen Street. Unlikely to have any impacts on wildlife habitat or terrestrial features.	None
Queen Station	Station Entrance/ Ventilation Shafts	The proposed station entrance and ventilation shafts west of Bay Street may require removal of a small number of semi-mature, planted trees in a small commons area. The small cluster of trees may provide nesting habitat for birds.	Breeding Birds
Sub-Station #2	n/a	The construction footprint may require removal of a couple planted boulevard trees contained in planters. Trees are semi-mature with moderate canopies and may provide nesting habitat for birds.	Breeding Birds

Table 6-14: Locations at Risk of Disturbance due to Construction Activity (2 of 4)

Station/ Location	Component	Description of Surface Disturbance	Potential Impact/ Wildlife Receptor
Sherbourne Station	Station Entrance (West)	Located within Moss Park on the west side of Sherbourne Street. The construction footprint may require removal of several large, mature trees that may provide nesting habitat for birds.	Breeding Birds
Sherbourne Station	Station Entrance (East)	The construction footprint may require removal of trees in a parking lot that may provide nesting habitat for birds.	Breeding Birds
Sherbourne Station	Station	The construction footprint may require removal of planted boulevard trees contained in planters along Queen St., which may provide nesting habitat for birds.	Breeding Birds
Sumach Station	Station Entrance (West)	Located within Sackville Playground. The construction footprint may require removal of several large, mature trees that may provide nesting habitat for birds, as well as a portion of the park.	Breeding Birds
Sumach Station	Station Entrance (East)	The construction footprint may require removal of residential trees that may provide nesting habitat for birds.	Breeding Birds
Sumach Station	Station	The west end of the station is within Sackville Playground. The construction footprint may require removal of several large, mature trees that may provide nesting habitat for birds, as well as a portion of the park.	Breeding Birds
Sub-Station #3	n/a	Located adjacent to the Adelaide Street East overpass. The construction footprint may disturb areas of cultural meadow and a few scattered trees, which may provide nesting habitat for breeding birds.	Breeding Birds

Table 6-15: Locations at Risk of Disturbance due to Construction Activity (3 of 4)

Station/ Location	Component	Description of Surface Disturbance	Potential Impact/ Wildlife Receptor
Don River Crossing	Tunneling	The construction footprint associated with tunneling beneath the Don River may disturb an area of cultural meadow in Corktown Common Park on the west side of the river. Vegetation clearing and construction activity adjacent to the Don River may lead to erosion impacts and/or overland release of sediment or contaminants (e.g. fuel) to the river.	Erosion / Sedimentation and Fuel Spill
Broadview Station	Station	The construction footprint may require removal of several boulevard trees and trees planted in landscaped berms of parking lots along Sunlight Park Road. The trees may provide nesting habitat for breeding birds.	Breeding Birds
Broadview Station	Station Entrance (Southeast)	The station entrance on the east side of the CN railway line requires a pedestrian walkway to access the station. The construction footprint may require removal or disturbance of hedgerow trees bordering the railway line, which may provide nesting habitat for breeding birds.	Breeding Birds
Broadview Station	Station Entrance (North)	The station entrance on the north side of Eastern Avenue may disturb an area of manicured grass with a few planted saplings. Although less likely to provide habitat due to the small size and isolation of the saplings, there is potential to provide habitat for breeding birds.	Breeding Birds
Broadview Station	Station Entrance (South)	The station entrance attached to the southwest corner of the station may require removal of a small number of planted trees in the parking lot.	Breeding Birds
EEB #4	n/a	The construction footprint may disturb a portion of the playground for the Morse Street Junior Public School, including mature trees that may provide nesting habitat for breeding birds.	Breeding Birds

Table 6-16: Locations at Risk of Disturbance due to Construction Activity (4 of 4)

Station/ Location	Component	Description of Surface Disturbance	Potential Impact/ Wildlife Receptor
Carlaw Station	Station	The construction footprint may require removal of several planted, immature boulevard trees along Carlaw Avenue that may provide nesting habitat for breeding birds.	Breeding Birds
Gerrard Station	Station	The north end of the construction footprint may require removal of a small number of residential trees that may provide nesting habitat for breeding birds.	Breeding Birds
Gerrard Station	Station Entrance (South)	The construction footprint of the south entrance north of Gerrard Street East may require removal of several planted, mature boulevard trees that may provide nesting habitat for breeding birds.	Breeding Birds
Pape Station	Track	The construction footprint associated with the tracks between Cavell Ave and Pape Station may require removal of several planted boulevard trees that may provide nesting habitat for breeding birds.	Breeding Birds
Pape Station	Station	The construction footprint may require removal of some planted boulevard trees that may provide nesting habitat for breeding birds.	Breeding Birds
EEB #6	n/a	The construction footprint may disturb a residential yard of manicured lawn. Unlikely to have any impacts on wildlife habitat or terrestrial features.	None

The majority of the Project will be constructed underground and as such avoids impact to vegetation and wildlife habitat. However, there may be some surface impacts during the open cut construction of stations if required. As well there may be some vibrations or noise effects from the construction on wildlife species using the habitats in the vicinity of the construction area. Dust from construction has the potential to affect air quality and the quality of habitats for wildlife in the vicinity of the construction area. However, the wildlife habitat in the vicinity of the station is limited as it is a highly urbanized area. And measurable changes to the quality of wildlife habitat are not anticipated.

Mitigation

The Project falls within Environment Canada's Nesting Zone C2 (Nesting Period extends from end of March to end of August). To mitigate the potential to kill, harm or harass breeding birds during the nesting season and comply with the Migratory Birds Convention Act, clearing vegetation outside of the nesting period is required. In the event that vegetation clearing activities must take in the nesting period a nest search must be undertaken by a qualified biologist to identify and locate active bird nests prior to clearing. Active bird nests will be buffered with an appropriate setback and vegetation clearing will not take place within that buffered area until the nesting period is over.

In order to compensate for the trees cleared for construction of the Project, a replanting/ restoration plan will be developed to include new plantings of trees and shrubs where possible. Any tree clearing must also be conducted in compliance with the City of Toronto's Tree Cutting By-law, which outlines appropriate tree protection zones and requirements for permits where injury or destruction of trees will occur. Completion of an arborist report may be required to identify each tree that will be impacted by the Project.

For construction activities adjacent to the Don River, mitigation will include installation of appropriate sediment barriers to prevent surface runoff carrying disturbed soils into the watercourse. In addition, a fuel spill response plan will be developed for use in the event of a fuel spill to prevent the transfer of contaminants to the river.

Wetlands

The proposed construction footprint for the Project does not occur within, or in proximity to, any wetlands. As such these activities are not anticipated to have an impact on wetlands.

Species at Risk

Temporary surface disturbance of open habitats, such as meadows, riparian vegetation and roadside vegetation, may impact foraging habitat or nesting sites for monarch and yellow-banded bumble bee, species designated special concern provincially. Special concern species do not receive individual or habitat protection under the Endangered Species Act. Potential impacts are expected to be temporary in duration and local in scale. There is abundant similar habitat in the study area and surrounding region, and the Project is not expected to have an adverse effect on the local population of monarch or yellow-banded bumblebee.

Mitigation

Clear vegetation outside of the active season for wildlife. Additionally, vegetation will be replanted/restored when construction period is over to replace the habitat.

Soils

The existing soil and bedrock conditions along the proposed tunnel alignment are described in the Conceptual Geotechnical Design Report (**Appendix 3-4**). Tunnelling and box structure construction activities will cause displacement of the soils and bedrock. This may result in ground movement and settlement during construction activities (e.g. during tunnelling, deep excavations for box structures, and/or dewatering activities).

Additional site-specific subsurface information will be required to further characterize the soil and bedrock conditions along the tunnel alignment and assess the potential for ground movement and settlement during construction. The assessment of potential ground movement/ settlement will need to consider existing man-made features in the project area (e.g. Metrolinx rail corridors, hydro towers, buried municipal services, buildings, roadways, etc.). The Toronto and Region Conservation Authority (TRCA) flood protection landform (FPL) at the West Don Lands must also be considered. Adequate tunnel design and construction methodology will be required to prevent potential impacts to the integrity of the FPL. Appropriate design and construction strategies will need to be developed to minimize potential ground movement/ settlement.

Based on experience with West Don Lands, the soil condition is quite weak. Hybrid TBMs will be capable of both open faced drilling in the bed-rock, as well as earth-pressure balanced drilling in the soft soil conditions.

Mitigation

A detailed settlement analysis will be completed during the detailed design phase of the project. Potential ground movement mitigation measures that may be used during construction, as necessary, include:

- Adequate excavation support (i.e. shoring) systems will be required to support deep excavation walls in the overburden (soils) and to minimize movement of the adjacent ground. Such excavation support system are generally anticipated to consist of soldier pile and lagging walls, diaphragm walls and/or secant piles (contiguous caissons) with internal bracing or tie-back anchor support;
- Excavation support systems that provide cut-off to groundwater inflow such as diaphragm walls and/or secant piles (contiguous caissons) may be considered where excavations extend below the groundwater levels, especially where soil conditions include water-bearing granular soils. This will minimize dewatering needs during construction and reduce the potential for ground movements adjacent to the excavations, as groundwater lowering results in a change in stress conditions in the ground and can induce settlements;
- As shale bedrock has a tendency to slake, ravel or otherwise degrade when exposed, rock walls in deep excavations extending into the shale bedrock will need to be supported in a manner that prevents the spalling and ravelling of the rock and protect it from weathering or deterioration. Typically, temporary rock supports such as rock bolts, wire mesh and shotcrete are adequate for this application;
- Tunnelled structures in the overburden will require adequate tunnelling equipment to reduce the potential for ground loss and the associated potential for settlements at the ground surface. The tunnel is anticipated to be advanced below the groundwater table. The water-bearing granular soils will require control, generally through the use of a pressurized face Tunnel Boring Machine (TBM) consisting of an Earth Pressure Balance with pre-cast liner segments;
- It is anticipated that the tunnel will encounter mixed-face conditions (i.e. soil-bedrock transitions). It may be necessary to perform ground treatment (e.g. jet grouting) to facilitate the soil-bedrock transitions and reduce the risk of ground loss, particularly if and where ground conditions at the transitions include water-bearing granular soils; and
- Tunnelling in shale bedrock will have to consider the shale's tendency to slake, ravel or otherwise degrade when exposed, which results in a relatively short stand-up time. The use of a shielded TBM with pre-cast segments in the shale bedrock will generally mitigate the impact of the shale degradation and short stand-up time.

Development of settlements at the ground surface can generally be minimized by careful workmanship, however, some post-construction settlements may occur as a result of the tunnel and box structure installation. Hence, a settlement monitoring program will need to be implemented during construction to:

- Document the effects of the tunnel installation on the overlying roads, adjacent structures/underground utilities/services, and other man-made features;
- Potentially identify adverse ground movement trends that could occur due to the construction methods and equipment or unforeseen ground conditions;
- Evaluate the contractor's compliance with the settlement limits specified in the Contract; and
- Allow adjustments to be made to the tunnel installation methods such that the settlement limits established are not exceeded.

Contingency

Review and alert levels (i.e. settlement limits) will be established as part of the development of the settlement monitoring program. Provisions for adequate remedial actions during construction will need to be made (e.g. additional monitoring, additional ground support, grouting) in the event that measured settlements exceed tolerable thresholds.

Groundwater

The existing groundwater conditions along the proposed tunnel alignment are described in the Conceptual Geotechnical Design Report (**Appendix 3-4)**. Temporary impacts to the groundwater conditions may be expected during construction, particularly where dewatering activities are undertaken. As mentioned in **Section 6.3.1**, groundwater lowering results in a change in stress conditions in the ground and can induce settlement.

Mitigation

Impacts to the groundwater conditions and associated potential ground movements may generally be mitigated through design and construction strategies that minimize dewatering requirements. This includes excavation support systems that provide cut-off to groundwater inflow (e.g. diaphragm walls and/or secant piles) within the overburden and tunnelling methodologies that use a pressurized face (e.g. Earth Pressure Balance TBM) to control water-bearing soils.

Drainage and Stormwater Management

The details of the features proposed to mitigate the permanent effects of the Project are outlined in **Section 6.3.1**. Sedimentation and soil erosion is anticipated during the cut-and-cover construction at stations and special track structures.

Mitigation

An Erosion and Sediment Control (ESC) Plan and Specifications for construction activities will be provided during the detailed design stage. The ESC Plan and Specifications will be prepared in accordance with the Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guidelines for Urban Construction (2006).

Monitoring

An ESC inspector will be responsible for ensuring all ESC measures are properly installed/constructed, implemented, and maintained. Inspection and monitoring of all ESC measures will be completed regularly and after every storm event. Appropriate contingency plans and remedial measures will be in place and implemented in case of failure of any of the ESC measures.

Contaminated Properties

Historical land use within or adjacent to the proposed tunnel alignment has contributed to the potential for past soil contamination that may be encountered during Project activities. If existing contamination is encountered it would likely result in a need for additional investigation to determine the nature and the extent of the contamination. Based on this characterization, possible outcomes or additional requirements may include:

- An assessment of risks to human health, both during construction or during future access or servicing activities within the tunnels;
- An assessment of potential incompatibilities with, or deleterious effects, materials to be used in the construction of the tunnels; and/or
- Possible remediation, or mitigation and monitoring as required to mitigate any potential effects that are identified.

Based on the desktop study completed in support of the Project and described in Section 6 of the Conceptual Geotechnical Design Report (**Appendix 3-4**), a number of potentially contaminated properties were identified as having to contribute to environmental contamination along the Project right-of-way. Based on the review of these potentially contaminated properties, 73 properties were identified as having a high risk of potentially affecting the proposed tunnel alignment. Further investigation that would include soil or groundwater sampling would be required to confirm whether impacts are actually present in association with these properties, and whether the associated contaminants, if present, pose risks to the project.

Mitigation

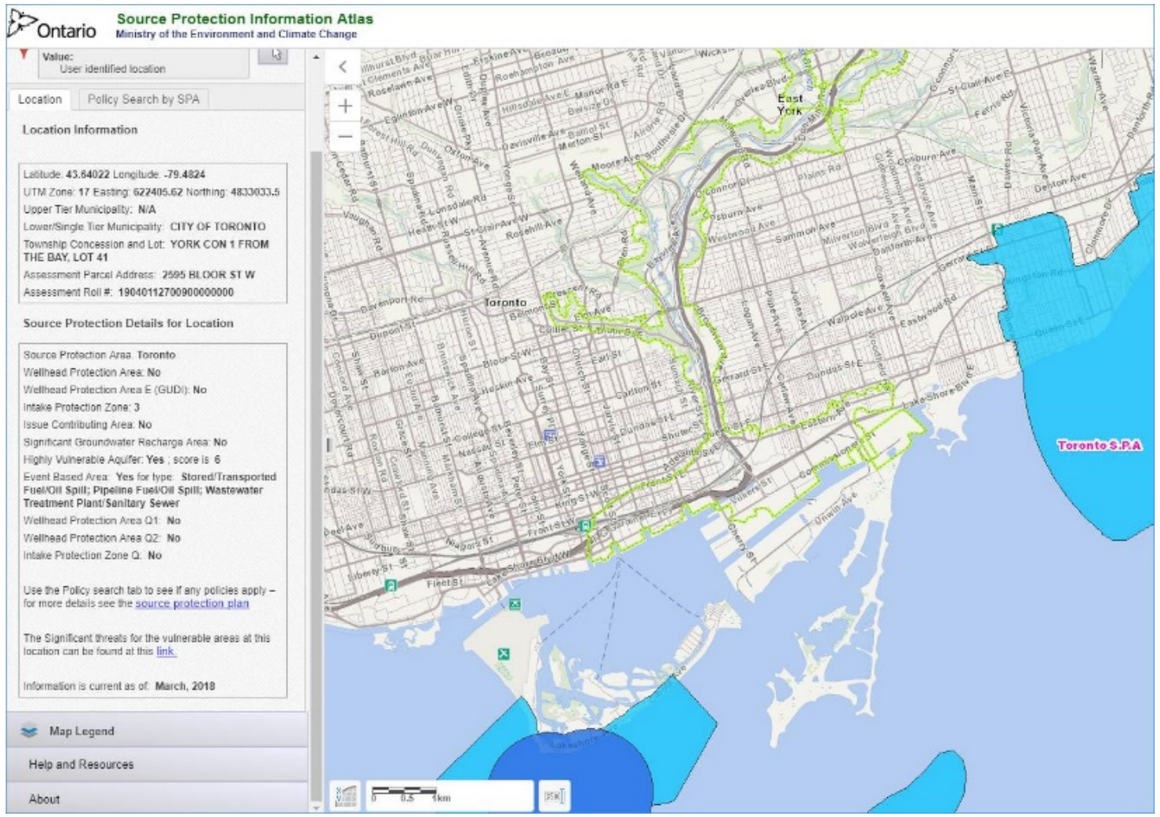
A common strategy that may be considered is excavation and disposal following chemical analysis, particularly where such excavation can be conducted in conjunction with other project activities. Where excavation of materials is not feasible to mitigate identified risks, implementation of engineered controls such as barriers or other containment or extraction facilities may be possible. Substitution of construction materials to address chemical incompatibilities may also be a possible approach.

The Project falls within the Toronto and Region Source Protection Area (TRSPA) in the CTC Source Protection Region (CTC SPR). As part of the CTC Source Protection Plan (CTC SPP), a vulnerable area is identified in the vicinity of the Don River with policies to protect against potential threats from fuel and sewage spills that may impact the nearby Lake Ontario drinking water supply intakes.

Although the project is outside of the more vulnerable intake protection zones (IPZ) for the nearby Lake Ontario intakes (referred to as IPZ1 and IPZ2), the project's study area intersects an IPZ3 zone. This IPZ3 zone is an event-based area (EBA) where various kinds of spills can be a significant threat to the sources of drinking water.

Figure 6-1 illustrates the IPZ3 zone (shown in green outline) where fuel and sewage spills can be a threat to the sources of drinking water.

Figure 6-1: Source Water Protection Vulnerable Area IPZ3 (shown in green outline)



During the course of construction, there is a risk of spills of fuels or other contaminants by the Contractor. As described in **Section 6.3.3** and **Section 7**, an Environmental Spills Prevention and Response Plan will be developed to ensure proper mitigation and notification procedures are in place during construction. The Environmental Spills Prevention and Response Plan will fulfill the requirements of the CTC Source Protection Plan for this project.

6.3.2 Emissions

Climate Change

Impact of the Project on Climate Change

A recent study from the University of Toronto (Saxe et al., 2017) has identified key factors that impact climate change as a result of the construction of new subway infrastructure. Greenhouse gas (GHG) emissions associated with construction activities are attributable to:

- Manufacturing of construction materials;
- Energy consumed at construction sites;
- Transportation energy used in the movement of people, materials and machinery/equipment to and from the site; and
- Infrastructure design and size.

These key factors will impact the overall carbon footprint generated from the construction of the Transit Project which will in turn have an impact on climate change.

Mitigation

To minimize GHG emissions during construction it is recommended that:

- All construction equipment used on the project be well maintained and kept in good working condition;
- Where possible optimize the movement of people, materials and machinery/equipment to, from and on-site;
- Where possible avoid unnecessary idling of heavy duty equipment and vehicles; and
- Where possible, in particular, where noise/vibration is not a concern, extend construction hours and/or overnight work to reduce construction-related traffic flow disruption and the overall duration of the construction project.

Impact of Climate Change on the Project

The Greater Toronto Area (GTA) is expected to experience increasing incidents of extreme weather events due to climate change, including unusual cold spells, extreme heat and extended heat waves, flooding and ice storms (TPH, 2015). These events have the potential to result in power outages, damage to infrastructure, and disruption to transportation which can ultimately delay construction of the Relief Line South. In addition, health and safety of construction personnel may be compromised during these extreme events.

Mitigation

To mitigate the impact of climate change on the Project, it is recommended that adequate plans for severe weather events and emergencies, closures and rerouting, be implemented during the construction phase. Health and safety plans should also be developed to ensure that on-site personnel are aware and are properly trained to recognize and respond to hazards and emergencies caused by extreme weather events.

Details of the climate change impacts from the operations and maintenance of the Relief Line South are further discussed in **Section 6.2.4**.

Air Quality

Suspended particulate matter (SPM or dust) is the primary contaminant of concern that may impact air quality during the construction of the Relief Line South infrastructure. Sources of dust

emissions include cut-and-cover construction techniques, tunnelling, demolition, material handling and trackout by construction vehicles on public roads. Other contaminants including nitrogen oxides (NOx), carbon monoxide (CO), sulphur dioxide (SO2) particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$) and volatile organic compounds (VOC) are emitted from the tailpipe of construction equipment. As with any construction site, dust and tailpipe emissions may cause nuisance type impacts, will be of relatively short duration and unlikely to have long-lasting effect on the surrounding area. Details of the air quality impacts from the operations and maintenance of the Relief Line South are further discussed in **Section 6.4.3**.

Mitigation

There are several ways that dust impact can be mitigated during the construction of the Relief Line South infrastructure. Dry air and high winds have the potential to cause the release and dispersion of dust emissions. The Environment and Climate Change Canada publication “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities” provides several mitigation measures for reducing emissions during construction activities. Mitigation of road dust, as recommended in the ECCC document, includes the use of wind barriers (i.e. fencing or solid barriers, or trees and shrubs), wetting or non-chloride dust suppressants, equipment washing, limiting vehicle speeds on unpaved road surfaces, and limiting the exposed area which may be a source of dust. Given the temporary nature of construction projects, the use of dust suppression techniques, wind speed reduction and the use of low silt content materials are the most common types of mitigation applied.

The Ministry of the Environment, Conservation and Parks (MECP) expects that emission from construction operations comply with the O. Reg. 419/05 SPM criteria. TTC Master Specifications require contractors to incorporate mitigation or control measures into construction activities to achieve compliance with this objective. Control measures articulated in the Controls and Methods Plan will need to be carried out diligently under contractual specifications. Such measures include, but are not limited to:

- Develop a comprehensive environmental Controls and Methods Plan for dust control;
- Cover or wet down dry materials to prevent blowing dust and debris;
- Prevent dust from blowing across the worksite and from leaving the worksite, in particular frequently wet paved and unpaved temporary roads and excavated areas;
- Comply with provincial ordinances and Engineer's requirements regarding minimizing of dust and airborne pollution;
- Wash down the streets within the worksite on a weekly basis and as additionally directed by the Engineer;
- Securely cover excavated material being removed from the worksite and all fill materials being delivered to the worksite to prevent blowing of dust or fines into the streets and haul routes; and
- Application of calcium chloride will be kept to minimum and will be restricted to vehicle right-of-way. In close proximity to watercourses, frequent applications of water will be the preferred method. Obtain the Engineer's approval before chemicals for dust control are used; and
- Tailpipe emissions during the construction phase can be controlled by following the recommendations outlined under Climate Change.

Noise and Vibration

Perceptible noise and vibration from construction activities are anticipated as part of this Project, both for the construction of the stations and other surface infrastructure, and potentially during the construction of the tunnel. Construction impacts will be temporary in nature, particularly those associated with the TBM. The TBM is projected to proceed at a rate of 15-30 m per day. The construction methods for the stations and TPSSs are expected to be comparable to typical urban development projects of similar size. A detailed Noise and Vibration Assessment Report can be found in **Appendix 6-4**, with the construction related impacts and mitigation described below.

Impacts of Tunnel Boring Machines

It is expected that the operation of TBMs will result in perceptible vibrations at sensitive receptors along the preferred route, and these vibrations may in turn result in audible noise within buildings. The tunnel will be founded in bedrock for the majority of the route. This is beneficial in terms of regular subway operations, as ground level vibrations from operations in rock-founded tunnels are generally lower than those for soil-founded tunnels. However, as the TBM is acting directly on the rock, the higher density and rigidity provides more resistance to the grinding mechanism, resulting in higher ground level vibrations compared to boring through softer soil material. The TBM impacts are temporary, as the equipment will be moving at approximately 15-30 m per day. Therefore it is expected that any impacts will be limited to less than two weeks (including approach and departure). It is also important to note that the vibration levels associated with the operation of TBMs do not occur in a range at which structural damage is known to occur.

At the distances between the tunnel and receptors for this Project, the upper bound peak particle velocity (PPV) levels are expected to remain below the City of Toronto Construction Vibration criteria, with the exception of the area in the West Don Lands, on either side of the proposed Sumach Station, where predicted range of vibration levels are between approximately 0.4 mm/s and 9 mm/s PPV. The high maximum level is due to there being a minimal distance between the tunnel and the ground surface at this location. There are houses on Wilkins Avenue (west of the proposed Sumach Station) and on Sumach Street (east of the proposed Sumach Station, north of Eastern Avenue) in this area. Vibration monitoring during tunnelling is recommended at these locations.

While adherence to the City of Toronto construction vibration criteria will protect against structural damage for most homes and buildings, it should be noted that other jurisdictions and published papers outline that cosmetic damage and potentially more significant damage may occur at lower levels in older buildings. As the TBM is projected to pass underneath older homes and historic buildings, alternate criteria should be considered, as appropriate, during the preparation of the

City of Toronto Vibration Control Form. Per multiple sources, a vibration criterion of 6.4 mm/s would be more appropriate for older homes with plaster walls, and historic structures that may be considered highly sensitive. The dense residential area generally occurs between the proposed Broadview Station and the end of the tail tracks north of Pape Station. The predicted vibration levels are projected to comply with a level of 6.4 mm/s throughout this segment.

The interior sound levels during TBM operations will be strongly dependent upon the frequency spectrum of the TBM as it works through the rock material. Based on the predicted upper bound vibration levels, it is expected that the TBM operations will at times result in audible noise inside of buildings along the route, which may lead to complaints and concerns from residents.

A potential additional effect of the tunnel boring operation may be noise and vibration from the use of the temporary construction railway that will be utilized to transport materials to and from the tunnel face. These temporary tracks are laid as the tunnel boring operation proceeds (and therefore use jointed track), and are often fastened directly to the invert (i.e. with no vibration isolation). Furthermore, the transport vehicle suspension is typically stiff both to accommodate heavy material loads, and because passenger comfort is not a consideration. Due to the temporary nature of the track, the regular maintenance to smooth the wheels and the track is often impractical. The potential impacts are best controlled by adhering to speed restrictions on the track.

Impacts of Surface Construction

Surface construction will be completed using conventional construction methods and equipment, and will abide by the City of Toronto by-law, as applicable. This will include construction of the following infrastructure:

- Subway stations (x8);
- TBM launch shafts (x2) and extraction shafts (x4);
- TPSSs (x5);
- EEBs (x7);
- Tunnel ventilation exhausts; and
- Sections of tunnel constructed using cut-and-cover approach.

In some instances, pile driving may be required for construction, which would represent the highest potential for noise and vibration impacts at sensitive receptors during construction of stationary facilities. Where possible, use of hydraulic type pile drivers should be used. Other construction equipment will generally include pavement breaking (e.g. jackhammers), earth-moving (e.g., dozers, trucks) and construction material placement (e.g. cranes) equipment. Construction activities will be managed out of construction laydown areas located intermittently along the route. A total of nine (9) construction laydown areas are proposed.

The sound level at a given receptor due to construction will vary by the type of equipment in use, how many pieces of equipment are in use simultaneously, and the locations of the equipment in relation to the receptors. It should be noted that if multiple pieces of equipment are in use simultaneously, the sound levels must be added logarithmically to be representative of potential overall exposure. Conversely, vibration levels are influenced less by the number of sources operating simultaneously, but rather are driven by the strongest source in operation.

Mitigation

The following control measures are recommended for implementation, to minimize the potential for noise and vibration impacts during construction:

- TTC and its contractors should proactively communicate with the community in advance of construction, in order to provide the public with a schedule, contact information and a description of what they may experience in terms of noise and vibration during construction (e.g. potential for perceptible vibration and induced noise from tunnelling; identifying that building damage occurs at levels much higher than the threshold of perception);
- All construction activity should adhere to the City of Toronto by-law requirements for noise and construction vibrations. This will include the observance of the allowable operating hours (or adhering to the process for obtaining an exemption) for applicable activities, as well as the completion of a Vibration Control Form and associated studies where required;
- Minimize the rail gaps for the temporary construction rail, and implement speed controls in sensitive areas to minimize perceptible vibration and induced noise;
- All equipment used on the project is to be well maintained, with effective muffling devices in good working order where applicable. It is recommended that the sound level limits for construction equipment from the MECP Model Municipal Noise By-law, sections NPC-115 and NPC-118, be applied;
- Where possible, use white noise or broadband reverse alarms rather than beepers for mobile construction equipment, in order to reduce nuisance noise complaints;
- Maximize, to the greatest extent possible, the separation distance between construction laydown areas and nearby sensitive receptors to reduce noise impacts. Investigate the feasibility of temporary noise barriers where laydown areas are planned for residential areas;
- Where possible, construction activities should be planned to minimize the amount of equipment operating simultaneously;
- Any temporary roads for construction vehicle access should be well maintained and free of potholes and ruts to avoid excessive noise and vibration from heavy vehicles travelling on uneven surfaces;
- A complaints protocol should be established for receiving, investigating and addressing construction noise complaints from the public, including a plan for how the public is to be notified of their options for lodging a complaint; and

- A noise complaint should trigger an investigation into whether the equipment meets the recommended sound level limits from NPC-115 and NPC-118, and whether further controls are technically, administratively and economically feasible. Possible controls should be considered with preference to source control, then pathway control, and lastly receptor control options.

It is expected that the completion of the City of Toronto Vibration Control Form (required to obtain the construction permit) will necessitate the development of a pre-consultation program with the public and a monitoring program to take place before and during construction (particularly for use of the TBM). It is recommended that the monitoring of the TBM operation take place as soon as possible during construction, in order to refine estimates of the potential vibration levels for the entire route using actual propagation and frequency characteristics of the TBM moving through rock.

Electromagnetic Interference

There are no transient impacts anticipated due to the construction of the Transit Project. Potential for localized impacts exists in relation to the operations of the subway and is described in **Section 6.2.2**.

Stray Current

There are no transient impacts anticipated due to the construction of the Transit Project. Potential for localized impacts exists in relation to the operations of the subway and is described in **Section 6.2.2.**

6.3.3 Socio-Economic Environment

Buildings and Property (Property Acquisition)

Temporary property acquisitions are required where construction footprints extend past the public right-of-way. Property required for construction of the Transit Project include construction staging and laydown areas, launch and extraction shafts, open cut excavation areas, and temporary underground easements. A summary of property impact tiers is summarized in **Section 6.2.3**. The size of the requirement and the type of activity to occur determines whether the impact is classified as Tier 4 or Tier 5. Tier 4 impacts are considered a partial taking or underground easement where the day-to-day activities of the property can continue without unreasonable impedance. Properties identified for a Tier 4 taking are not anticipated to require any demolition of the main structure. Tier 5 impacts, however, are construction activity areas that are judged to require the entire property to proceed, which in many cases requires demolition of existing structures.

In total, there is one property identified for partial acquisition/easement (Tier 4) and 10 properties for full temporary acquisition (Tier 5). A complete list of properties temporarily impacted by the Transit Project can be found in the property impact matrix detailed in **Appendix 6-1** of this report.

Properties and structures adjacent to the Transit Project construction zone are susceptible to impacts arising from vibration and ground settlement. **Section 6.3.2** and **Section 6.3.1**, respectively, describe these potential impacts in greater detail.

Indirect property impacts may also occur during construction that relate to the disruption to residents and businesses caused by construction actives, much of which is described in other sections. The scale, duration, and location of the proposed excavation areas will almost certainly lead to impacts to the day-to-day operations of local businesses. This will primarily be due to changes in vehicle and pedestrian movement patterns, but may also include the following:

- Reduced visibility of storefronts and signage;
- Reduced on-street parking;
- Less convenient access and disruption to (including closures to) off-street parking facilities; and
- Patrol inconvenient due to temporary construction debris, noise, and dust.

<u>Mitigation</u>

The City of Toronto will negotiate temporary easements and construction agreements with property owners on a case-by-case basis following the procedures described in **Section 6.3.1**. To the extent possible, following construction, the lands acquired will be restored to pre-construction conditions. In all cases, the resulting compensation is intended to leave the affected owner “whole,” thereby mitigating any impacts.

Properties at risk of impact from settlement or vibration will be identified through the establishment of a zone of influence. The owners of the identified properties will be contacted to have a precondition survey completed. More details related to mitigation and monitoring measures for potential vibration and settlement impacts are described in **Section 6.3.1** and **Section 6.3.2**, respectively.

Impacts to businesses and residents will be mitigated by requiring contractor(s) to minimize any inconvenience caused by construction activities to business owners, residents, and property owners. The Proponent’s public relations team will work with, and continuously inform affected parties of works planned along the corridor. A Construction Liaison Committee will be established and will act as the community’s advocate, to develop relationships with the affected communities, receive and respond to questions and concerns, and anticipate community issues. The Committee members works with a variety of stakeholders such as residents, businesses, Business Improvement Areas (BIAs), community organizations, religious institutions, and schools, to identify and respond to issues and find ways to mitigate against construction impacts.

Aesthetics

Construction work can impair the visual setting of the surrounding environment on a temporary basis. Activities such as demolition, land clearing, excavation, earth-moving, staging, concrete pouring, and overnight site lighting may be visually intrusive, often for extended periods of time.

Other concerns that may be associated with construction include mud tracking onto sidewalks, roads, and open spaces; improperly stored construction debris; and unsightly damage to sidewalks, trees, and other elements of the public realm. Construction hoarding, designed to screen construction sites or protect vulnerable features in their vicinity, such as trees, may also negatively impact the visual setting by restricting views of or blocking access to amenities.

Mitigation

Recognizing that the Relief Line South passes through some of the densest residential and commercial neighbourhoods in Toronto, retail areas of regional significance, and near important natural and cultural sites including Osgoode Hall, City Hall, Corktown Common, and the Don River, the Proponent will take measures to minimize adverse aesthetic impacts associated with construction. The CHAR will also assess the indirect impacts of the Relief Line South on adjacent heritage properties, and recommend mitigation measures.

In particular, construction sites will be hoarded to minimize visual intrusion of the construction activity. Where appropriate, the Proponent will provide additional measures to improve the appearance of hoarding and areas around the constructions site, such as through the integration of public art and attractive lighting, in line with City of Toronto requirements. Temporary construction site lighting will also be positioned to minimize light infiltration into adjacent residential properties while meeting construction safety requirements. Construction debris, including excavated earth, will be appropriately managed, stored, and removed from the site to prevent its spread onto surrounding property or public space.

The proponent will also take measures to minimize damage and maintain access to sidewalks, green space, street trees, and other components of the public and private realm during construction.

Human Health and Safety

Local employees and residents as well as Transit Project construction workers will potentially be affected by construction-related noise, vibration and dust. Another important issue is the health and safety of construction workers. Construction can also have health and safety implications for pedestrians and cyclists, due to the increased potential for tripping and slipping hazards and bike lane and sidewalk closures or detours.

Dust is a concern with any form of construction, especially with cut-and-cover excavations. Dust sources at cut-and-cover construction sites (or tunneling access locations) are discussed in **Section 6.3.2**.

Mitigation

Noise, vibration and dust impacts and proposed mitigation methods are described in previous sections. Project traffic management plans will address pedestrian and cyclist safety concerns, ensuring compliance to all relevant legislation, including the Accessibility for Ontarians with Disabilities Act (AODA).

Monitoring

As described in **Section 6.2.2**, the Proponent and its contractor will monitor noise, vibration and dust effects during construction. In addition, the proponent will monitor contractor compliance with applicable legislation and regulations. The proponent's safety policies for staff and standard specifications for construction contracts will require full compliance with the following Acts and Regulations:

1. The Ontario Occupational Health and Safety Act (OHSA);
2. The Ontario Regulations for Construction Projects;
3. Workplace Hazardous Materials Information System (WHMIS) Regulations;
4. The Canadian Environmental Protection Act and regulations; and
5. All other legislation, regulations and standards as applicable.

In addition, for any building demolition a Designated Substance Survey will be undertaken in accordance with the requirements of Section 30 of the OHSA. The purpose of the survey will be to determine the presence of building products or equipment containing biological, chemical or physical agents termed Designated Substances under the OHSA or PCB's and to recommend actions for management during demolition and reconstruction of the existing subway station. The survey findings will be included in the contract documents for the Project. In addition, the contractor will be required to comply with all applicable regulations, including the OHSA and the Export and Import of Hazardous Waste Regulations and the Storage of PCB Material Regulations (under the Canadian Environmental Protection Act).

Contingency

During the course of construction, there will be a risk of spills or discharge of pollutants or contaminants by the contractor. The following contingency plan will be put in place:

1. Identify names and telephone numbers of persons in local municipalities and MECP to be notified forthwith of a spill;
2. Identify names and telephone numbers of representatives of fire, police and health departments of local municipalities who are responsible to respond to emergency situations;
3. Identify names and telephone numbers of companies experienced in control and cleanup of hazardous materials that will be called in an emergency involving a spill;
4. Include provisions for hazardous or unknown materials (e.g. puncturing a drain during excavation);
5. Containment and control of a spill and clean up procedures are to be initiated immediately to mitigate environmental damage, while awaiting additional assistance; and
6. Ensure materials and products are on site with which temporary repairs can be made to broken pipelines or other services so emission of pollutants can be controlled and stopped.

6.3.4 Cultural Environment

Built Heritage Resources and Cultural Heritage Landscape

The CHAR identified 114 properties of known or potential cultural heritage value or interest that will potentially be directly or indirectly impacted by the Project during construction. The direct impacts include destruction of, or damage to, heritage attributes during construction of new components, or the addition of new components that are incompatible or unsympathetic to the design or appearance of properties of cultural heritage value or interest and cultural resources. Addition of new Project components may result in indirect impacts, primarily from construction vibration, shadows that change the appearance of heritage attributes, or obstruct significant view or vistas from, or to, identified properties of cultural heritage value or interest or cultural resources.

Mitigation

Property-specific mitigation recommendations for temporary construction impacts are provided in **Table 6-17** to **Table 6-31** by study area defined in the CHAR. Note that these recommendations are based on a current understanding of the project and may need to be re-visited if components are moved or altered during detailed design, or if it is determined that there will be surface impacts in areas of the corridor excluded from this study. The latter situation may require a minor or major TPAP amendment.

Table 6-17: Queen and Osgoode Station (Interchange) Study Area Conservation/Mitigation Recommendations (1 of 5)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Protected heritage properties (designated, Part V): • 168 John Street • 252-254 Queen Street West • 313 Queen Street West	Monitor 313 Queen Street West for vibration impact during adjacent excavation and construction and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part V): • 299 Queen Street West	Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Any alterations to the property will require heritage permit approval from the City. Monitor for vibration impact during adjacent cut-and-cover excavation and substation, EEB, and vent shaft construction and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part V): • 250 Queen Street West/ 155-161 John Street	Consider options during detailed design to move Substation #1, EEB#1, and vent shafts to a nearby, non-contributing property. If moving the project components is not technically feasible, conduct a property-specific HIA during detailed design in accordance with the City *Terms of Reference.* The HIA should identify any additional external or internal heritage attributes and recommend mitigation measures to avoid or reduce adverse impacts to all identified heritage attributes, especially those on the exterior, such as the two-storey massing, mansard roof with dormers and symmetrical fenestration. Any alterations or new construction visible from the exterior must comply with design guidelines outlined in the Queen Street West HCD Plan, and all alterations to the property will require heritage permit approval from the City. A heritage conservation plan should also be completed to ensure the property's heritage attributes are protected during construction, and guide future use and long-term maintenance.
Protected heritage property (designated, Part V): • 246 Queen Street West	Consideration to move the project components is recommended for the adjacent 250 Queen Street West/ 155-161 John Street. If moving the project components is not technically feasible, the City may require an HIA be conducted for 246 Queen Street West to assess the impacts of the new construction on the CHVI of the HCD. Any new construction on the property must comply with design guidelines outlined in the Queen Street West HCD Plan and will require heritage permit approval from the City.

Table 6-18: Queen and Osgoode Station (Interchange) Study Area Conservation/Mitigation Recommendations (2 of 5)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Projected heritage property (designated, Part V): • 244 Queen Street West	Confirm the location and extent of adjacent construction during detailed design. If the adjacent construction extends into the property, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Any new construction on the property must comply with design guidelines outlined in the Queen Street West HCD Plan and will require heritage permit approval from the City.
Protected heritage properties (designated, Part V): • All properties on the north side of Queen Street West, including and between 180 and 242 Queen Street West • All properties on the south side of Queen Street West, including and between 205 and 279 Queen Street West	Confirm the location and extent of cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Any new construction on the property must comply with design guidelines outlined in the Queen Street West HCD Plan and will require heritage permit approval from the City. Monitor for vibration impact during cut-and-cover excavation and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part V): • 160 Queen Street West	Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Monitor for vibration impact during adjacent cut-and-cover excavation and station entrance construction and immediately cease work if vibration thresholds are exceeded.
Built heritage resource (listed on the City Heritage Register): • 250 University Avenue/ 180 Richmond Street West	Since the property is currently used as a station and currently proposed for a 54-storey condominium development above the existing building, it is not recommended that options be considered to move the project components to a less sensitive property. However, a property-specific HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to confirm the property's heritage attributes and recommend appropriate mitigation measures. A heritage conservation plan should also be completed to safeguard the property's heritage attributes during construction, and guide future use and long-term maintenance.

Table 6-19: Queen and Osgoode Station (Interchange) Study Area Conservation/Mitigation Recommendations (3 of 5)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resources (monuments): • South African War Cenotaph • Sir Adam Beck Memorial Park	The City should be consulted to determine whether a CHER is required for Sir Adam Beck Memorial Park. The CHER should evaluate if either property meets the criteria prescribed in *O. Reg. 9/06.* If the CHER finds that for Sir Adam Beck Memorial Park has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. The HIA should also assess whether the above grade construction will result in adverse visual impacts to the Sir Adam Beck Memorial. Monitor the South African War Cenotaph and Sir Adam Beck Memorial for vibration impact during adjacent cut-and-cover excavation and station and vent shaft construction and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part IV): • 130-132 Queen Street West	Conduct a structural assessment during detailed design to determine whether the iron fence (a heritage attribute) will be vulnerable to vibration impacts during adjacent excavation and construction. If design alterations or conditions require adjacent construction or excavation to extend into the property, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent cut-and-cover excavation and station entrance and vent shaft construction, and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part IV): • 130-132 Queen Street West	Conduct a structural assessment during detailed design to determine whether the iron fence (a heritage attribute) will be vulnerable to vibration impacts during adjacent excavation and construction. If design alterations or conditions require adjacent construction or excavation to extend into the property, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent cut-and-cover excavation and station entrance and vent shaft construction, and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: • 123 Queen Street West	Confirm during detailed design the extent of adjacent cut-and-cover excavation and station entrance construction and consult the City to determine if a CHER is required. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in *O. Reg. 9/06.* If a CHER finds the property has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent cut-and-cover excavation and station entrance construction and immediately cease work if vibration thresholds are exceeded.

Table 6-20: Queen and Osgoode Station (Interchange) Study Area Conservation/Mitigation Recommendations (4 of 5)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Protected heritage property (designated, Part IV): • 100 Queen Street West	Conduct an HIA during detailed design compliant with the City *Terms of Reference* to determine the appropriate mitigation for direct and indirect visual impacts to the property and specifically Nathan Phillips Square from construction of vent shafts and station entrance and vent shafts at the southwest and southeast corners of the property. The HIA should also determine if monitoring the built heritage resources for vibration impact during construction is required. All alterations to the property will require heritage permit approval from the City.
Potential built heritage resource: • 65 Queen Street West	Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether a CHER is required. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in *O. Reg. 9/06.* If a CHER finds the property has CHVI, conduct an HIA during detailed design in accordance with the MTCS *Standards & Guidelines* and City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent cut-and-cover excavation and station entrance and vent shaft construction and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part IV): • 60 Queen Street West	Conduct a structural assessment during detailed design to determine whether the Cenotaph and Old City Hall will be vulnerable to vibration impacts during adjacent cut-and-cover excavation and station entrance and vent shaft construction. The City should be consulted to determine whether an HIA is required to assess the impact of the station entrance on the adjacent property. The HIA, if required, should be undertaken during detailed design in accordance with *City Terms of Reference*. If design alterations or conditions require construction or excavation to extend into the property, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent cut-and-cover excavation and station and vent shaft construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-21: Queen and Osgoode Station (Interchange) Study Area Conservation/Mitigation Recommendations (5 of 5)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Protected heritage property (designated, Part IV): • 176 Yonge Street	Confirm the location and extent of cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Any new construction on the property will require heritage permit approval from the City. Monitor for vibration impact during adjacent cut-and-cover excavation and vent shaft construction, and immediately cease work if vibration thresholds are exceeded.
Protected heritage property (designated, Part IV): • 2 Queen Street West	Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. The HIA, if required, should be undertaken during detailed design in accordance with the *City Terms of Reference*. Any new construction on the property will require heritage permit approval from the City. Monitor for vibration impact during construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-22: Sherbourne Station Study Area Conservation/Mitigation Recommendations

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resources: • 100 Queen Street East • 104 Queen Street East • 108-114 Queen Street East • 225 Queen Street East • 244-246 Queen Street East • 250 Queen Street East	Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether a CHER is required. If required, the CHER should evaluate if the property meets the criteria prescribed in *O. Reg. 9/06.* If a CHER finds a property has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent construction and immediately cease work if vibration thresholds are exceeded.
Built heritage resources and protected heritage properties: • 229 Queen Street East (listed on the City Heritage Register) • 216-232 Queen Street East (listed on the City Heritage Register) • 234-242 Queen Street East (designated, Part IV) • 263-265 Queen Street East (designated, Part IV) • 98 Queen Street East • (listed on the City Heritage Register) • 245 Queen Street East • (Intention to designate) • 111 Queen Street East • (designated, Part IV) • 99-123 Queen Street East (designated, Part IV) • 237-243 Queen Street East (designated, Part IV)	Conduct a structural assessment at 216 Queen Street East during detailed design to determine whether the built heritage resource will be vulnerable to vibration impacts during excavation and construction for the adjacent station entrance and vent shafts. Confirm the location and extent of adjacent cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether an HIA is required to determine the appropriate mitigation. If an HIA is required, it should be undertaken during detailed design in accordance with the City *Terms of Reference.* Monitor for vibration impact during adjacent cut-and-cover excavation and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: • 150 Sherbourne Street	Monitor for vibration impact during adjacent excavation and construction and immediately cease work if vibration thresholds are exceeded.

Table 6-23: Sumach Station Study Area Conservation/Mitigation Recommendations (1 of 3)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resource: • 489-495 King Street East	Conduct a structural assessment during detailed design to determine whether the potential built heritage resource will be vulnerable to vibration impacts during adjacent station and vent shaft construction and subsurface tunnel boring. Monitor for vibration impact during adjacent tunnel boring and construction and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: • 507 King Street East	Conduct a CHER during detailed design to determine if the property meets the criteria prescribed in *O. Reg. 9/06.* If any of the property is found to have CHVI, an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to recommend appropriate mitigation measures. This may include measures such as monitoring the built heritage resource for vibration impact during construction or documenting cultural features on the property that may require removal. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during tunnel boring and vent shaft construction, and immediately cease work if vibration thresholds are exceeded.
Built heritage resource (listed on the City Heritage Register): • 19 Sackville Street	Conduct a structural assessment during detailed design to determine whether the built heritage resource will be vulnerable to vibration impacts during tunnelling for the station entrance. Although the surface of the property will not be impacted under the current design, the City should be consulted to determine whether a property-specific HIA is required to confirm the property's heritage attributes and assess the nature and extent of temporary indirect impacts during construction. If design alterations or conditions require construction or excavation on the surface of the property, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-24: Sumach Station Study Area Conservation/Mitigation Recommendations (2 of 3)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resources: • 6-12 Sumach Street	Conduct a structural assessment during detailed design to determine whether the potential built heritage resources will be vulnerable to vibration impacts during tunnel boring and adjacent construction for a station entrance. Although the surface of the properties will not be directly impacted under the current design, if design alterations or conditions require excavation or other alterations to the surface of the properties or potential built heritage resources, the City should be consulted to determine whether a CHER is required during detailed design. The CHER, if required, should evaluate if the properties meet the criteria prescribed in *O. Reg. 9/06.* If the CHER determines the properties have CHVI, an HIA should be undertaken in accordance with the City *Terms of Reference* to recommend the appropriate mitigation measures. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during construction, and immediately cease work if vibration thresholds are exceeded.
Built heritage resource (listed on the City Heritage Register): • 153 Eastern Avenue	Conduct a structural assessment during detailed design to determine whether the built heritage resource will be vulnerable to vibration impacts during tunnel boring beneath the northwest corner of the property. Although the surface of the property will not be impacted under the current design, the City should be consulted to determine whether a property-specific HIA is required to confirm the property's heritage attributes and assess the nature and extent of temporary indirect impacts during tunnel boring and construction. If design alterations or conditions require excavation or other alterations to the surface of the property or built heritage resource, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during tunnel boring and construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-25: Sumach Station Study Area Conservation/Mitigation Recommendations (3 of 3)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resource: • 171 Eastern Avenue	Conduct a structural assessment during detailed design to determine whether the potential built heritage resource will be vulnerable to vibration impacts during tunnel boring. Although the surface of the property will not be directly impacted under the current design, if design alterations or conditions require excavation or other alterations to the surface or potential built heritage resource, the City should be consulted to determine whether a CHER is required during detailed design. The CHER, if required, should evaluate if the properties meet the criteria prescribed in *O. Reg. 9/06.* If the CHER determines the properties have CHVI, an HIA should be undertaken in accordance with the City *Terms of Reference* to recommend the appropriate mitigation measures. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during tunnel boring, and immediately cease work if vibration thresholds are exceeded.

Adjacent to the Sumach Station Study Area are housing units (460-470 King Street East and 21-33 Sackville Street) that have potential design or physical value as representative examples of late 19th century row housing, and historical or associative value and contextual value for their connections to the Corktown neighbourhood. Although currently outside the area predicted to have elevated vibration levels from tunnel boring, these masonry structures may be particularly susceptible to vibration impact. To ensure these properties are not adversely impacted during construction, it may be necessary to expand the area monitored for vibration impact and cease work immediately if vibration limits are exceeded.

Table 6-26: Broadview Station Study Area Conservation/Mitigation Recommendation

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resource: • 9 Lewis Street	Confirm during detailed design the location and extent of construction for the adjacent station entrance. If the construction will encroach on 9 Lewis Street and impact the property, the City should be consulted to determine whether a CHER is required. If the CHER finds the property has CHVI, an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent construction and immediately cease work if vibration thresholds are exceeded.

Table 6-27: Carlaw Station Study Area Conservation/Mitigation Recommendations (1 of 2)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resources: • 137 Morse Street • 144 Morse Street	Confirm the location and extent of adjacent excavation for EEB#4 during detailed design. If the adjacent excavation extends south into 137 Morse Street, the City should be consulted to determine whether a CHER is required. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in *O. Reg. 9/06.* If the CHER finds that 137 Morse Street has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor both 137 Morse Street and 144 Morse Street for vibration impact during adjacent construction, and immediately cease all work if vibration thresholds are exceeded.
Potential built heritage resource: • 180 Carlaw Avenue	The City should be consulted to determine whether a CHER is required for the property. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in *O. Reg. 9/06.* If the CHER finds that the property has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor the school building for vibration impact during adjacent construction, and immediately cease all work if vibration thresholds are exceeded.
Potential built heritage resource: • 972-978 Queen Street East	Consider options during preliminary design to move the station entrance and vent shafts to a nearby property that does not have known or potential built heritage resources. If moving the project components is not technically feasible, conduct a CHER during detailed design to determine if the building on the combined properties meets the criteria prescribed in *O. Reg. 9/06*. If the combined properties are found to have CHVI, an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to recommend appropriate mitigation measures. A structural assessment should also be undertaken during detailed design to determine whether the remaining sections at 976-978 Queen Street East will be vulnerable to vibration impacts during adjacent excavation and construction. The HIA may also need to consider if the above ground elements of the proposed station will indirectly impact the remaining sections at 976-978 Queen Street East by introducing incompatible massing or design. In addition to any other mitigations that may be recommended in an HIA (if required), monitor the remaining sections at 976-978 Queen Street East for vibration impact during adjacent construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-28: Carlaw Station Study Area Conservation/Mitigation Recommendations (2 of 2)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resource: • 945-947 Queen Street East	Monitor for vibration impact during adjacent construction of the station entrance and vent shafts, and immediately cease all work if vibration thresholds are exceeded.
Potential built heritage resource: • 181-183 Carlaw Avenue	During detailed design confirm the location and extent of adjacent cut-and-cover excavation and construction for the station entrance and vent shafts. If the adjacent excavation and construction will impact the property, the City should be consulted to determine whether a CHER is required. If a CHER is required, the evaluation should determine if the property meets the criteria prescribed in *O. Reg. 9/06*. If a CHER finds the property has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent excavation and construction and immediately cease work if vibration thresholds are exceeded.
Built heritage resource: • 201 Carlaw Avenue	Confirm the location and extent of cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts the property, the City should be consulted to determine whether an HIA is required to confirm the property's heritage attributes and assess the nature and extent of temporary indirect impacts during construction. The HIA, if required, should be compliant with the City *Terms of Reference*. Monitor for vibration impact during excavation in the vicinity of this property and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resources: • 250-302 Carlaw Avenue • 235 Carlaw Avenue	Confirm the location and extent of cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether a CHER for each property is required. If the CHER finds either or both properties have CHVI, HIAs should be conducted during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during excavation in the vicinity of the property and immediately cease work if vibration thresholds are exceeded.

Table 6-29: Gerrard Station Study Area Conservation/Mitigation Recommendations

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Built heritage resource (Provincial Heritage Property): • Gerrard Street East Subway GO rail corridor Bridge Crossing	Conduct a structural assessment during detailed design to determine whether the bridge, including concrete abutments and piers, will be vulnerable to vibration impacts during adjacent excavation for Gerrard Station and construction of Substation #4. Monitor for vibration impact during adjacent construction, and immediately cease all work if vibration thresholds are exceeded. If design alterations or conditions require construction or excavation to extend beyond the adjacent property, conduct an HIA compliant with the MTCS *Standards and Guidelines* to recommend appropriate mitigation measures.
Potential built heritage resources: • 229 Langley Avenue • 231 Langley Avenue • 233-235 Langley Avenue • 237-239 Langley Avenue • 241-243 Langley Avenue	Conduct a CHER during detailed design to determine if they meet the criteria prescribed in *O. Reg. 9/06*. If any of the properties are found to have CHVI, an HIA should be conducted during detailed design in accordance with the City *Terms of Reference* to recommend appropriate mitigation measures. This may include measures such as monitoring the built heritage resource for vibration impact during construction or documenting cultural features such as fences and outbuildings prior to their removal. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent construction, and immediately cease work if vibration thresholds are exceeded.

Table 6-30: Pape Station Study Area Conservation/Mitigation Recommendations (1 of 2)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Potential built heritage resources: • 619-621 Pape Avenue • 634 Pape Avenue • 638 Pape Avenue • 660-662 Pape Avenue • 661 Pape Avenue • 667 Pape Avenue • 664 Pape Avenue • 681-683 Pape Avenue • 685 Pape Avenue • 701 Pape Avenue • 705-707 Pape Avenue • 784 Pape Avenue • 871 Pape Avenue • 873-877 Pape Avenue • 911 Pape Avenue • 923 Pape Avenue	Confirm the location and extent of cut-and-cover excavation during detailed design. If the adjacent cut-and cover excavation extends beyond the right-of-way and impacts one of the properties, the City should be consulted to determine whether a Cultural Heritage Evaluation Report (CHER) is required. If required, the CHER should evaluate if the property meets the criteria prescribed in *O. Reg. 9/06.* If a CHER finds that the impacted property has CHVI, conduct an HIA during detailed design in accordance with the City *Heritage Impact Statement Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during excavation in the vicinity of these properties and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: • 832 Pape Avenue	During detailed design confirm the location and extent of excavation for the adjacent cut-and-cover excavation and construction of Extraction Shaft #3 and EEB#6. If the adjacent excavation and construction will impact the property, the City should be consulted to determine whether a CHER is required. If required, the CHER should evaluate if the property meets the criteria prescribed in *O. Reg. 9/06.* If a CHER finds the property has CHVI, conduct an HIA during detailed design in accordance with the City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent excavation and construction and immediately cease work if vibration thresholds are exceeded.

Table 6-31: Pape Station Study Area Conservation/Mitigation Recommendations (2 of 2)

Resource Type & Civic Address	Conservation/ Mitigation Recommendations
Built heritage resource (listed on the City Heritage Register): • 646 Danforth Avenue	Conduct a structural assessment during detailed design to determine whether the property will be vulnerable to vibration impacts during adjacent open cut-and-cover excavation, demolition, and construction for Extraction Shaft 2, a station entrance and vent shafts. Additionally, the City should be consulted to determine whether a property-specific HIA is required to confirm the property's heritage attributes and assess the nature and extent of temporary indirect and potentially direct impacts (if the adjacent 640 Danforth is demolished) during construction. The HIA may also need to consider if the above ground elements of the proposed station will indirectly impact the adjacent built heritage resource by introducing incompatible massing or design. If design alterations or conditions require construction or excavation beyond the adjacent properties, conduct an HIA compliant with the City *Terms of Reference* to determine the appropriate mitigation. In addition to any other mitigations that may be recommended in an HIA (if required), monitor for vibration impact during adjacent construction and excavation, and immediately cease work if vibration thresholds are exceeded.
Potential built heritage resource: • 746 Pape Avenue	During detailed design confirm the location and extent of the adjacent cut-and-cover excavation and construction for Extraction Shaft #2 and station entrance and vent shafts. If the adjacent excavation and construction will impact the property, the City should be consulted to determine whether a CHER is required. If required, the CHER should evaluate if the property meets the criteria prescribed in *O. Reg. 9/06* and *O. Reg. 10/06.* If a CHER finds the property has CHVI, conduct an HIA during detailed design in accordance with the MTCS *Standards & Guidelines* and City *Terms of Reference* to determine the appropriate mitigation. Monitor for vibration impact during adjacent construction and excavation, and immediately cease work if vibration thresholds are exceeded.

Archaeological Resources

Prior to the use of the laydown areas and prior to the construction of the permanent infrastructure components related to the Relief Line South, Stage 2-3 Archaeological Assessments will be required. The Stage 1 Archaeological Assessment has determined that there is no potential for the presence of significant archaeological resources to be preserved within the following portions of the Relief Line South alignment:

a. Osgoode Station: all above ground infrastructure footprints (see Map 19-A of **Appendix 6-3**);

b. Queen Station: all above ground infrastructure footprints (see Map 19-B of **Appendix 6-3)**; and

c. Subterranean Tunnel and Stations: corridor alignment and station infrastructure tunneled 25-40 metres below ground except where open-cut shafts or cut and cover construction areas are proposed at ground surface level above (see Maps 19-A–I of **Appendix 6-3**).

As such, it is recommended that these areas have no archaeological potential and may be considered free of further archaeological concern. No further archaeological assessment of these portions of the Project Area is required (**Appendix 6-3**).

This Stage 1 Archaeological Assessment has also determined that there is potential for the presence of archaeological resources to be preserved within all or part of the following portions of the Relief Line South alignment:

d. Sherbourne Station: above ground infrastructure footprints encompassing greenspace/paved area northwest of where Sherbourne and Queen Streets intersect as well as paved area in northeast corner of Seaton and Queen Streets (see Map 19-C of **Appendix 6-3**);

e. Sumach Station: above ground infrastructure footprints encompassing greenspace northeast of King and Sackville Streets (Sackville Park) as well as greenspace west of the Richmond Street East/Eastern Avenue merger (see Map 19-D of **Appendix 6-3**);

f. Broadview Station: all above ground infrastructure footprints (see Map 19-E of **Appendix 6-3**);

g. Carlaw Station: above ground infrastructure footprints encompassing paved area in southwest corner of Carlaw and Colgate Avenues as well as greenspace in southwest corner of the schoolyard for Morse Street Junior P.S. (see Map 19-F of **Appendix 6-3**);

h. Gerrard Station: above ground infrastructure footprints in paved area north (1) and northeast (2) of Riverdale Shopping Centre (see Map 19-G of **Appendix 6-3**);

i. Pape Station: above ground infrastructure footprint (northern street entrance) west of Pape Avenue (see Map 19-H–I of **Appendix 6-3**);

j. Cut-and-cover construction areas: ground surface (pavement) disturbances located along Pape Avenue (encompassing Launch Shaft 3 and Extraction Shafts 2 and 3), along Queen Street West (encompassing Extraction Shaft 1), as well as within Queen Street East encompassing the subterranean station footprint for Sherbourne Station and within Carlaw Avenue encompassing the subterranean station footprint for Carlaw Station (see Map 19-A–I of **Appendix 6-3**);

k. Launch Shafts 1 and 2: ground surface (pavement) disturbances located within the Broadview Station subterranean station footprint (see Map 19-E of **Appendix 6-3**);

l. Wye track connections: ground surface (greenspaces and residential structures on periphery) disturbances located within Logan Avenue and Langford Parkettes (see Map 19-H of **Appendix 6-3**);

As such, it is recommended that these areas have archaeological potential requiring further archaeological assessment in the form of Stage 2-3 property survey and assessment as described in the Stage 1 Archaeological Assessment (**Appendix 6-3**).

Mitigation

Archaeological Stage 2-3 survey methods in deeply buried conditions are outlined in Section 2.1.7 (p.36) and Section 3.3.3 (p.55) of the *Standards and Guidelines for Consultant Archaeologists* (MTCS 2011). Standards include:

a. Test pitting where viable to carry out survey surface methods to identify any archaeological sites or determine the extent of disturbance;
b. On-site monitoring where construction excavation is extending to a depth that warrants concern;
c. Mechanically excavate trenches at maximum intervals of 10 m;
d. Excavate within the core of archaeological resources; and
e. Gain understanding of the full depth and extent of archaeological resources.

Contingency

Despite best efforts and all due diligence, no archaeological assessment can necessarily account for all potential archaeological resources. Should deeply buried archaeological resources be identified during ground disturbance activity associated with future development of the Project Area, ground disturbance activities should be immediately halted and the Archaeology Division of the Culture Programs Unit of the MTCS notified.

The Stage 1 Archaeological Assessment can be found in **Appendix 6-3.**

6.3.5 Transportation

Automobile Traffic and Transit Service

Although the majority of the Transit Project alignment follows the right-of-way for sections of Pape Avenue, Carlaw Avenue, Eastern Avenue, and Queen Street, the potential disruption to automobile traffic and transit service will be limited due to the tunnelling construction method for the line sections. However, impacts will occur as a result of cut-and-cover construction for the new stations, subway connection works required at Pape, Queen, and Osgoode Stations, Wye track connections to Line 2, construction and operation of launch and extraction shafts, and emergency egress shafts.

Cut-and-cover works will directly impact:

- Existing transit service, including all surface routes currently using Pape Avenue, Carlaw Avenue, Eastern Avenue, Queen Street, affected cross streets and detour routes;
- Existing subway line and station service at the connecting stations and Wye track connections to Line 2
- Traffic, including both vehicular and pedestrian/cyclist movements;
- Driveways and private roads for adjacent properties;
- Sidewalks and building entrances/exits for adjacent properties.

Although temporary in nature, the construction activities that cause these types of impacts will occur over several months and therefore warrant consideration of mitigation measures.

Mitigation

During the detailed design phase, the proponent of the Transit Project will work with the City of Toronto, TTC, and other key stakeholders to develop traffic management plans. The objective of these plans will be to maintain vehicle and pedestrian access at all times for all streets, driveways and property entrances and to facilitate efficient construction of the Transit Project. There will be trade-offs between minimizing construction duration and maintaining access, which will be addressed in the traffic management plans.

The contractor will be required to prepare and submit a detailed and comprehensive Traffic and Transit Management Plan for review and approval by the appropriate City and TTC departments. The Traffic and Transit Management Plan will include the following sub-plans:

- Traffic control plan;
- Transit management plan;
- Emergency services access plan;
- Travel demand management plan;
- Incident management plan;
- Risk management plan;
- Advisory temporary signing plan;
- Implementation plan; and
- Communications plan.

Pedestrians and Cyclists

The impacts and mitigation measures described above will also apply for pedestrians and cyclists.

Mitigation

This work will be carried out in a manner as to ensure the least interference with pedestrians and cyclists, and will include fencing, hoarding, pavement markings, signals, wayfinding signs, and lighting as required to provide safe, accessible, and continuous routes.

Adequate temporary decking over the excavated construction areas during each stage will allow pedestrian and cyclist circulation and crossing of affected roads and sidewalks at all times. Details on decking implementation will be fully detailed during the design stage. Detours around work zones that include sidewalk closures or sidewalk alignment shifts may be required, and will include temporary pedestrian walkways that are protected through jersey barriers, fencing, and hoarding. Temporary sidewalk widths will depend on observed pedestrian volumes during the AM and PM peak periods. At the very minimum a 1.5m pedestrian sidewalk will be provided on both sides of the street. A sidewalk may be closed temporarily on one side of the roadway with approval from the City. In these cases, a safe and reasonable alternative pedestrian route with appropriate signage must be provided. All pedestrian facilities must meet or exceed the Province's and City's accessibility standards as outlined in the AODA.

Where possible, separated cycling facilities should be provided. Where there is insufficient space, lane widths should be wide enough to allow for safe passage of cyclists. Where lanes widths would be too narrow to accommodate safe passing by vehicles, clear "share-the-road" signage should be provided at regular intervals encouraging cyclists to take up the whole lane when passing through the construction area.

Rail

The proposed subway alignment crosses beneath the Metrolinx-owned GO rail corridors at three locations:

- Sta. 3+220 – in soft soils under the Richmond Hill GO corridor adjacent to the Don River;
- Sta. 3+700 – in bedrock under the Lakeshore East/Stouffville GO corridor on Eastern Ave between Broadview and Logan Avenues; and
- Sta. 5+320 – in bedrock under the Lakeshore East/Stouffville GO corridor east of the intersection of Gerrard Street East and Carlaw Avenue.

Additionally, a secondary entrance planned as part of the Broadview Station design to access the proposed East Harbour development requires the construction of an underground pedestrian walkway beneath the rail corridor. All three of these crossings have the potential to produce minor track settlement.

Mitigation

The majority of the subway running structure, including at the three rail crossings above, is proposed to be constructed using twin TBMs, which minimizes the settlement effects when compared to open cut methods. Under the Don Valley, the tunnels are proposed to be constructed using hybrid earth-pressure balance TMBs, while under the two Lakeshore East/Stouffville GO rail crossings, rock-face TMBs are proposed.

The construction approach of the passageway beneath the Lakeshore East/Stouffville GO corridor will be refined during preliminary and detailed design of that station area. Conceptually, precast concrete sections for the underground connection could be installed using weekend work-blocks on the railway corridor, as long as the temporary shoring to support this excavation is installed ahead of time. This methodology is commonly employed for construction of underground pedestrian crossings across GO corridors at stations.

During preliminary and detailed design stages of the Project, settlement analysis will be done for all structures within the zone of influence. Mitigation plans will be developed for any areas where the settlement risk is deemed unacceptable.

Monitoring

Monitoring during construction will include ground settlement measures that are described in more detail in **Section 5.7.2**.

6.3.6 Utilities

Services will be maintained to the greatest extent possible during relocation and notice of planned service interruptions will be provided to service users prior to interruptions. The location of all plant, potential conflicts and the relocation strategy will be confirmed with service providers during the detailed design phase.

Any utilities that are in direct conflict with the alignment will require relocation. Services will be maintained to the extent possible during relocation and notice of planned service interruptions will be provided to service users prior to the interruptions. The location of all plant, potential conflicts and the relocation strategy will be confirmed with service providers during the detailed design phase.

The two main approaches that will be considered for the impacted utilities are:

1. Temporary support for small utilities that are not in direct conflict with the permanent works. Minor utilities that are not in direct conflict with the Relief Line South alignment or stations will be supported and protected during construction where possible.
2. Relocation of utilities that will be in direct conflict with the permanent works or for large utilities that cannot be temporarily braced. Any utilities that are in direct conflict with the Relief Line South alignment will require relocation.

Municipal services (storm sewers, combined sewers, sanitary sewers, and watermains), Enwave Energy (steam tunnels), Toronto Hydro, Enbridge Gas and telecommunications (Bell, Rogers, TELUS and Cogeco) have been identified as having utilities with potential impacts from the proposed cut-and-cover construction.

Services will be maintained to the greatest extent possible during relocation. Notice of planned service interruptions will be provided to service users prior to interruptions. The location of all plant, potential conflicts and the relocation strategy will be confirmed with service providers during detailed design.

Mitigation

The most suitable methods for utilities that may be affected will be determined during the detailed design phase. The staging and relocation approach will also be determined during this phase.

It is anticipated that the cut-and-cover method will be utilized to construct project elements such as the launch and extraction shafts, station boxes, EEBs, TPSSs, crossovers and tail tracks. To avoid effects to utilities in the vicinity of these proposed elements, cut-and-cover requires special consideration for the maintenance of utilities. In advance of the subway construction to facilitate cut-and-cover method, these utilities should be relocated or temporarily suspended through the construction site.

Utilities affected by the cut-and-cover construction along the Relief Line South corridor will be temporarily relocated within the right-of-way. As a result of the cut-and-cover construction being undertaken at stations and special track structures, utilities along the corridor will be affected during construction. An example of a direct conflict is the 1800mm sanitary sewer on Carlaw Avenue. A temporary bypass system with pumping stations will be required to mitigate this. The subsurface utility engineering investigations completed during the detailed design phase will provide additional utility information for the impacted and surrounding areas. There is a possibility that some utilities may require temporary easements on private property during temporary relocations and detours (to be determined during detailed design).

A utility monitoring plan for construction will be developed during the detailed design phase of the project to ensure that the constructor will comply with any applicable environmental regulations, permitting and other mitigation measures identified during the design phase. The purpose of the monitoring plan is to ensure compliance with the utility conflict mitigation plans (i.e. suspend in place, relocation, removal).

6.4 Operations and Maintenance Impacts and Mitigation Measures

This section outlines the permanent impacts—and proposed mitigation and monitoring—caused by the activities associated with ongoing operation and maintenance of the Transit Project.

6.4.1 Natural Environment

Fisheries and Aquatic Habitat

The operation and maintenance of the subway will take place in the underground tunnel. As such these activities are not anticipated to have an impact on fish or aquatic habitats. The impact of a subway train travelling through a tunnel underneath the Don River is not expected to result in a change in the quality of the aquatic habitat from vibrations in the river.

Vegetation, Wildlife and Terrestrial Habitat

The operation and maintenance of the subway will take place in the underground tunnel. As such these activities are not anticipated to have an impact on vegetation, wildlife or terrestrial habitats.

Wetlands

The operation and maintenance of the subway will take place in the underground tunnel. As such these activities are not anticipated to have an impact on wetlands.

Species at Risk

The operation and maintenance of the subway will take place in the underground tunnel. As such these activities are not anticipated to have an impact on species at risk or their habitats.

Soils and Bedrock

Potential impacts to the soils and bedrock are generally related to construction activities, as described in **Section 6.3.1**. No permanent impacts to the soils and bedrock are anticipated as a result of the operations and maintenance activities.

Groundwater

Potential impacts to the groundwater conditions are generally related to construction activities, as described in **Section 6.3.1**. No permanent impacts to the groundwater conditions are anticipated as a result of the operations and maintenance activities.

Drainage and Stormwater Management

Mitigations measures to address drainage and stormwater management impact are described in **Section 6.2.1**. These measures, including bio-retention, soakaway pits, and tree planters will need to be maintained as required. Operation and maintenance manuals for these features will be provided at the detailed design stage.

Contaminated Properties

Additional site-specific investigation will be required to further assess the potential presence of contaminated soils, bedrock and/or groundwater along the tunnel alignment. Potential impacts are generally associated with construction activities, as described in **Section 6.3.1.**

6.4.2 Emissions

Climate change

<u>Impacts of Climate Change on the Transit Project</u>

The Relief Line South will be located below ground and will be susceptible to flooding events which may result in power outages, damage to infrastructure and disruption to transportation. In addition, there are components of the subway system which will be located above ground and could be directly impacted by extreme weather conditions. The components of the Relief Line South which will need to be designed to withstand extreme weather conditions include the traction power substations, ventilation shaft exhausts for the tunnel and emergency exit infrastructure.

Mitigation

To mitigate the impact of climate change on the Transit Project, it is recommended that the TTC update plans for severe weather emergencies, closures and rerouting, and traveller information alerts. Health and safety plans should also be developed to ensure that on-site personnel are aware and are properly trained to recognize and respond to hazards and emergencies caused by extreme weather events.

Impacts of the Project on Climate Change

The Relief Line South is designed as a means of relieving crowding on Line 1 and at the Bloor-Yonge interchange station in addition to providing transit coverage to a broader area of Toronto. The operation of the Relief Line South is expected to have a positive influence on public transit ridership and surrounding land use by concentrating residences and employment around the new stations (Saxe et al., 2017). Concentrating land uses can reduce the distance people need to travel to work by way of locating jobs and amenities closer to residences which can ultimately reduce GHG emissions.

Mitigation

Reductions in GHG gas emissions and impacts on climate change will be realized by applying the City of Toronto's ***Change is In the Air*** Climate Change Action Plan, which provides guidance on sustainability measures. These will be applied to this Transit Project including the Green Development Standards, Green Roof/Eco-Roof Strategy, and Sustainable Transportation Strategy.

Air Quality

Small, localized impacts on suspended particulate matter (SPM) levels are anticipated due to operation of the Relief Line South. A recent urban transportation exposure study (Van Ryswyk et al., 2017) found that the operation of Toronto's existing rail transit system can produce emissions of particulate matter or "rail dust" as a result of conventional steel wheels rolling on steel rail tracks through regular wear on the system. The components of rail dust are largely metallic, particularly in iron. The rail dust can become suspended in the environment and potentially released through ventilation shafts and subway entrances via forced air ventilation and the piston effect of train movement. System features identified in the study which affect the level of rail dust within the subway include distance to outside air, depth and elevation.

Mitigation

In order to mitigate the air quality impacts from rail dust, the TTC will employ standard operating procedures for equipment and/or machinery comprising the rail system and will ensure that regular maintenance is performed in accordance with good engineering practices or as recommended by the supplier such that the equipment is kept in good operating condition. To mitigate rail dust, TTC will also adhere to conditions outlined in all permits, authorizations and/or approvals. A detailed report on the air quality impacts and mitigation measures is provided in **Appendix 6-5**.

Noise and Vibration

In 1993, the Ministry of the Environment and Energy (MOEE, now MECP) developed a protocol for the assessment of noise and vibration impacts from the proposed Yonge-Spadina Subway Loop Line, which has since been commonly applied in the assessment of noise and vibration from subsequent TTC subway projects (the "MOEE/TTC Protocol" or the "Protocol"). Adherence to this Protocol ensures a consistent evaluation of all TTC projects, and assists the MECP in streamlining the Transit Project Assessment Process (TPAP).

The MOEE/TTC Protocol establishes a limit for ground-borne vibration of 0.1 mm/s, which is to be applied at the outside premises of the building(s) being assessed. The vibration criterion of 0.1 mm/s corresponds to the approximate threshold of human perception, which is much lower than the threshold beyond which building damage may occur. As such, adherence to this limit protects against both annoyance and adverse structural impacts.

The MOEE/TTC Protocol specifically excludes commercial and industrial properties; however, the preferred Relief Line South route is projected to pass underneath buildings of this nature, such as concert venues and studios, which have interior environments that are considered to be sensitive to ground-borne vibration and noise. Appropriate ground-borne vibration and noise limits for such spaces have been identified through a literature review, and the recommended criteria are provided in **Table 6-32** below.

Table 6-32: Summary of Ground-Borne Noise and Vibration Criteria (Commercial)

Land Use	Outdoor Vibration Velocity (VdB rms re: 10^{-6} in/s)	Indoor Sound Level (dBA)
Sensitive Commercial I *(Concert halls, TV/recording studios)*	65	25
Sensitive Commercial II *(Auditoriums)*	72	30
Sensitive Commercial III *(Theaters)*	72	35

The mainline track of the Relief Line South is founded in bedrock, which is advantageous for the suppression of ground-borne vibrations as it is more difficult for the train and tunnel infrastructure to induce vibration in rock compared to soil. There are two segments of the mainline where the tunnel is not founded in bedrock. The first is in the area of the Don Valley, where the bedrock drops sharply west of the Don River, and then rises sharply to its former level to the east, at Sunlight Park Road. The second is from approximately 6+100 to the terminus at 7+400, where the track elevation increases to align more closely with the existing Pape Station.

On average, the mainline track is approximately 28 m below ground level. With this degree of depth in combination with the secure founding in bedrock, it is predicted that ground-borne vibration levels will remain well below the assessment criteria.

For the purposes of this study, the ground-borne vibration effects were determined for discrete segments of the mainline, and for the Wye tracks near Pape Station which connect the Relief Line South tracks with the Line 2 tracks. The findings are as follows:

- Osgoode Station to Queen Station (plus tail tracks) - The maximum vibration level reached through this segment is predicted to be 0.03 mm/s (61 VdB), or 30% of the MECP limit. This occurred in a commercial area, at a cross-over track in the vicinity of Nathan Phillips Square, where there are no sensitive receptors that meet the MECP definition. The predicted vibration levels at key other sensitive receptors such as the Four Seasons Centre for the Performing Arts and the Bell Media complex are each 43 VdB. These are well below the Category I criteria of 65 VdB recommended for concert halls and TV studios.
- Queen Station to Sherbourne Station - The maximum vibration level reached through this segment is predicted to be 0.015 mm/s (55 VdB), or 15% of the MECP limit. This is projected to occur in the area where the trains are projected to be operating at full speed, between Bond Street and George Street. The MECP limit is therefore predicted to be met at all apartments as well as at St. Michaels Hospital. The Metropolitan United Church is set back approximately 60 m from the nearest tunnel, and therefore the predicted vibration level is lower, at 0.008 mm/s (50 VdB).
- Sherbourne Station to Sumach Station - The maximum vibration levels predicted along this segment were 0.016 mm/s (56 VdB), or 16% of the MECP limit. In the acceleration and deceleration zones, the maximum predicted vibration levels were 0.013 mm/s (53 VdB), or 13% of the MECP limit.
- Sumach Station to Broadview Station - The maximum vibration level in the vicinity of the condominiums in the West Don Lands is 0.029 mm/s (61 VdB), or 29% of the MECP limit. The comparatively higher vibration velocity during full speed operations compared to other segments is due to the sharp drop in the bedrock layer through the Don Valley. The tunnel is founded in soil through the Don Valley, and soil-founded tunnels are generally associated with higher vibration levels.
- Broadview Station to Carlaw Station - The maximum predicted vibration level was 0.014 mm/s (55 VdB), or 14% of the MECP limit, and occurs in the full speed operation zone. Residential dwellings are positioned directly above the proposed alignment within this zone; however, the predictions indicate that the ground-borne vibration levels will meet the MECP limit at these locations.
- Carlaw Station to Gerrard Station - The maximum vibration velocity level predicted along this segment of the route was 0.012 mm/s (54 VdB), or 12% of the MECP limit. This occurs while the trains are projected to be in full-speed operation. While no vibration-sensitive commercial locations were explicitly identified in this section, it should be noted that the predicted maximum ground-borne vibration velocity (54 VdB) is well below the most stringent limit for commercial properties from **Table 6-7** (65 VdB).
- Gerrard Station to Pape Station (plus tail tracks) - The maximum predicted vibration velocity was 0.075 mm/s (69 VdB), or 75% of the MECP limit. This is predicted to occur at the track crossover between Cavell Avenue and Harcourt Avenue (6+270 to 6+360). The relatively high prediction compared to other segments is due to several factors: (i) the tunnel is founded in soil at this location, which is associated with operational vibration levels that are higher than rock-founded tunnels; (ii) the crossover track is located in the full-speed operating zone (80 km/h); and (iii) there is minimal horizontal setback from the crossover to the houses.
- Wye Tracks - The maximum predicted vibration velocity level along the length of the Wye tracks was 0.016 mm/s (56 VdB), or 16% of the MECP limit. The noise sensitive land uses in this area are primarily residential and commercial with second-floor residential. No vibration-sensitive commercial operations were identified in this section of the alignment; however, it should be noted that the predicted maximum ground-borne vibration velocity is below the most stringent limit for commercial properties from **Table 6-7**.

Criteria have been established in **Table 6-32** for various categories of noise sensitive commercial buildings. The most stringent of these, for concert halls and studios, are the most appropriate for this study. The interior ground-borne noise (i.e. only that noise which is induced by ground-borne vibrations) limit is 25 dBA. The maximum predicted interior ground-borne noise level along the route is 20 dBA, and so the most stringent of the sensitive commercial ground-borne noise criteria of 25 dBA is predicted to be met at all locations.

The MOEE/TTC Protocol states that ancillary facilities are to be assessed in accordance with MOEE procedures for stationary sources. Ancillary facilities in the context of this assessment include subway stations, emergency services buildings, and transformer substations. The MECP has outlined an approach to the assessment of noise from stationary sources in Publication NPC-300 Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning. Adherence to this guideline is required in order for the MECP to issue an Environmental Compliance Approval (ECA) for the facility, which is a legal instrument that must be obtained for the proposed operations to commence.

At this point, the information required to complete accurate sound level impact predictions, such as the location of ventilation systems for subway stations, transformer ratings, dimensions and locations of the transformers within the designated areas, tunnel ventilation, etc., are not known and will not be available until the detailed design stage. However, it should be noted that noise controls for such installations are considered to be routine, and therefore designing these facilities to comply with the MECP stationary source sound level limits is not expected to pose any technical problems during the detailed design stage.

The testing of emergency equipment may exceed the noise and vibration criteria, however under the City of Toronto By-Law for noise, operation of such fans, when used in emergency situations, is not subject to the MECP Environmental Approval Process.

After operations commence on the Relief Line South, it will be important to maintain the facilities in order to avoid noise and vibration issues that may arise though regular wear on the system. The TTC has systems in place to detect and respond to conditions that may result in elevated noise and vibration levels, which are solved through continuous maintenance programs.

Over time, the wheels of a train develop flat spots, primarily due to braking. As the wheels rotate, the flat spots continually hit the rail causing a cyclical impulse sound. The TTC uses remote

sensors to detect wheel flats, and when necessary, the wheels are smoothed using a wheel truing machine. General use of the rail system can also cause rough spots on the wheels and the rail itself. Wheel roughness is corrected using the wheel truing machine, while rails are grinded as necessary to remove any rough spots and replaced when necessary.

Mitigation

On average, the mainline track of the Relief Line South is approximately 28 m below ground level. This degree of depth in combination with the secure founding in bedrock, in most areas, are two effective vibration mitigation measures.

The discussion above indicates that the proposed Relief Line South is predicted to meet the MECP ground-borne vibration limits. In light of this, no additional mitigation measures have been proposed beyond the measures that are already integrated into the proposed design. For example, the TTC implements a discontinuous floating slab system on all new subway lines. This system serves to isolate the rolling stock from the track bed, minimizing the load that may be transferred to the tunnel structure and surrounding material. This has been demonstrated to be one of the most effective means of attenuating ground-borne vibrations from subway tunnels.

During operations, TTC will continue to follow their practices of routine maintenance of train wheels to eliminate “wheel flats” on their remote “wheel flats” monitoring stations or based on routine inspections of subway train wheels.

As was indicated above, much of the data pertaining to stationary sources of noise are not yet known, and would probably be only available at the detailed design stage. However, it should be noted that noise controls for such installations are considered to be routine, and therefore designing these facilities to comply with the MECP stationary source sound level limits is not expected to pose any technical problems during the detailed design stage. It is recommended, however, that once the construction design details are known, that the noise from the stationary sources be modelled to verify compliance with NPC-300.

A more detailed record of the Noise and Vibration assessment is provided in **Appendix 6-4**.

Electromagnetic Interference

The most common concern with respect to Electromagnetic Interference (EMI) is the adverse effect that it will have on computing devices including: microprocessor based patient diagnostic, monitoring, and therapeutic equipment. Based on tests undertaken by the Bay Area Rapid Transit (BART) system in California, examples of Electromagnetic Frequency intensities from human activities include the following:

1. Earth’s static magnetic field varies from 300 mG (30 µT) at the equator to over 600 mG (60 µT) at the magnetic poles;
2. Overhead power transmission line: 32 to 57 mG (range of exposure to utility workers);
3. Household appliances: 8 to 165 mG (at a distance of 27 cm, or 12 inches);
4. Computer video display: 2 to 4 mG (at 35 cm, or 16 inches); and
5. Rail vehicle (electrically powered): 400 mG (at 110 cm, or 43 inches from the vehicle floor) to 1,500 mG (at floor level) 1.

Recognizing that TTC and BART operate similar systems at similar power requirements (600 VDC), the measurements taken on the BART system can be applied to the proposed Relief Line South in order to identify potential EMI sensitive uses. The results of the modelling undertaken for the BART system showed that the fields do not extend beyond 10.0 to 15.0 metres from the centre of the two tracks at track level. Since the Relief Line South track level will be well in excess of 15 metres below the surface, the EMI is mitigated by the depth of the proposed alignment running structure. The following is a list of depth the track at select locations with known sensitivities to EMI:

- Queen Street West at University Avenue (proximate to Hospital Row): 33.8 m
- Queen Street East at Victoria Street (St. Michael’s Hospital): 29.0 m
- Carlaw Avenue south of Gerrard Street East (Toronto Hydro Building): 34.4 m

Stray Current

Stray current corrosion, which is a form of electrolytic corrosion, occurs on buried metallic structures and differs from other forms of corrosion damage in that the current, which causes the corrosion, has a source external to the affected structure. Stray current is caused by a portion of the negative return current which leaks into the ground and returns to the traction power substation through parallel paths provided by the ground and by any other metallic structures. For a non-metallic structure, such as plastic or concrete pipe and plastic coated cables, stray current is a non-issue.

Mitigation

In order to minimize uncontrolled stray currents a number of measures will be used in connection with measures applied to the traction power return system:

1. Low linear rail resistance;
2. High rail-to-earth resistance, including insulated trackwork mounted fittings and appurtenances;
3. Good rail bonding, both longitudinal and track cross-bonding;
4. Parallel connected negative reinforcing feeder cables, insulated and cross-bonded to the return rails;
5. Good water drainage;
6. Structural steel-work and reinforcing isolation/separation; and
7. Utility structures to be electrically insulated, bonded, coated and cathodically protected as required.

The subway traction power distribution system will be ungrounded and will have no direct connection to earth.

The running rails will be insulated from earth with the use of pads and hardware, and by the isolation of all rail associated metal ware from earth. The negative running rails will be connected to the AC ground system through a floating negative automatic grounding switch. The switch operates (and alarms) only during abnormal conditions.

The insulating pads under the rails will have the following provisions:

1. Be capable of shedding water;
2. Resist the accumulation of airborne dirt;
3. Discourage DC current tracking over the surfaces of the insulation;
4. Have a high surface finish; and
5. Have high insulation levels from earth when installed and maintain an insulation level of at least 300 Ohms - km per rail during the design life.

Monitoring

Similar to other locations where TTC's subway crosses a high-pressure steel pipeline, the following monitoring program will be put in place:

1. Prior to construction, a baseline survey for stray current corrosion control is undertaken and reported to relevant utilities;
2. During construction, stray current test equipment is installed in the immediate vicinity of the pipelines;
3. Upon completion of the work, stray currents will be monitored as often as is prudently required; and
4. All data will be shared between the relevant utilities and TTC.

6.4.3 Socio-Economic Environment

Buildings and Property (Property Acquisition)

There are no permanent property requirements for the ongoing operation and maintenance of the Transit Project. Impacts related to the permanent built form of the Project, as well as for its construction, are described in **Section 6.2.3** and **Section 6.3.3**, respectively.

Aesthetics

There are no permanent issues associated with the ongoing operations and maintenance of the Transit Project.

Human Health and Safety

The possibility of accidental spills is always present in association with the operation and maintenance of any facility, including transit systems. The contingency measures in place during construction, as detailed in **Section 6.3.3**, are also applicable to the operation of the system.

6.4.4 Cultural Environment

Built Heritage Resources and Cultural Heritage Landscapes

Property-specific recommendations have been made to ensure impacts from adjacent excavation and construction, as well as installation of below and above grade project components, will be mitigated during detailed design. For directly impacted properties, further studies such as heritage impact assessments and conservation plans are recommended during detailed design to identify measures for long-term conservation of the resources and reduce adverse visual effects. No impacts to cultural heritage resources are associated with the ongoing operations and maintenance of the Transit Project.

6.4.5 Transportation

Automobile Traffic and Transit Service

The Transit Project will provide significant additional transportation capacity to the eastern half of the City of Toronto and therefore the overall effects on reducing automobile traffic (and congestion) and increasing transit service speed and reliability will be positive.

The proposed new stations at the intersections of Gerrard Street East and Carlaw Avenue, Queen Street East and Carlaw Avenue, Broadview Avenue and Eastern Avenue, Sumach Street and King Street East, and Sherbourne Street and Queen Street East, and the expansion of three existing stations have the potential for localized negative impacts due to potential increased activity in the vicinity of the station.

While there will be no commuter parking lots associated with these stations, there may be passenger pick-up and drop-off (PPUDO) and bus transfer activity resulting in additional traffic volumes in the vicinity of these stations. Additional traffic analysis must be completed during detailed design to address the proposed station traffic.

The Relief Line South and the station locations may result in major shifts of transit travel patterns and there may be significant changes to the existing surface transit services. During the detailed design phase, there will be the need for discussions with TTC to refine the surface transit network and connections and bus lay-by or waiting area requirements adjacent to the stations. These requirements will be the subject of further study in coordination with TTC and the City of Toronto.

Mitigation

Monitoring of traffic volumes on public roads and transit schedules post-construction will allow for the City to identify future issues and develop mitigation measures. As development proceeds

around each station, the City of Toronto and TTC will ensure the continued functioning of the road network, through the use of supporting traffic impact studies. The use of residential streets and adjacent properties surrounding stations for passenger drop off and pick up will be monitored.

Pedestrians and Cyclists

The Transit Project will have no have permanent adverse effects on pedestrian and bicycle circulation patterns. However, pedestrian and cyclist amenities will be included at the stations resulting in positive local benefits. These will be developed through the station site plan application process to enhance current amenities in the Relief Line South corridor and to achieve an equal or better level of service for both travel modes. Additionally, implementing additional cycling facilities (i.e. bicycle lanes or cycle tracks) leading to the stations may be also considered to enhance cycling and transit connectivity.

Passengers and pedestrians are also expected to experience improved level of service and comfort at Bloor-Yonge Station and other stations resulting from diversion of other passengers to the Relief Line South, leading to a reduction in crowding at existing stations.

Rail

No permanent effects resulting from the operation and maintenance of the Transit Project are anticipated. Transient impacts are described in **Section 6.3.5**.

6.4.6 Utilities

The depth of the cover between the top of the tunnel excavation and the roadway surface above ground and associated utilities such as sewers and watermains, will be examined during the detailed design stage. Measures will be developed to ensure that any possibilities of minor settlement damage from tunnel construction will be sufficiently mitigated.

Upon completion of construction, any temporary supports and temporary bypasses should be removed and temporarily relocated utilities should be reinstated to the original locations. All permanent relocations should already be complete prior to subway operations. Disruptions to utility customers are anticipated when switching customer connections to and from temporary services.

All disruptions will be minimized through continual discussions with the utility companies and careful planning. For all utilities that will be relocated, relocation plans and construction activities will be undertaken in accordance with the City of Toronto and the utility owner’s regulation.