

4. Stage Three: Alternative Methods of Carrying Out Undertaking

4.1 Overview of the Alternative Methods Stage

The ToR for the IEA provided that Alternative Methods of Carrying Out the Undertaking would be identified in the IEA following selection of the preferred Alternative to the Undertaking and described in detail such that the environmental effects of each alternative can be readily understood. Based on the set of road and transit improvements included in the preferred Alternative to the Undertaking, the Alternative Methods of Carrying out the Undertaking consisted of variations in the proposed alignments for those improvements.

The preferred Alternative to the Undertaking, Alternative 8, consists of implementation of the road and transit improvements laid out in the 2002 York Region Transportation Master Plan, along with Travel Demand Management (TDM) and Transportation Systems Management (TSM) measures, and additional transit improvements¹. Since there are no physical improvements associated with either TDM or TSM as part of the undertaking, no Alternative Methods related to TDM or TSM were considered.

The methodology followed in the IEA for identifying and evaluating the Alternative Methods of Carrying Out the Undertaking in accordance with the ToR is shown in **Figure 4-1**.

After conceptual alignments for the selected road improvements were developed, field studies were conducted to confirm the existing environmental conditions in the Study Area identified through desktop research. The evaluation criteria that were developed during the ToR stage and refined during the Alternatives to the Undertaking stage were further refined to reflect the potential effects associated with the conceptual alignments. The indicators and measures developed for each evaluation criterion were used as the basis for a net effects analysis of the alignments for each road or road segment. The criteria, indicators and measures used for the net effects analysis are shown in **Table 4-1**. The rationale for including these criteria and indicators is provided in **Appendix 4A**.

The net effects analysis took place as a three-part process. Firstly, information gathered through the field studies was used to consider the potential effects of the alignment on each indicator. Secondly, appropriate mitigation, compensation, or enhancement measures were proposed to address each of the potential effects. Thirdly, the net effects of the alignment on each indicator were determined through consideration of the results of the proposed mitigation measures.

In the case of road segments in which two or more alternative alignments had been developed, each of the alternatives was first subjected to a net effects analysis, and then compared using a comparative evaluation process. For each indicator, the net effects of the competing alternatives were compared, resulting in a ranking of most preferred, moderately preferred, or least preferred for each alternative at the indicator level. By considering the indicator-level rankings associated with a given criterion, rankings between alternatives were then established at the criterion level in a similar fashion. In the same manner, alternatives were ranked at the factor level, based on their rankings for the various criteria associated with the factor. Finally, the alternatives

1. *At the time that the Alternatives to the Undertaking were being developed and later assessed, York Region had not yet approved its updated TMP, which was adopted by Council in November, 2009. For this reason, the 2002 TMP was used as the basis for this Alternative.*

were given overall rankings based on the preferences established at the factor level. At every level, reasoning was established for each ranking. The rankings were not calculated quantitatively, but determined qualitatively through a reasoned argument approach that considered the tradeoffs between alternatives.

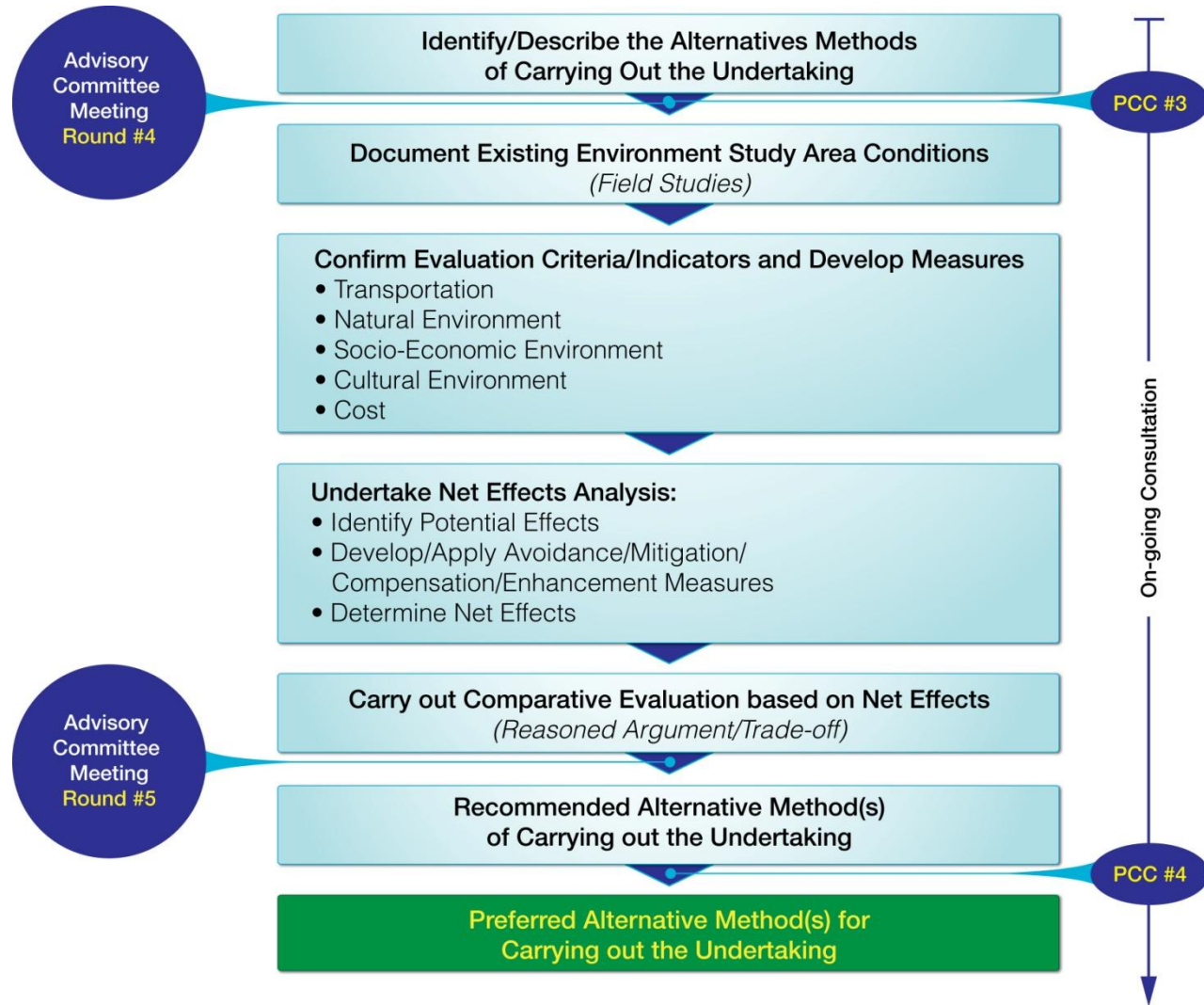


Figure 4-1 Approved Evaluation Methodology – Alternative Methods of Carrying Out the Undertaking

Table 4-1 Factors, Criteria, Indicators and Measures Used in the Net Effects Analysis

Factors & Criteria	Indicators	Measures
Transportation		
Potential for Achieving Appropriate Design Standards	<ul style="list-style-type: none"> Horizontal and vertical curves that meet appropriate design standards (Transportation Association of Canada’s Geometric Design Guide for Canadian Roads, 1999) Grades that meet appropriate design standards (Transportation Association of Canada’s Geometric Design Guide for Canadian Roads, 1999) 	<ul style="list-style-type: none"> Number and percentage of horizontal and vertical curves with radii that meet appropriate design standards Percentage of the length of roadway for which the required number of lanes meets appropriate design standards, for each direction
Potential for Providing Adequate Space to Meet the Needs of All Users of the Road Right-of-way in a Safe and Efficient Manner	<ul style="list-style-type: none"> Number and width of through vehicular lanes that meet York Region’s Road Design Guidelines Exclusive turn lanes and width of lanes at intersections that meet York Region’s Road Design Guidelines HOV lanes that meet York Region’s Road Design Guidelines Cycling lanes that meet York Region’s Road Design Guidelines Provision of sidewalks that meet York Region’s Road Design Guidelines 	<ul style="list-style-type: none"> Number and percentage of the length of roadway for which the required number of lanes can be achieved at a width (in metres) that meets York Region’s Road Design Guidelines, for each direction. Percentage of signalized and unsignalized intersections with exclusive turn lanes that meet York Region’s Road Design Guidelines Percentage of the length of roadway for which HOV lanes meet York Region’s Road Design Guidelines, for each direction Percentage of the length of roadway for which cycling lanes meet York Region’s Road Design Guidelines, for each direction Percentage of the length of roadway for which sidewalks meet York Region’s Road Design Guidelines, for each side
Potential for Maintaining or Providing Appropriate Road Network Connections and Vehicular Accesses to Adjacent Land Uses	<ul style="list-style-type: none"> Provision of municipal road connections Provision of private road and driveway connections 	<ul style="list-style-type: none"> Number and percentage of existing and planned municipal road connections that can be accommodated, by major block, for each side Number and percentage of existing and planned private road and driveway connections that can be accommodated, by major block, for each side
Natural Environment		
Potential Effects on the Aquatic Environment	<ul style="list-style-type: none"> Effects on sensitive or critical aquatic habitats and functions Effects on fish species at risk (according to COSSARO and COSEWIC), including endangered, threatened and special concern/rare species, provincially rare (S1-S3 NHIC) Changes to surface water quality (increased pollutants) and quantity (flood levels and erosion) 	<ul style="list-style-type: none"> Presence and attributes of aquatic habitat within 30 m of the centre line of the alignment Current presence and/or management zone of species at risk (according to COSSARO and COSEWIC), including endangered, threatened and special concern/rare species, provincially rare (S1-S3 NHIC) on either side of road crossing Relative changes to surface water quality (increased pollutants) and quantity (flood levels and erosion)
Potential Effects on the Terrestrial Environment	<ul style="list-style-type: none"> Effects on sensitive wildlife habitats / forest cover Effects on terrestrial species at risk (according to COSSARO and COSEWIC), including endangered, threatened and special concern/rare species, provincially rare (S1-S3 NHIC) and locally significant sensitive species (according to MNR’s Significant Wildlife Habitat Manual) 	<ul style="list-style-type: none"> Presence and attributes of forest cover within 30 m of the centre line of the alignment Total area of natural cover removed (in hectares) Occurrence of terrestrial species at risk, including endangered, threatened and special concern/rare species, provincially rare (S1-S3 NHIC) and locally significant area sensitive bird species (according to MNR’s Significant Wildlife Habitat Manual) within 20 m of the right-of-way

Table 4-1 Factors, Criteria, Indicators and Measures Used in the Net Effects Analysis

Factors & Criteria	Indicators	Measures
	<ul style="list-style-type: none"> Effects on ANSIs, ESAs or PSWs 	<ul style="list-style-type: none"> Presence and attributes of ANSIs, ESAs, and PSWs within 30 m of the centre line of the alignment Total area of natural cover removed from ANSIs, ESAs and PSWs (in hectares)
	<ul style="list-style-type: none"> Indirect loss of wildlife habitats and functions through spray, etc 	<ul style="list-style-type: none"> Relative effect on wildlife habitats and functions through spray, etc
	<ul style="list-style-type: none"> Effects on wetland habitats and functions 	<ul style="list-style-type: none"> Presence and attributes of wetland habitat within 30 m of the centre line of the alignment Total area of wetland removed (in hectares)
Potential Effects on Groundwater	<ul style="list-style-type: none"> Effects on water supply and groundwater quantity in wells 	<ul style="list-style-type: none"> Number of wells within 30 m of centre line of alignments Relative changes to groundwater quantity (e.g., groundwater flow direction or reduction in water levels in shallow wells < 15 m deep)
Potential Effects on the Broader Regional Natural Heritage System	<ul style="list-style-type: none"> Effects on ecological connectivity, within and outside of the Study Area 	<ul style="list-style-type: none"> Relative loss of the broader regional natural cover and connectivity
Socio-Economic Environment		
Potential Effects on Existing Land Uses/Resources	<ul style="list-style-type: none"> Disturbance to residential communities, businesses, institutions, and/or recreational/community facilities 	<ul style="list-style-type: none"> Total area of property acquisition (in hectares) Number and description of displaced or disrupted features during construction
	<ul style="list-style-type: none"> Loss of / disturbance to open space land uses 	<ul style="list-style-type: none"> Total area of property acquisition, displacing open space land use (in hectares) Interference with existing and planned trail network and access points Disruption to use of open space (passive, active, educational, interpretive)
	<ul style="list-style-type: none"> Loss of Class 1 to Class 3 agricultural soils 	<ul style="list-style-type: none"> Total area of property acquisition displacing Class 1 to Class 3 agricultural soils (in hectares)
	<ul style="list-style-type: none"> Disturbance to residential areas and sensitive institutional uses due to traffic 	<ul style="list-style-type: none"> Increase in traffic noise in noise sensitive areas (residential areas and sensitive institutional uses) in 2031
	<ul style="list-style-type: none"> Through traffic infiltration via local roads 	<ul style="list-style-type: none"> Relative changes to traffic patterns on local roads
	<ul style="list-style-type: none"> Encroachment upon waste disposal sites and contaminated property 	<ul style="list-style-type: none"> Total length of physical improvements adjacent to or crossing through waste disposal sites and contaminated property (in km)
Potential Effects on Approved/Planned Land Uses	<ul style="list-style-type: none"> Effects on approved/draft approved development plans 	<ul style="list-style-type: none"> Relative effect on approved/draft approved development plans
Potential Effects on Air Quality	<ul style="list-style-type: none"> Effects of traffic congestion on regional air quality and greenhouse gas emissions 	<ul style="list-style-type: none"> Percentage change in air pollutant levels compared to 2006 Percentage change in greenhouse gas emissions compared to 2006
	<ul style="list-style-type: none"> Effects of change in local air quality on sensitive receptors 	<ul style="list-style-type: none"> Number of sensitive receptors within 100 m of alignment
Cultural Environment		
Potential Effects on Archaeological Resources	<ul style="list-style-type: none"> Loss or disturbance of known archaeological sites 	<ul style="list-style-type: none"> Number of documented archaeological sites within 30 m of the centre line of the alignment
	<ul style="list-style-type: none"> Loss or disturbance of lands with potential for archaeological sites 	<ul style="list-style-type: none"> Total length of land frontage (in m) with potential for archaeological sites (on one or the other side of the ROW) that would be affected by expansion of the existing ROW (Note: total length of land frontage is twice the length of the ROW)
Potential Effects on Cultural/Heritage Resources	<ul style="list-style-type: none"> Disturbance or removal of built heritage features 	<ul style="list-style-type: none"> Number of built heritage features that would be disturbed or removed
	<ul style="list-style-type: none"> Disturbance or removal of cultural landscape units 	<ul style="list-style-type: none"> Number of cultural landscape units that would be disturbed or removed
	<ul style="list-style-type: none"> Disturbance or removal of cemeteries 	<ul style="list-style-type: none"> Number of cemeteries that would be disturbed or removed
Financial		
Potential Implementation Costs	<ul style="list-style-type: none"> Capital costs 	<ul style="list-style-type: none"> Approximate net present value in current CDN \$ of York Region improvement

The remainder of this chapter will explain how the preferred Alternative To the Undertaking was further optimized, and describe the alignments developed for each road in the study, including the existing environmental conditions potentially affected by these alignments. It will present the overall net effects that were identified through the net effects analysis, as well as the comparative evaluations used to select between alternative alignments. The potential effects of the alignments and the appropriate mitigation measures are provided in **Appendix 4D**, along with the associated net effects and comparative evaluation tables.

Overall, this chapter will lay out the process by which alignments were developed, evaluated, selected and confirmed.

4.2 Optimization of the Preferred Alternative Transportation Improvements

Following the confirmation of Alternative 8 as the preferred Alternative to the Undertaking, a corridor optimization process was carried out to determine whether all of the road and transit improvements included in Alternative 8 were indeed necessary. These improvements include:

- Widening Major Mackenzie Drive between Highway 50 and Highway 400 from two lanes to six lanes, including two high occupancy vehicle (HOV) lanes;
- Eliminating the jog in Major Mackenzie Drive at Highway 27 by rerouting Major Mackenzie Drive immediately west of Highway 27;
- Widening Rutherford Road between Highway 50 and Weston Road, Highway 27 between Steeles Avenue and Major Mackenzie Drive, Pine Valley Drive between Steeles Avenue and Highway 7, and Weston Road between Steeles Avenue and Major Mackenzie Drive from four lanes to six lanes, including HOV lanes;
- Widening Highway 50 between Steeles Avenue and Highway 7 and between Rutherford Road and Major Mackenzie Drive from four lanes to six lanes; and,
- Widening Highway 27 between Major Mackenzie Drive and Nashville Road and Pine Valley Drive between Rutherford Road and Teston Road from two lanes to four lanes.

The updated information that informed the corridor optimization investigation included both improved population and employment forecasting and new information about undertakings by other jurisdictions, such as the confirmation that the Ministry of Transportation planned to carry out the extension of Highway 427 north to Major Mackenzie Drive. Specifically, the corridor optimization investigation considered whether any combination of the following revisions to Alternative 8 might be advisable in the context of these updated assumptions:

- Widening Major Mackenzie Drive to four lanes only, rather than to six;
- Foregoing the widening of Rutherford Road from four to six lanes; and,
- Foregoing the widening of Pine Valley Drive from two to four lanes between Rutherford Road and Teston Road.

Future traffic modelling for the three corridors under consideration was updated, and a sensitivity analysis was conducted to determine how a reduced cross-section in each corridor would perform under a variety of scenarios. It was determined that neither Rutherford Road nor Major Mackenzie Drive would adequately accommodate the east-west traffic volumes expected in 2031 without both roads being widened to a six lane cross-section.

In the case of Pine Valley Drive, however, the modelling concluded that, due largely to the discontinuity that would be maintained south of Rutherford Road, it was not likely that future traffic volumes on Pine Valley Drive north of Rutherford Road would necessitate a four-lane cross-section. This finding, combined with public and stakeholder concern about potential effects to the natural environment adjacent to this part of Pine Valley Drive, led to the decision to remove the widening of Pine Valley Drive between Rutherford Road and Teston Road from further consideration in the WVIEA.

Technical results of the sensitivity modelling are provided in **Appendix 4B**.

At the same time as the results of the corridor optimization investigation were being determined, York Region became aware of Peel Region's intent to conduct a Municipal Class EA for the widening of sections of Highway 50 to six lanes. Based on this information, the widening of Highway 50 between Steeles Avenue and Highway 7 and between Rutherford Road and Major Mackenzie Drive was removed from the IEA.

Thus, the improvements that were carried forward as part of the Alternative Methods of Carrying out the Undertaking are:

- Widening Major Mackenzie Drive between Highway 50 and Highway 400 from two lanes to six lanes, including two HOV lanes;
- Eliminating the jog in Major Mackenzie Drive at Highway 27 by rerouting Major Mackenzie Drive immediately west of Highway 27;
- Widening Rutherford Road between Highway 50 and Weston Road, Highway 27 between Steeles Avenue and Major Mackenzie Drive, Pine Valley Drive between Steeles Avenue and Highway 7, and Weston Road between Steeles Avenue and Major Mackenzie Drive from four lanes to six lanes, including HOV lanes; and,
- Widening Highway 27 between Major Mackenzie Drive and Nashville Road from two lanes to four lanes.

4.3 Identification, Description, and Rationale for Alternative Alignments

In the case of most roads identified for improvements pursuant to Alternative 8, the proposed alignment was centred on the existing centreline, with the road widened equally to either side. In these locations, only one alignment was recommended because other alignments were not considered reasonable due to existing natural, social or cultural constraints. In these cases, the proposed alignment was simply subjected to a net effects analysis.

In locations where a widening would affect an existing natural, social or cultural feature, alternative alignments were developed to avoid or minimize effects on that feature. In addition, alternative alignments were developed to eliminate the jog at Major Mackenzie Drive and Highway 27 and create a new road through undeveloped land. In these cases, each alternative alignment was subjected to a net effects analysis, after which a comparative evaluation was used to determine the preferred alternative alignment for the segment.

In general, widening to six lanes to reflect York Region's approved transit / HOV cross-section requires a minimum of 36 metres for the right-of-way, which would provide for two 3.3 metre wide general-purpose lanes in each direction, one 5.0 metre wide transit and bicycle lane in each direction, sidewalks and an associated boulevard in each direction, and a 6 metre wide centre median, as shown in **Figure 4-2**. For the purpose of assessing the effects associated with the alternative alignments, a 42.6 metre ROW was typically used.

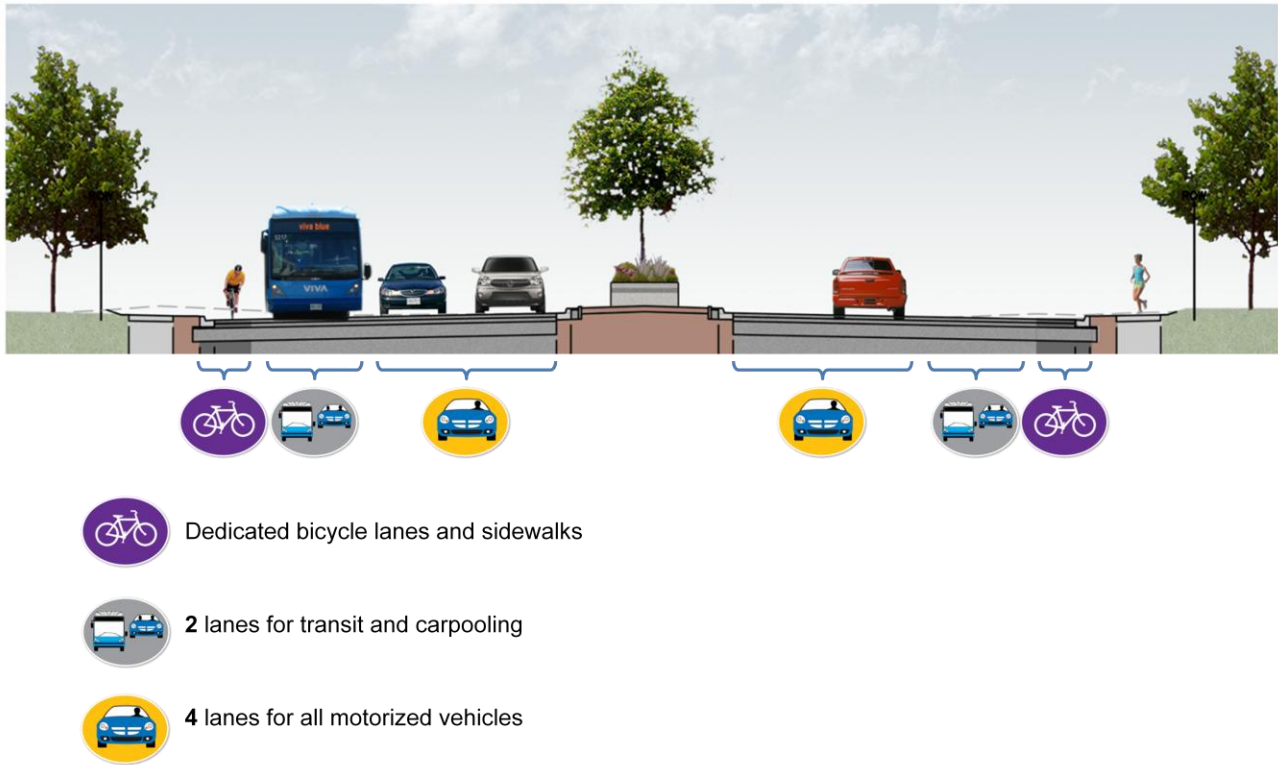


Figure 4-2 York Region Approved Transit / High Occupancy Vehicle Cross-section

The conceptual designs for all Alternatives also reflect York Region’s Road Design Guidelines as well as the Transportation Association of Canada’s Geometric Design Guide for Canadian Roads.

4.3.1 Major Mackenzie Drive (High 50 to Highway 400)

As described in Chapter 3, Major Mackenzie Drive was identified as requiring widening from two to six lanes between Highway 50 to the west and Highway 400 to the east. For the purposes of considering potential effects and mitigation, and evaluating alternative alignments, the Major Mackenzie Drive study corridor was broken into five segments as illustrated in **Figure 4-3**.



Figure 4-3 Location of Segments and Alternative Alignments on Major Mackenzie Drive

4.3.1.1 Segment MM

Segment MM-1 is located between Highway 50 and just over 600 metres east of Huntington Road. Segment MM-1 includes the westernmost part of the Major Mackenzie Drive study corridor and the portion of Major Mackenzie Drive that would be realigned as part of the proposed Highway 427 interchange, as shown in **Figure 4-3**. The proposed realignment, which is being examined as part of the Ontario Ministry of Transportation's 427 Transportation Corridor Environmental Assessment, curves to the north and then back to the original alignment, to the east of Huntington Road. The portion of segment MM-1 west of the Highway 427 realignment is limited in terms of design by the need to tie into the existing intersection with Highway 50 to the west and to the 427 realignment to the east. Aligning the road to the north or the south would result in a curvilinear design, which is less desirable from a safety perspective. In addition, the design is further constrained by the CP rail yard to the south. As such, only one alignment was developed. It is centred on the existing centreline of Major Mackenzie Drive and has a right-of-way width of 42.6 metres.

4.3.1.2 Segment MM

Segment MM-2 is located between the eastern terminus of segment MM-1 (just over 600 metres east of Huntington Road) and just over 600 metres east of Highway 27. Segment MM-2 includes the crossing of the Main Humber River and the intersection with Highway 27, as shown in **Figure 4-3**. It is within this segment that Major Mackenzie Drive is to be realigned to eliminate the jog at Highway 27. Four alternative alignments were developed for this segment for comparison, as follows:

- Alternative MM-2A follows the existing alignment of Major Mackenzie Drive eastward until relatively close to Highway 27 before curving south to cross the Humber Valley and connect with the existing intersection of Highway 27 and Major Mackenzie Drive east;
- Alternative MM-2B curves south farther west than Alternative MM-2A and crosses the Humber Valley at a similar location to MM-2A; and,
- Alternatives MM-2C and MM-2D curve south of the existing roadway at the western extremity of the segment, but do so at different angles, and cross the Humber Valley at the same location as MM-2A.

All of the alternatives have a right-of-way width of 42.6 metres. Two structures will need to be built along this segment: a new grade separation at the railway crossing east of Huntington Road, and a new crossing of the Main Humber River.

4.3.1.3 Segment MM

Segment MM-3 is located between the eastern terminus of segment MM-2 (just over 600 metres east of Highway 27) and Islington Avenue, as shown in **Figure 4-3**. The design of this segment was based on avoiding important features along the corridor, including the recently constructed St. Padre Pio Church to the north and Sonoma Heights Park to the south. As a result of these constraints, only one alignment was developed for this segment. It is centred on the existing centreline of Major Mackenzie Drive, and has a right-of-way width of 42.6 metres.

4.3.1.4 Segment MM

Segment MM-4 is located between Islington Avenue and Pine Valley Drive, as shown in **Figure 4-3**. Segment MM-4 runs adjacent to conservation lands and heritage properties between Islington Avenue and Pine Valley Drive. Two alignments were developed for comparison for the widening of this segment, as follows:

- in Alternative MM-4A, the road is widened equally to the north and south, maintaining the existing centreline; and
- in Alternative MM-4B, the road is widened solely to the north, maintaining the current southern edge of the pavement.

For this particular segment, the right-of-way width is 42.6 metres.

4.3.1.5 Segment MM

Segment MM-5 is located between Pine Valley Drive and Highway 400, as shown in **Figure 4-3**. Only one alignment was developed for this segment to avoid affecting commercial and residential properties located to the north, and the residential properties that back onto the road to the south. As a result, MM-5 is centred on the existing centreline of Major Mackenzie Drive and has a right-of-way width of 42.6 metres.

4.3.2 Rutherford Road (Highway 50 to Weston Road)

As described in Chapter 3, Rutherford Road was identified as requiring widening from four to six lanes between Highway 50 and Weston Road. For the purposes of considering potential effects and mitigation, and evaluating alternative alignments, the Rutherford Road study corridor was broken into five segments as illustrated in **Figure 4-4**.

4.3.2.1 Segment RR

Segment RR-1 is located between Highway 50 and 275 metres west of Highway 27, as shown in **Figure 4-4**. Segment RR-1 includes a new underpass at the crossing of the railway east of McGillivray Road. For this segment, only one alignment was developed. The western portion of the alignment is constrained by the need to tie into the Highway 50 intersection at its western limit and by a gas station on the southeast corner of Rutherford Road and Highway 50. The CP intermodal yard precluded an alignment to the north at Huntington Road, while a cemetery on the north and the Bethel Christian Centre to the south at McGillivray Road provided further design constraints. Lastly, the alignment is constrained west of the CP McTier tracks by a watercourse crossing and east of the tracks by a wetland to the north and residential properties to the south.

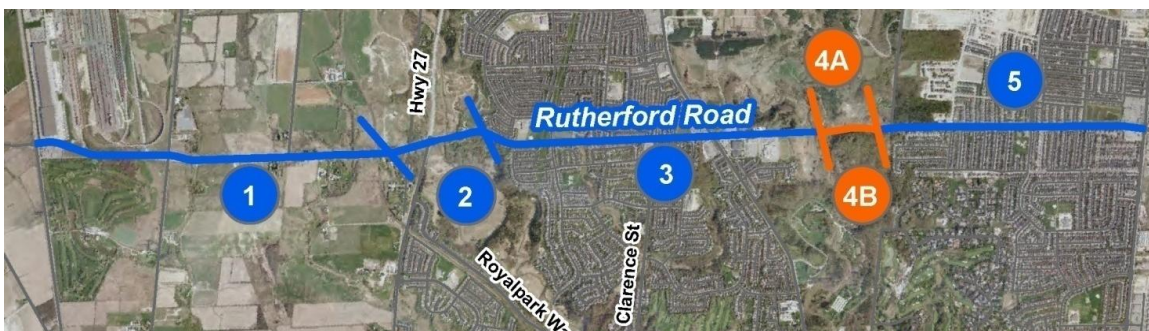


Figure 4-4 Location of Segments and Alternative Alignments on Rutherford Road

As a result of the design constraints, the alignment is centred on the existing centreline of Rutherford Road for the entire length, except at the intersection with Huntington Road, where the proposed alignment lies slightly north of the existing alignment. The alignment has a right-of-way width of 42.6 metres.

4.3.2.2 Segment RR

Segment RR-2 is located between the eastern terminus of segment RR-1 (275 metres west of Highway 27) and approximately 350 metres east of Highway 27, as shown in **Figure 4-4**. Segment RR-2 includes the intersection with Highway 27 and the crossing of the Humber River. Initially, two alignments for the widened segment were developed for comparison, both of which would replace the existing curve with a straight segment. One would align with the existing Rutherford Road / Highway 27 intersection, and narrow to the east of Highway 27 to connect with the existing bridge structure over the Humber River. The other would align with the existing right-of-way at the western extremity of the segment, but cross Highway 27 and the Humber River slightly south of the existing intersection and Humber River crossing.

However, based on the results from field investigations and consultation with stakeholders, it was determined that there were only minor differences between the alternatives and the lack of advantages unique to the latter alternative meant that there was no value in considering it further. Specifically, widening to the north was shown to minimize the effects to properties, the Main Humber River and a wetland to the east. Therefore, only the former alignment was carried forward for a full net effects analysis. Segment RR-2 aligns with the existing Rutherford Road / Highway 27 intersection, and narrows to the east of Highway 27 to connect with the existing bridge structure over the Humber River. It has a right-of-way width of 42.6 metres.

4.3.2.3 Segment RR

Segment RR-3 is located between the eastern terminus of segment RR-2 (approximately 350 metres east of Highway 27) and approximately one kilometre east of Islington Avenue, as shown in **Figure 4-4**. For segment RR-3, only one alignment was developed as this section is tightly constrained by residential subdivisions backing onto both sides of the alignment. As a result, RR-3 is centred on the existing centreline of Rutherford Road and has a right-of-way width of 42.6 metres.

4.3.2.4 Segment RR

Segment RR-4 is located between the eastern terminus of segment RR-3 (approximately one kilometre east of Islington Avenue) and approximately 125 metres west of Pine Valley Drive, as shown in **Figure 4-4**. Segment RR-4 currently follows a gentle arc to the north. Two alignments were developed for comparison for the widening of this segment:

- in alternative RR-4A, the arc is maintained, with the road centred on the existing centreline of Rutherford Road throughout the length of the segment; and,
- in alternative RR-4B, the arc is replaced by a straight road between the limits of the segment.

Both alternatives have a right-of-way width of 42.6 metres.

4.3.2.5 Segment RR

Segment RR-5 is located between the eastern terminus of segment RR-4 (approximately 125 metres west of Pine Valley Drive) and Weston Road, as shown in **Figure 4-4**. For segment RR-5, only one alignment was

developed as this section is tightly constrained by residential subdivisions backing onto both sides of the alignment. As a result, RR-5 is centred on the existing centreline of Rutherford Road and has a right-of-way width of 42.6 metres.

4.3.3 Weston Road (Major Mackenzie Drive to Steeles Avenue)

Only one alignment was developed for the widening of Weston Road to six lanes. Weston Road is tightly constrained by residential subdivisions that back onto both sides of the alignment and commercial properties on the east side to the north of Rutherford Road. It is further constrained by a proposed development to the east side, south of Rutherford Road. Due to the design constraints, Weston Road is centred on the existing centreline of Weston Road and has a right-of-way width of 42.6 metres.

4.3.4 Pine Valley Drive (Highway 7 to Steeles Avenue)

Only one alignment was developed for the widening of Pine Valley Drive to six lanes due to the residential subdivisions that back onto the west of the alignment and commercial properties on both sides. As a result, this alignment is centred on the existing centreline of Pine Valley Drive and has a right-of-way width of 42.6 metres.

4.3.5 Highway 27 (Nashville Road to Steeles Avenue)

Only one alignment was developed for the widening of Highway 27 to four lanes from Nashville Road to Major Mackenzie Drive, and to six lanes from Major Mackenzie Drive to Steeles Avenue. Between Nashville Road and Major Mackenzie Drive the alignment ties in to the bridge over the Main Humber River to the south of Nashville Road, which eliminates the need to widen the bridge. In addition, this portion of the alignment is shifted to the west to avoid the Humber River.

To the south of Major Mackenzie Drive, the meander of the Main Humber River and the existing bridge structures constrain the alignment on both sides. Through the Rutherford Road intersection, the alignment is constrained by residential properties to the west and the Main Humber River to the east. To the south of Rutherford Road, steep embankments and the bridge for the CP McTier tracks constrain the alignment on both sides. This portion of the alignment, as well as the portion south of Langstaff Road is also constrained due to commercial uses to the west, such as Walmart, and residential subdivisions that back onto the road to the east.

Between Major Mackenzie Drive and Steeles Avenue, the alignment is centred on the existing centreline of Highway 27. The widening to four lanes has a right-of-way width of 26 metres, and the widening to six lanes has a right-of-way width of 42.6 metres.

4.4 Net Effects Analysis and Comparative Evaluation (Advantages and Disadvantages) of Alternative Alignments

The following sections provide, for each alternative alignment in the study, a summary description of the environment that is potentially affected, followed by the net effects and, where applicable, a comparative evaluation (including a summary of advantages and disadvantages) of the alignments. For the purpose of field investigations and the net effects analysis, all lands within 30 metres of the centreline of the alternative alignments were examined and assessed. These lands comprise the study corridor or buffer area for each alternative alignment.

Individual field investigation reports for the following disciplines can be found in **Appendix 4C**: aquatic ecology, terrestrial ecology, hydrogeology, archaeology, built heritage, air quality, noise, land use, and socio-economics.

4.4.1 Major Mackenzie Drive (Highway 50 to Highway 400)

Figures 4-5 to 4-12 show the alternative alignments for Major Mackenzie Drive in the context of existing natural, social, and cultural conditions. This evaluation includes the section of Major Mackenzie Drive that is realigned as part of the proposed extension of Highway 427 (between approximately 450 metres west and 600 metres east of Huntington Road). The effects associated with this section of Major Mackenzie Drive were not carried forward to the effects assessment stage (Chapter 5) because they were evaluated by the Ministry of Transportation as part of the 427 Transportation Corridor Environmental Assessment project.

4.4.1.1 Description of the Environment Potentially Affected

Natural Environment

Eighteen water crossings are present along Major Mackenzie Drive within the Study Area. Of these, 12 have been identified as direct or indirect fish habitat. The remaining six crossings were not considered to be fish habitat. The 12 crossings identified as fish habitat include nine in the Main Humber River watershed, including one in East Rainbow Creek and an associated tributary, two in East Robinson Creek, one in the Main Humber River and four associated tributary crossings; and three in the East Humber River watershed, namely Marigold Creek, Purpleville Creek and the East Humber River.

Most of the terrestrial natural cover along the Major Mackenzie Drive study corridor is found between Islington Avenue and Pine Valley Drive, with additional natural cover adjacent to the Humber River just west of Highway 27. Designated natural areas within the study corridor are also primarily located between Islington Avenue and Pine Valley Drive. This area includes several sections of a Provincially Significant Life Science ANSI, and parts of two Environmentally Sensitive Areas, namely Boyd Forest and McFayden Forest. There is also a section of a Provincially Significant Life Science ANSI east of Pine Valley Drive. A group of wetlands located mainly between Islington Avenue and Pine Valley Drive, known as the Humber Wetland Complex, has been labelled as a Provincially Significant Wetland+ (PSW) by the Ministry of Natural Resources. These wetlands overlap the study corridor in a few locations.

During field investigations, three regionally rare flora species and several occurrences of area sensitive bird species were found, generally, between Islington Avenue and Pine Valley Drive. The regionally rare flora species are Black Maple (*Acer nigrum*), Long-beaked Sedge (*Carex sprengelii*), and Hairy-beard Tongue (*Penstemon hirsutus*). The bird species are Pileated Woodpecker (*Dryocopus pileatus*), Blue-grey Gnatcatcher (*Polioptila caerulea*), American Redstart (*Setophaga ruticilla*), Eastern Meadowlark (*Sturnella magna*), Bobolink (*Dolichonyx oryzivorus*), Sharp-shinned Hawk (*Accipiter striatus*), Ovenbird (*Seiurus aurocapillus*) and Pine Warbler (*Dendroica pinus*).

In terms of geology and hydrogeology, thin deposits of surficial glaciolacustrine silts and clays with occasional surficial silty sand deposits overlie the Halton Till between Highway 50 and the East Humber River along Major Mackenzie Drive. Between the East Humber River and Highway 400, the Halton Till is present at the surface. The Halton Till is a low permeability silty clay to clayey silt till, which forms the major regional aquitard for the Study Area and helps protect water supply aquifers below.

The majority of the area along Major Mackenzie Drive is considered a groundwater recharge area; although infiltration rates through the Halton Till are generally low and surface runoff of precipitation dominates the water balance. Groundwater discharge is not anticipated to occur in watercourses that overlie the Halton Till or glaciolacustrine silts and clayey silts. Groundwater discharge is anticipated to occur in the deep valleys of the Humber River and the East Humber River, where permeable sediments are present at the surface.

Examination of the water well database reveals a total of 175² reliably located wells on record³ within 500 metres of the Major Mackenzie Drive study corridor, including 24 wells within the 30 metre buffer area. Of these, 130 are screened in the overburden, and 43 are screened in bedrock. Of these 130 overburden wells, 18 are screened within the upper 15 metres of overburden sediments and are extremely sensitive to land use because of their shallow depth.

Socio-Economic Environment

Major Mackenzie Drive constitutes a rural cross-section throughout the study corridor. Three residential subdivisions back onto Major Mackenzie Drive on either side of Islington Avenue, as does one just east of Pine Valley Drive. Individual residences and community features exist alongside the rest of the study corridor. Agriculture and light industrial uses, such as freight carton storage, dominate west of Highway 27. Most of the area along Major Mackenzie Drive between Islington Avenue and Pine Valley Drive are natural heritage lands with recreational uses. Specifically, the Kortright Centre for Conservation lies on the south side of this segment of Major Mackenzie Drive. Two trail systems cross Major Mackenzie Drive in this area, namely the William Granger Trail and the Kortright Centre trail system.

There are two active Draft Plans of Subdivision located on the south side of Major Mackenzie Drive between Weston Road and Woodend Place. The Draft Plan of Subdivision and accompanying Official Plan and Zoning By-law Amendments for the lands located on the north side of Major Mackenzie Drive, west of Highway 27, were approved by the City of Vaughan on October 9, 2009. The lands are zoned with a Holding Provision (H) subject to the achievement of a number of conditions, including the allocation of adequate water supply and sewer servicing capacity. A draft approved subdivision, the Lakes Rivers subdivision, is also located on the north side of Major Mackenzie Drive just west of Highway 27.

Cultural Environment

Six registered pre-contact Aboriginal archaeological sites exist alongside the study corridor, five of them between Islington Avenue and Pine Valley Drive. One such site is found west of Islington Avenue. A new archaeological site was discovered during the field investigation of Major Mackenzie Drive, between Islington Avenue and Pine Valley Drive. The 14 Euro-Canadian archaeological sites, by contrast, tend to be found east of Pine Valley Drive and west of Highway 27, with the exception of one site between those roads.

Much of the study corridor has either been disturbed by the existing road and associated infrastructure, or is in low-lying and poorly drained areas, and therefore has little or no potential for new archaeological finds. The largest exception to this is the proposed realignment of Major Mackenzie Drive west of Highway 27, where the study corridor crosses well-drained undisturbed land with archaeological potential. In addition to this, archaeological potential exists in some undisturbed areas west of Huntington Road. There is also archaeological potential in some well-drained areas east of Islington Avenue.

- 2. The sum of the bedrock and overburdens may not equal the total number of reliably located wells as the depth of a few of these wells may be unknown.*
- 3. Estimates of the number of wells are approximate only, as the accuracy of the MOE water well database is poor. There may be up to 30% more wells because of unreported or unrecorded wells.*

There are seven cultural heritage resources along Major Mackenzie Drive, which include:

- one cemetery, located on the south side of Major Mackenzie Drive west of Huntington Road;
- three built heritage resources, located at 3936 Major Mackenzie Drive, 6611 Major Mackenzie Drive, and on the south side of Major Mackenzie Drive east of Pine Valley Drive; and,
- three cultural heritage landscapes, namely 3930 Major Mackenzie Drive, 6181 Major Mackenzie Drive, and the Kleinburg-Nashville Heritage Conservation District.

The results of the net effects analysis for the 5 segments of Major Mackenzie Drive described in Section 4.3.1 are documented below. This analysis includes the identification of potential effects, the development of avoidance, mitigation, or compensation to address any adverse effects (and enhancements to improve any positive effects), and the determination of net or residual effects that remain following mitigation.

4.4.1.2 Net Effects Analysis for Segment

Segment MM-1 is located between Highway 50 and just over 600 metres east of Huntington Road. **Figure 4-5** shows the segment in the context of existing natural, social, and cultural conditions. **Table 4D-1** of **Appendix 4D** provides the details of the net effects analysis for segment MM-1.

Transportation: Achieving Appropriate Design Standards

The alignment achieves appropriate design standards for horizontal and vertical curves and grades.

Transportation: Providing Adequate Space to Meet the Needs of All Users of the Road Right-of-way in a Safe and Efficient Manner

The alignment provides adequate space to meet the needs of all users in a safe and efficient manner, because it accommodates general purpose lanes, HOV lanes, on-street cycling lanes, and sidewalks that meet York Region's Road Design Guidelines. In addition, all of the signalized and unsignalized intersections have exclusive turn lanes that meet York Region's Road Design Guidelines.

Transportation: Maintaining or Providing Appropriate Road Network Connections and Vehicular Accesses to Adjacent Land Uses

All existing municipal road connections and private road and driveway connections along the alignment can be accommodated in their current location, although movements will be limited to right-in/right-out for the latter.

Natural Environment: Net Effects on the Aquatic Environment

During construction activities, the potential for effects to aquatic habitat and function at the tributary of East Rainbow Creek and at the stream crossings of East Rainbow Creek, West Robinson Creek and East Robinson Creek would be mitigated through the application of BMPs. Potential effects as related to proposed road alignments and water crossing structure design would be minimized through design consideration.

Overall, appropriate mitigation, enhancements and/or compensation would be employed, ensuring no net loss or a net gain/improvement to fish habitat.



Figure 4-5 Existing Conditions and Proposed Alignment for Major Mackenzie Drive, Segment MM-1

The potential temporary decrease in water quality from construction activities would be minimized with the implementation of erosion and sediment control techniques during construction, as would the long-term decrease in surface water quality and bank erosion of the watercourses through the implementation of riparian plantings. However, there would be a long-term minimal increase in salt concentrations in the watercourses.

Natural Environment: Net Effects on the Terrestrial Environment

Removal or disturbance of deciduous and coniferous forest totalling 0.05 hectares, cultural woodlands totalling 0.16 hectares, constructed green lands totalling 0.58 hectares and wetland totalling 0.02 hectares would be mitigated or compensated. Best Management Practices (BMPs) for salt application and sediment and erosion control measures would minimize any further effect on wetlands.

Natural Environment: Net Effects on Groundwater

Effects related to dewatering and loss of groundwater yield for two wells associated with construction of three water crossings would be mitigated or compensated.

Natural Environment: Net Effects on the Broader Natural Heritage System

Limited forest fragmentation would be mitigated through restoration or enhancement.

Socio-Economic Environment:

Net Effects on Existing Land Uses/Resources

Acquisition of 6.39 hectares of private property would be compensated, as would any resulting crop damage. Disruption to residences and a commercial feature due to short-term construction-related nuisance effects would be minimized. Noise level increases above 60 decibels or increases of more than 5 decibels for a planned residential development and several existing individual homes may be mitigated pending further analysis during preliminary design.

Socio-Economic Environment:

Net Effects on Approved/Planned Land Uses

There would be no effect on approved or planned land uses because currently there are no unbuilt approved or draft approved development plans in this area.

Socio-Economic Environment:

Net Effects on Air Quality

There would be no negative effects on air quality as a result of implementing this project.

Cultural Environment: Net Effects on Archaeological Resources

Loss or disturbance of potential archaeological sites within 805 metres of frontage and 934 metres of the full width of the right-of-way with archaeological potential would be avoided where possible through completion of a Stage 2 Archaeological

Assessment. Where avoidance is not possible, Stage 3 and, if required, Stage 4 Archaeological Assessments would be carried out to mitigate effects on potential archaeological sites. At any identified sites, appropriate consultation with Aboriginal communities would be undertaken in accordance with Ministry of Culture guidelines.

Cultural Environment: Net Effects on Cultural/Heritage Resources

Removal or disturbance of the cemetery located on the south side of Major Mackenzie Drive, west of Huntington Road would be avoided, if possible, by realigning the road or reducing the right-of-way width.

Financial: Implementation Costs

The improvements to Segment MM-1 are expected to cost approximately \$15 million in 2009 dollars.

4.4.1.3 Net Effects Analysis and Comparative Evaluation for Segment MM

Segment MM-2 is located between the eastern terminus of segment MM-1; just over 600 metres east of Huntington Road, and just over 600 metres east of Highway 27. Four alternative alignments were developed for this segment for comparison; they are MM-2A, MM-2B, MM-2C and MM-2D.

Alternative MM-2A

Alternative MM-2A follows the existing alignment of Major Mackenzie Drive eastward until relatively close to Highway 27 before curving south to cross the Humber Valley and connect with the existing intersection of Highway 27 and Major Mackenzie Drive east. **Figure 4-6** shows the alternative in the context of existing natural, social, and cultural conditions. **Table 4D-2** in **Appendix 4D** provides the details of the net effects analysis for alternative MM-2A.

Transportation: Achieving Appropriate Design Standards

The alignment achieves appropriate design standards for horizontal and vertical curves and for grades. However, there are curves that are tighter than optimal.

Transportation: Providing Adequate Space to Meet the Needs of All Users of the Road Right-of-way in a Safe and Efficient Manner

The alignment provides adequate space to meet the needs of all users in a safe and efficient manner, because it accommodates general purpose lanes, HOV lanes, on-street cycling lanes, and sidewalks that meet York Region's Road Design Guidelines. In addition, all of the signalized and unsignalized intersections have exclusive turn lanes that meet York Region's Road Design Guidelines.

Transportation: Maintaining or Providing Appropriate Road Network Connections and Vehicular Accesses to Adjacent Land Uses

All existing municipal road connections and private road and driveway connections can be accommodated, although movements will be limited to right-in/right-out for the latter. One planned municipal road connection may require realignment.

Figure 4-6 Existing Conditions and Proposed Alignment for Major Mackenzie Drive, Alternative MM-2A

