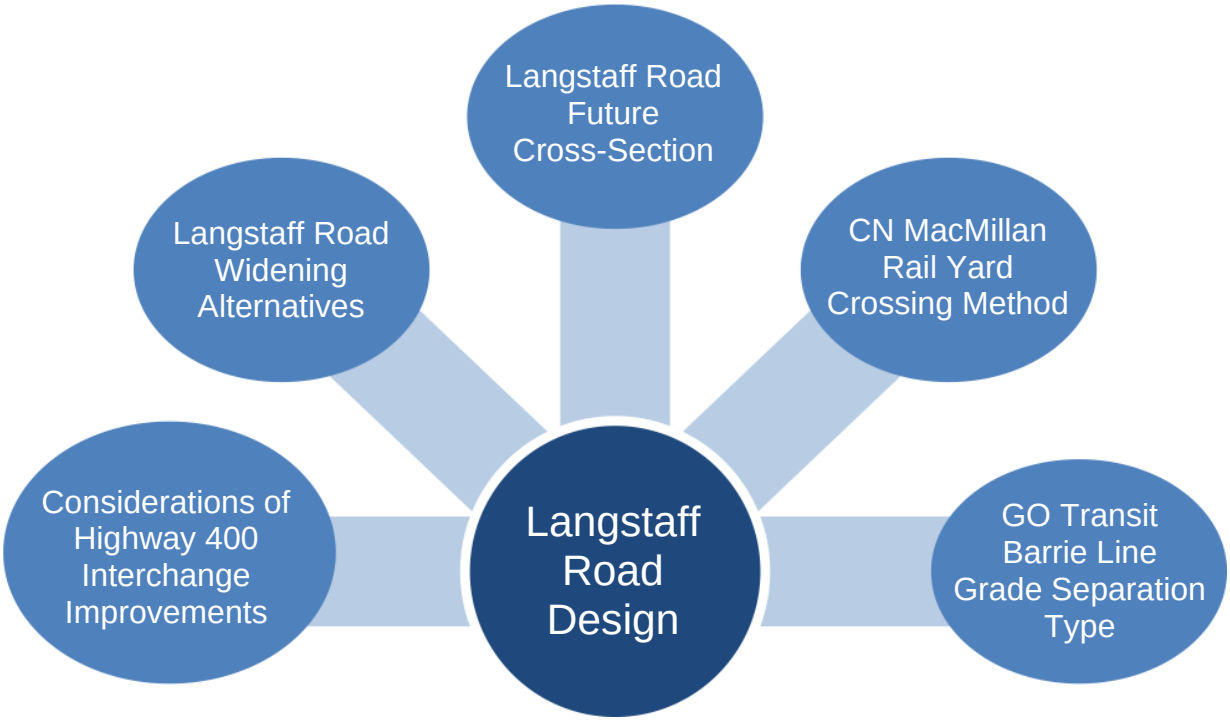
8 ALTERNATIVE DESIGN CONCEPTS

8.1 Design Process and Design Component

Phase 3 of the Municipal Class EA process involves the development and assessment of alternative design concepts. Having established the need for improvements to Langstaff Road between Weston Road and Highway 7 (discussed in **Chapters 3 to 6**), and selected a Preferred Planning Solution (**Chapter 7**), this next study phase involved the following activities (**Exhibit 8-1**) in the development and evaluation of the various design elements associated with Langstaff Road improvements:

- developing a **cross-section** to establish future right-of-way requirements (see **Section 8.2**);
- developing the **road widening alternative design concepts**, based on the cross-section and associated right-of-way requirements (see **Section 8.3**);
- developing the Metrolinx GO Transit Barrie Line **grade separation** alternative design concepts (see **Section 8.4**);
- developing the **CN MacMillan Rail Yard** crossing alternative design concepts (see **Section 8.5**);
- considering the opportunity for the improvements of the **Highway 400 / Langstaff Road interchange** modification and next steps (see **Section 8.6**);
- developing the **Preliminary Preferred Design Plan** based on the inputs above;
- inviting participating agencies and the public to attend Open House 2 (OH2) to review and provide comments on the **Preliminary Preferred Design Plan**; and
- refining the Preliminary Preferred Design Plan based on feedback received from agencies and the public and confirming the **Preferred Design Plan**.

Exhibit 8-1: Design Components



8.2 Typical Cross-Section

In developing the cross-section alternatives, a number of key constraints and design elements were considered and are discussed below:

Compatibility with adjacent land uses within the study area – the neighbourhood context was factored into the development of the cross-section. A primary objective was to avoid impacts to adjacent properties where feasible. The study area is largely of industrial / commercial land uses with some community features such as Langstaff Park and LeParc Park, as well as a residential community east of Dufferin Street. There are some existing active transportation facilities within the study area where land uses may be accessed by driving, walking, cycling and transit, from Langstaff Road. These were important factors in developing the cross-section.

Provision for pedestrians and cyclists and future multi-use path connections – As discussed in **Chapter 3**, Langstaff Road is a designated as separated cycling facility. Considering the land use context (access to commercial areas), the cross-section was developed to include opportunities for off-road cycling in the boulevard. A sidewalk is proposed on both sides of the road. The multi-use path will be continuous over the CN MacMillan Rail Yard crossing, as well as the Metrolinx GO Transit Barrie Line grade separation.

Available existing right-of-way and minimizing property impacts – While some sections of the existing Langstaff Road right-of-way are constrained by adjacent development; other sections have a much less constrained right-of-way. The current levels of constraints along Langstaff Road were considered in developing the cross-section alternative design concepts.

York Region's Official Plan right-of-way – York Region's Official Plan policy designates a 36 m right-of-way for Langstaff Road to accommodate elements of transportation infrastructure and streetscape design.

Reduction in lanes widths – In order to minimize property impacts to the extent possible, a reduction in travel lane widths was considered. The travel lane widths being considered are 3.5 m for the outside lanes and 3.3 m for the inside lanes. The proposed dimensions are within York Region standards.

Intersection and turning lane recommendations – The operation of all intersections within the study limits was considered. Existing and future traffic demand and intersection operations were analyzed and recommendations with respect to intersection reconfiguration, new dedicated turn lanes, and lengthening of turn lane storage were made. The proposed intersection designs are part of the Preferred Design Plan discussed in **Chapter 9**.

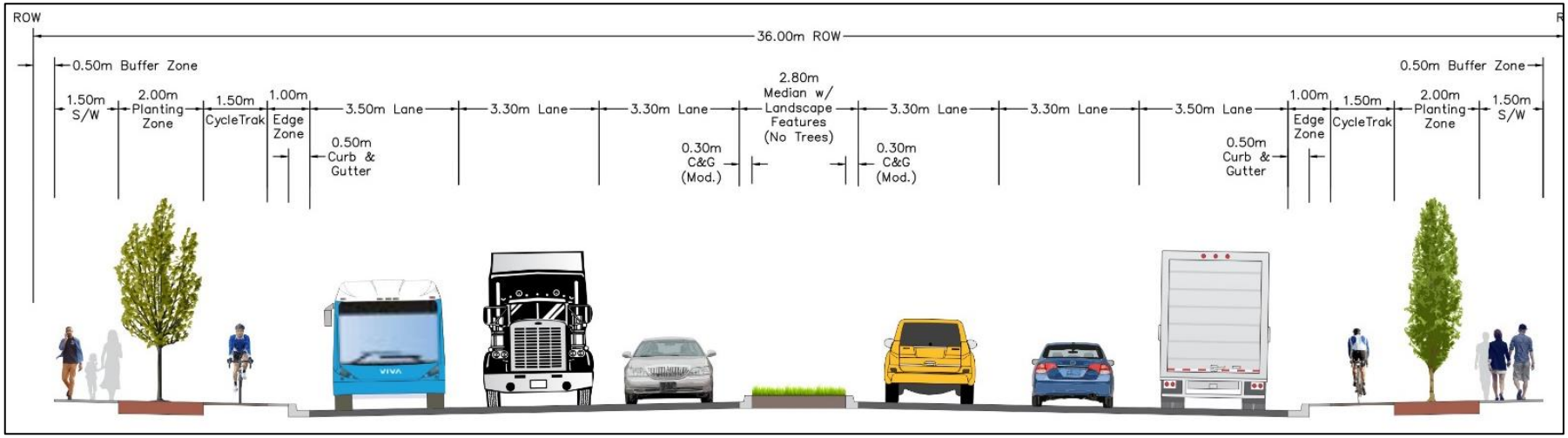
Geometric design requirements – The cross-section concept and the approach to road widening are governed by road design standards and guidelines (for example, TAC and York Region design standards, York Region's Pedestrian and Cycling Design Guidelines, and OTM Book 18: Cycling Facilities).

Region's Streetscape Program – The objectives and design principles of York Region's Streetscape Program were incorporated into the development of cross-section concepts with the intent to create a functional, active and vibrant street that enhances

pedestrian, cycling and transit facilities and encourages recreational use and social interaction.

Based on the considerations above, the typical roadway cross-section for Langstaff Road was developed collaboratively by staff from York Region's Capital Planning and Delivery, Streetscape, Forestry, Active and Sustainable Transportation and Operations/Maintenance departments through a meeting held on October 4, 2017. The Langstaff Road cross-section is illustrated by **Exhibit 8-2**. The proposed roadway supports the movement of commercial goods, motor vehicles, transit, pedestrians and cyclists, and protects opportunities for streetscape enhancements.

Exhibit 8-2: Langstaff Road Preliminary Cross-Section from Weston Road to Dufferin Street



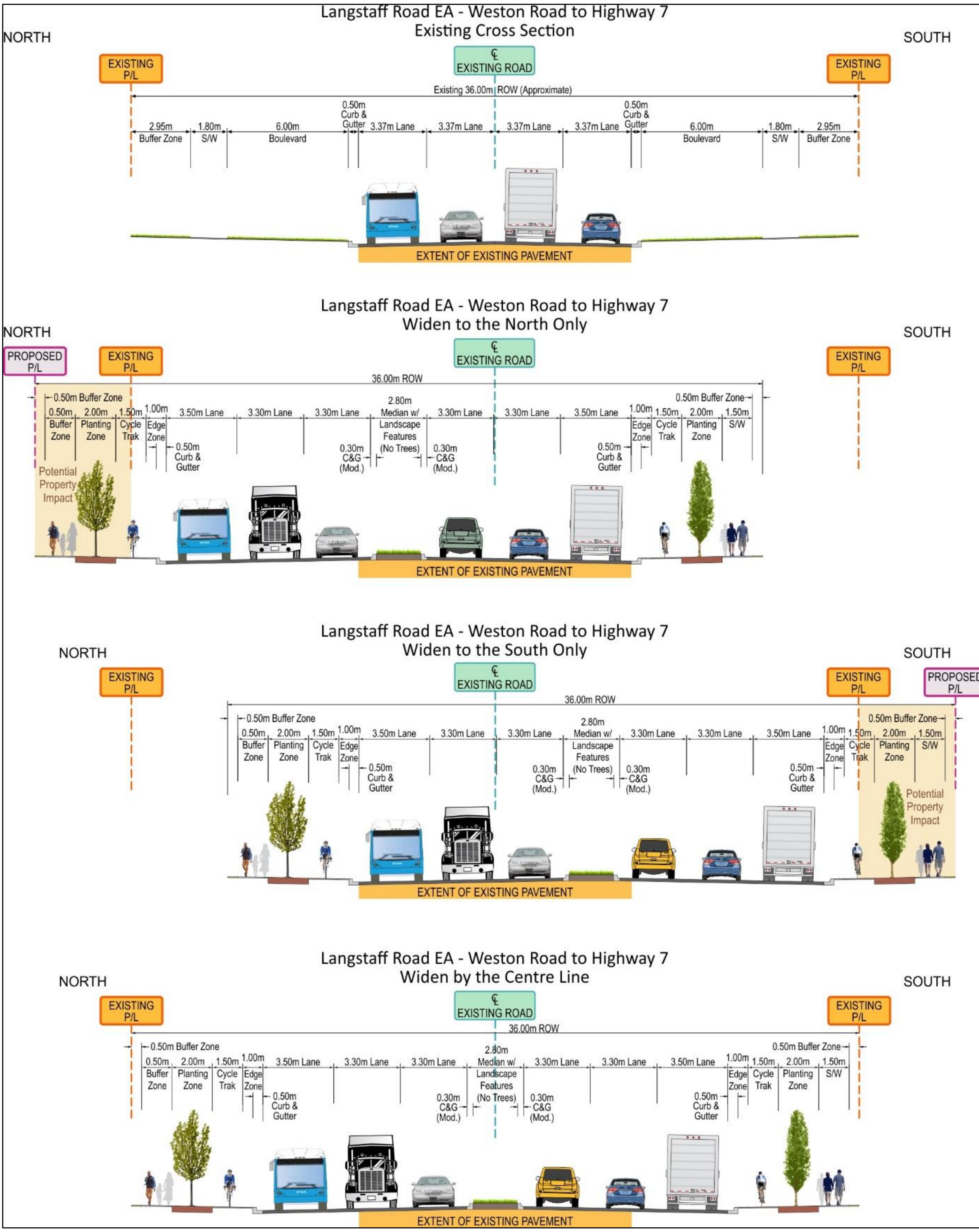
8.3 Langstaff Road Future Road Widening Alternative Design Concepts

Three roadway widening alternative design concepts were developed for Langstaff Road, as described below and depicted on **Exhibit 8-3**:

- Alternative 1: Widen to the north only
- Alternative 2: Widen to the south only
- Alternative 3: Widen by the existing centreline

It is noted that the cross-section alternative design concepts are conceptual, based on a mid-block location, and that the actual cross-section will vary depending on local conditions, constraints and intersection design.

Exhibit 8-3: Langstaff Road Future Widening Alternatives



While the above alternative design concepts provided a reasonable range of options, for much of the study area, there are existing constraints located along both sides of Langstaff Road. Therefore, it was not considered reasonable to develop alignments that widen “strictly” to the north or south, or on the existing centreline through the entire study area. Based on a qualitative assessment of these alternative design concepts, a “Best Fit” alignment that combines centreline, north and south widening provides the greatest opportunity to minimize property impacts for the proposed widening Langstaff Road between Weston Road and Dufferin Street.

8.4 Metrolinx GO Transit Barrie Line Grade Separation Alternative Design Concepts

8.4.1 Alternative Design Concepts

Two alternative design concepts were developed for the Langstaff Road grade separation crossing at Metrolinx GO Transit Barrie Line, as described below and as illustrated by **Exhibit 8-4**.

- Overpass Design Concept – road over rail
- Underpass Design Concept – rail over road

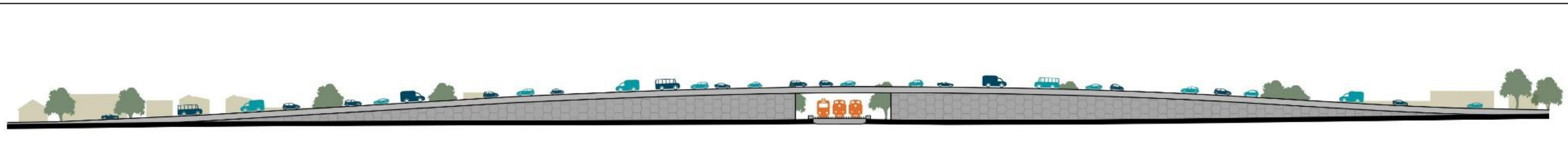
Throughout the course of the Class EA study, three meetings were held with Metrolinx, as well as email correspondence which is documented in **Section 2.3.3**.

8.4.2 Preferred Design Concept

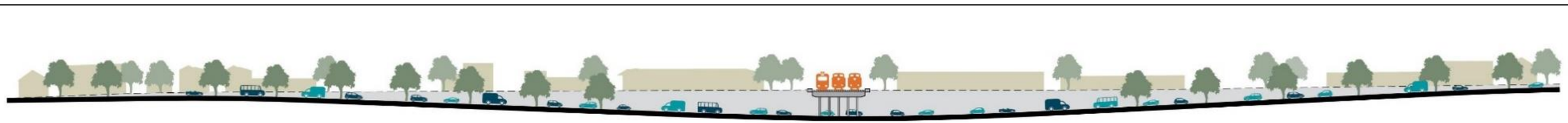
An assessment of the overpass and underpass design concepts is documented in **Table 8-1**. An overpass (rail over road) is preferred because, when compared to the underpass, this alternative:

- Has minimal impacts to rail line during construction;
- Has less complex construction;
- Does not require a pumping station; and
- Has substantially lower construction cost.

Exhibit 8-4: Schematic of Metrolinx GO Transit Barrie Line Grade Separation Alternatives



Overpass Profile



Underpass Profile

Table 8-1: Metrolinx GO Transit Barrie Line Grade Separation Alternative Design Concepts Evaluation

Factor	Overpass (Road Over Rail)	Underpass (Road Under Rail)
Social / Economy / Community	• Larger footprint requirement and impacts a greater number of properties. • Will impact four accesses to businesses. • Would create a strong visual intrusion to the surrounding community; however, the surrounding area is largely designated for industrial / commercial uses. • Reduce visibility of adjacent businesses. • May be challenging for pedestrians and cyclists to navigate the grades.	• Smaller footprint requirement and impacts a smaller number of properties • Will impact three accesses to businesses. • Relatively little visual intrusion to the surrounding community. • Provides for better visibility of adjacent businesses.
Natural Environment	• There are no natural environmental features that would be at risk of direct or indirect impact.	• There are no natural environmental features that would be at risk of direct or indirect impact.
Cultural Environment	• There are no potential built heritage or archaeological impacts.	• There are no potential built heritage or archaeological impacts.

Factor	Overpass (Road Over Rail)	Underpass (Road Under Rail)
Transportation	• Minimal impacts to rail operations during construction. • May be opportunity to maintain traffic on Langstaff Road through staged construction. • May be challenging for pedestrians and cyclists to navigate the grades. • Pumping station is not required.	• Construction method, duration and staging is more complex when rail disruptions must be minimized. • Likely a higher level of disruption to rail services since there is no opportunity / space for rail detour. • More attractive to pedestrians and cyclists. • Stormwater and / or groundwater may need to be actively pumped from underpass via pumping station, adding significantly to construction and operations costs.
Cost (estimated for comparison purposes only)	$16 Million	$25 Million
Result	**Recommended**	Not Carried Forward

8.5 Canadian National Railway (CN) MacMillan Rail Yard Crossing

8.5.1 Alternative Design Concepts

Three Langstaff Road extension alignment corridor concepts crossing the CN MacMillan Rail Yard were considered as part of the *Vaughan Metropolitan Centre and Surrounding Area Transportation Study (2012)*. The same three alignment alternatives were carried forward as the initial alignment alternative design concepts of the current Class EA study and were presented to CN at the early stage. Throughout the course of the Class EA study, a total of 7 meetings were held with CN as documented in **Section 2.3.1** of the ESR.

As illustrated in **Exhibit 8-5**, the Langstaff Road extension alignment alternative design concepts across CN MacMillan Rail Yard includes:

- North Alignment (bridge over rail yard)
- Centre Alignment (bridge over rail yard or tunnel under the rail yard)
- South Alignment (bridge over rail yard)

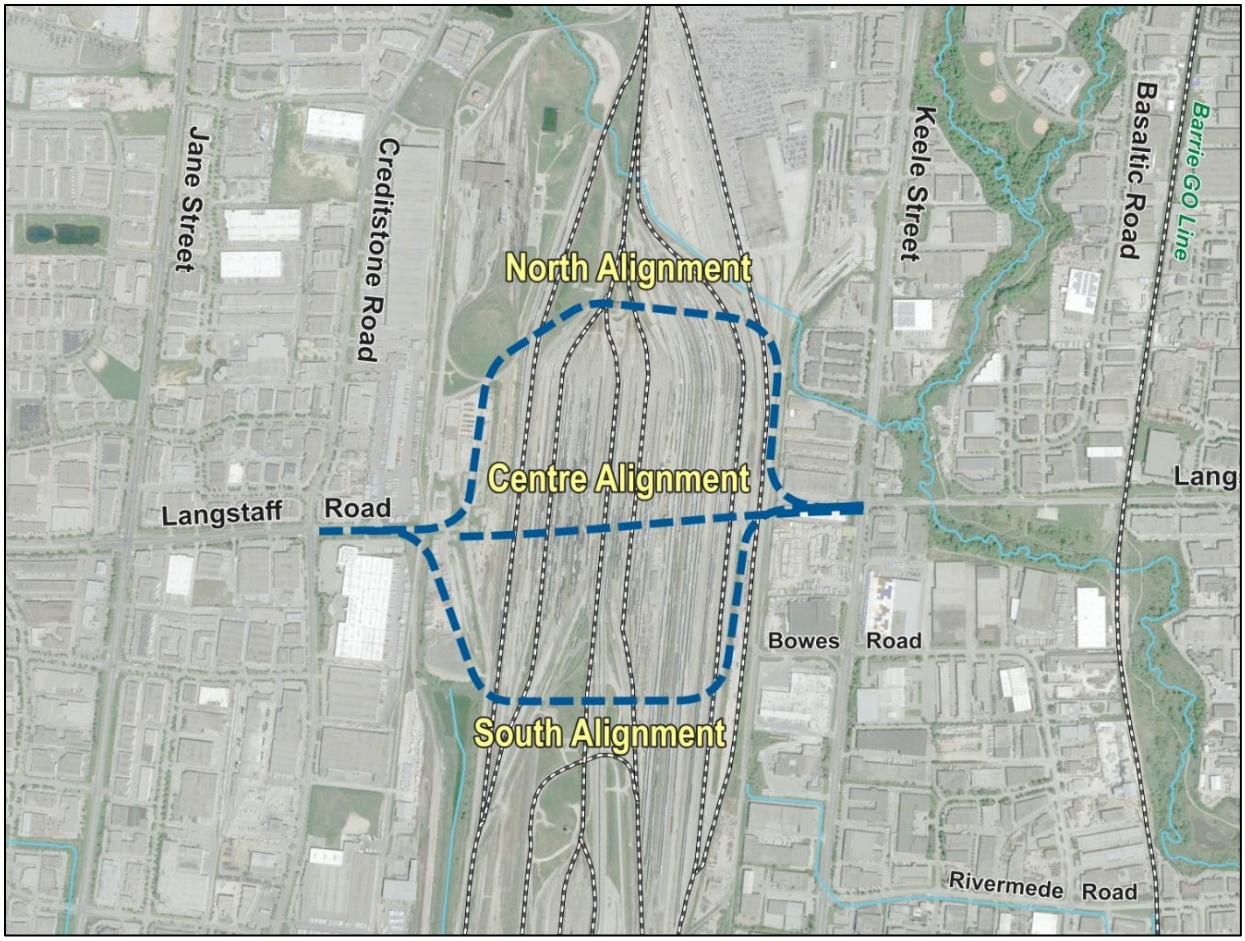
At the January 20, 2017 meeting with CN, CN representatives noted that amongst the three alignment design concepts, the south alignment is the only viable option due to key operational constraints in the areas associated with the centre and north alignments, summarized as follows:

- The north alignment involves crossing the “throat” of CN’s hump pullback and hump leads, which is a critical link to their classification system. The nature of the classification system is where trains are marshalled / organized into new train blocks for their destinations. These train blocks can be combined to form new trains. It is a critical function to the broader rail system. Any impact to the hump area will impact the operations of the entire rail yard, which operates 24 hours a-day / 7days a-week. Given the critical operation in this area within the CN MacMillan Rail Yard, the north alignment was not acceptable by CN.
- The centre alignment concept would cross through CN’s central core yard, the classification yard, which is considered to be a “no touch” zone for CN. The construction of a bridge crossing through the core classification area will have

significant impact to their operation and is considered a major safety concern due to proximity to live tracks that operate 24 hours a-day and 7 days a-week. Given the density of the rail tracks in the core area and the associated impacts, a bridge along the centre alignment was not preferred.

- CN considers the south alignment the most viable option relative to the other two alignment concepts.
- CN requested that a tunnel option along the centre corridor be considered as part of the evaluation.

Exhibit 8-5: CN MacMillan Rail Yard Crossing Alignment Alternatives



Further to the above, four overpass design concepts (i.e. different structural types) were subsequently developed along the south alignment, as well as the tunnel design concept that follows the centre alignment:

- Alternative 1A – Steel Box Girder Bridge – Long Spans (**Exhibit 8-6**)
- Alternative 1B – Steel Box Girder Bridge – Short Spans (**Exhibit 8-7**)
- Alternative 2 – Extradosed Bridge (**Exhibit 8-8**)
- Alternative 3 – Post-tensioned Segmental Concrete Bridge (**Exhibit 8-9**)
- Alternative 4 – Tunnel Option (**Exhibit 8-10**)

8.5.2 Analysis and Evaluation of Alternative Design Concepts

Langstaff Road extension across the CN MacMillan Rail Yard is one of the most challenging design components for the proposed improvements on Langstaff Road. The roadway will cross the one of the busiest rail yards in Canada in a highly constrained environment (i.e. closely spaced tracks, 24 hour a-day and 7 days a-week operation with substantial volume of in-and-out traffic and highly sophisticated operation system), which presents unique engineering challenges associated with the geometric design and constructability of the structure, while trying to best accommodate the operation of the yard during and after construction, as well as ongoing maintenance. In addition to the factors used in the evaluation of the other design components, such as social/ economic/community, natural environment, culture environment, transportation and cost, impact to CN operations and structure design are two major factors to be considered as well. The crossing alignment alternative design concepts are generally within an urban/industrial setting, direct or indirect impact to the natural environment and culture environment are not expected, therefore, these two factors are not included in the evaluation table.

The detailed evaluation of the CN MacMillan Rail Yard crossing alternative design concepts is shown in **Table 8-2**. Based on the analysis and evaluation of the CN MacMillan Rail Yard crossing alternatives as shown in **Table 8-2**, while Alternative 4 (tunnel) has the least impact to CN operation; the cost is not economically feasible compared to the other alternatives (about 5 times more). Therefore, it is not considered to be a preferred alternative.

Amongst Alternatives 1A, 1B, 2 and 3, Alternative 1B has the greatest impact to CN operation, and therefore it is not considered to be a preferred alternative. The remaining alternatives (1A, 2 and 3) all have similar socio-economic and transportation impacts and similar impacts to CN operation. Given Alternative 1A has the lowest cost of the remaining three alternatives and is the simplest structure to construct, Alternative 1A is selected as the technically preferred alternative.

Exhibit 8-6: CN Crossing Alternative 1A – Steel Box Bridge – Long Spans

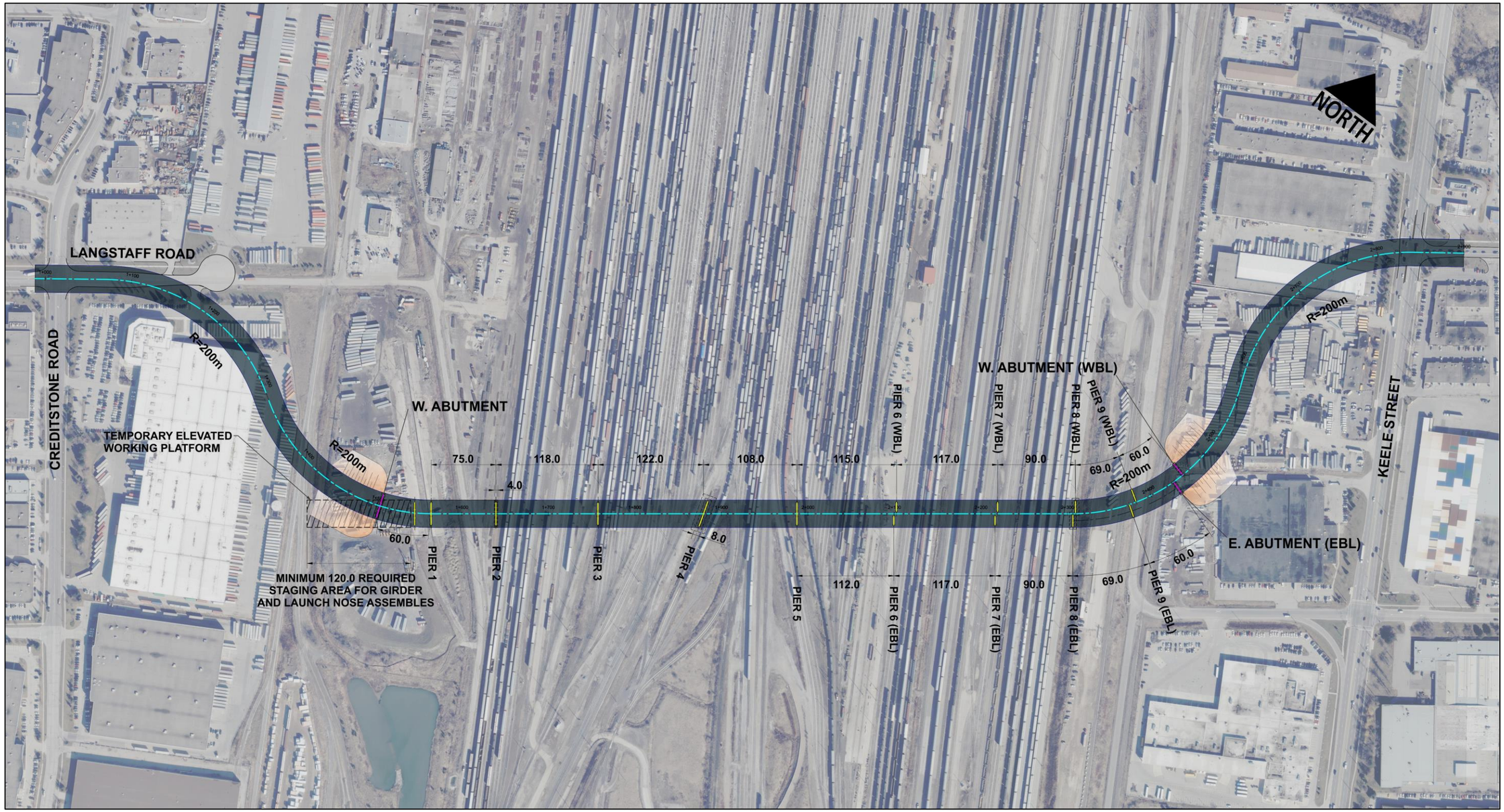


Exhibit 8-7: CN Crossing Alternative 1B – Steel Box Bridge – Short Spans

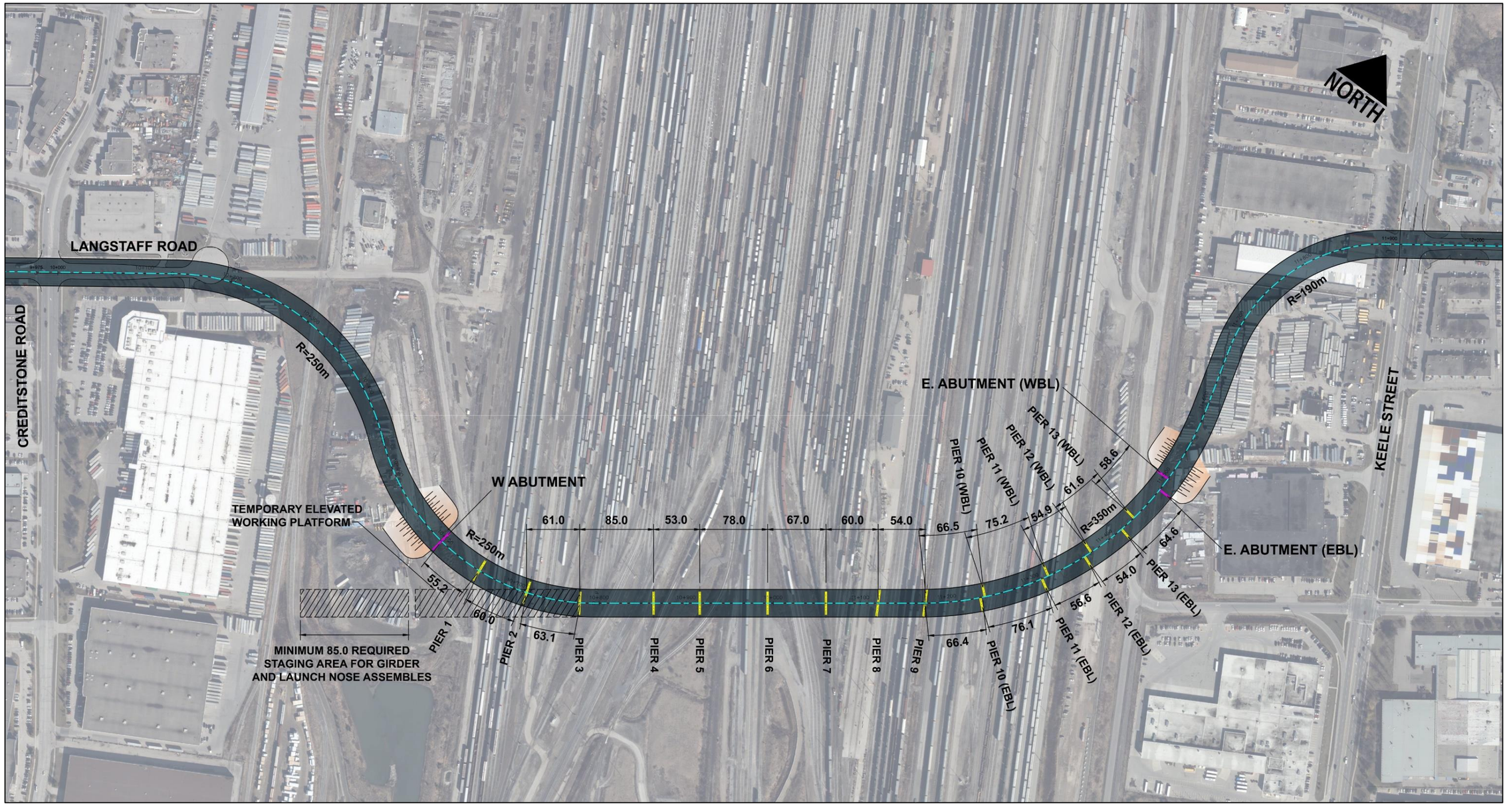


Exhibit 8-8: CN Crossing Alternative 2 – Extradosed Bridge

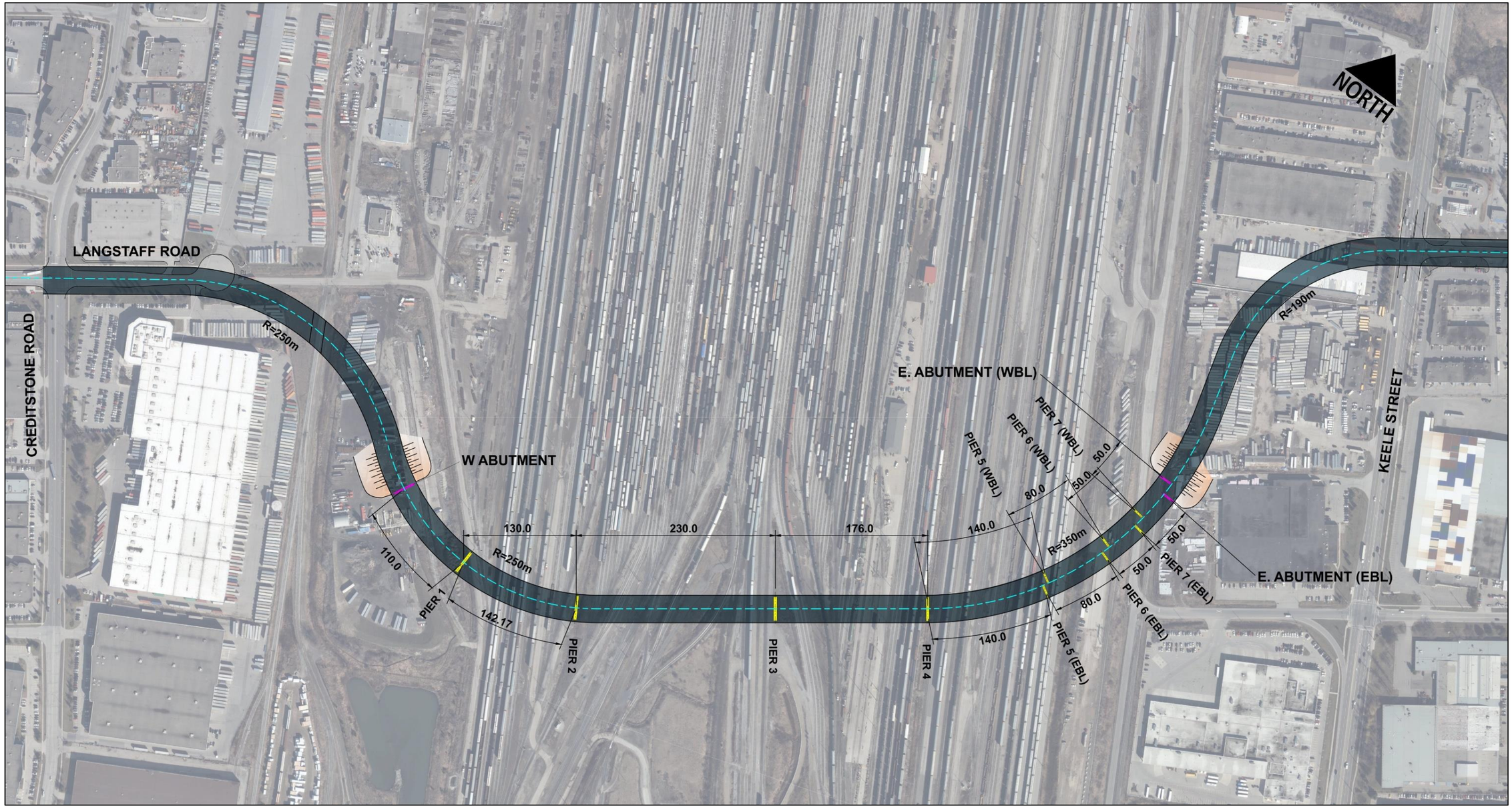


Exhibit 8-9: CN Crossing Alternative 3 – Post-tensioned Segmental Concrete Box Girder Bridge

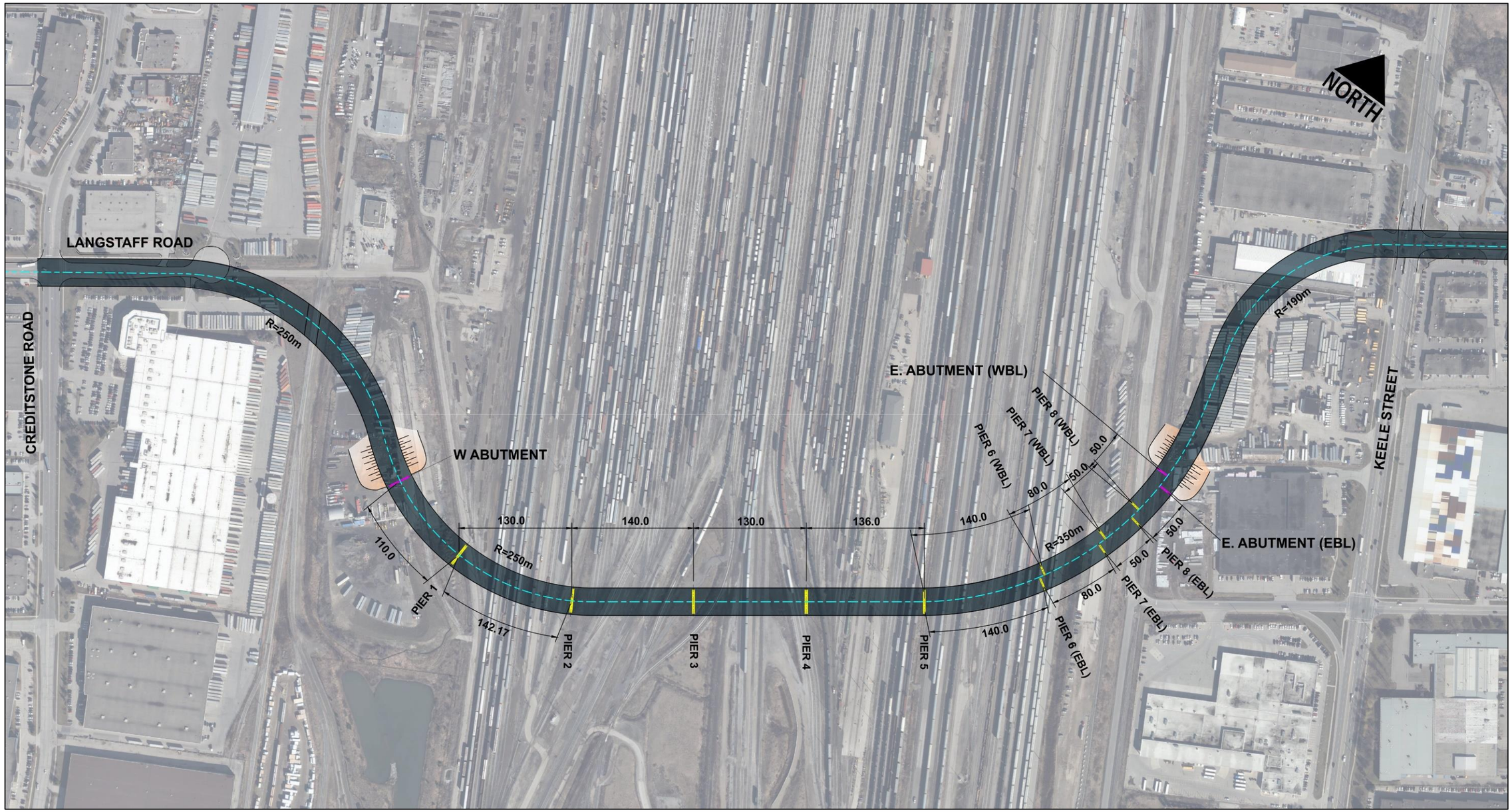
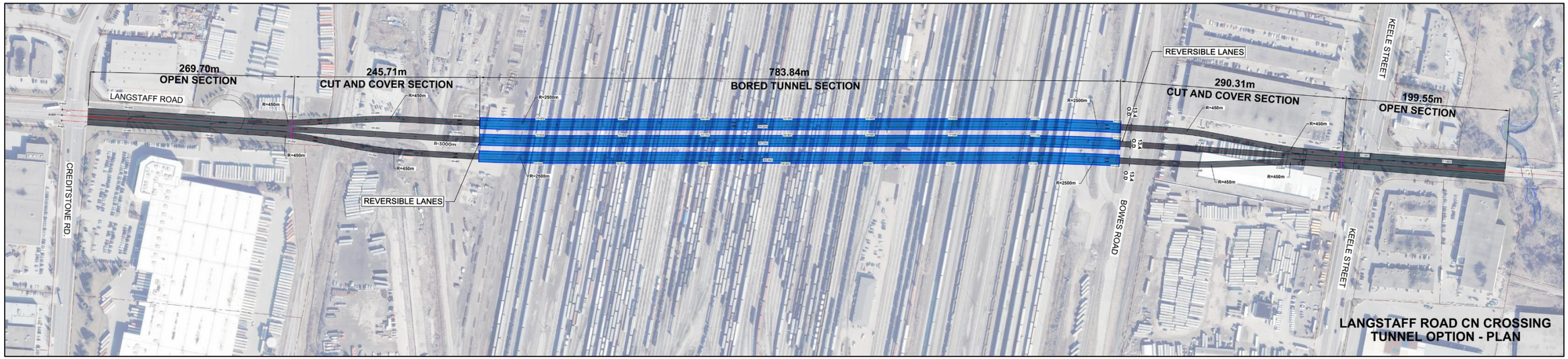


Exhibit 8-10: CN Crossing Alternative 4 – Tunnel Option



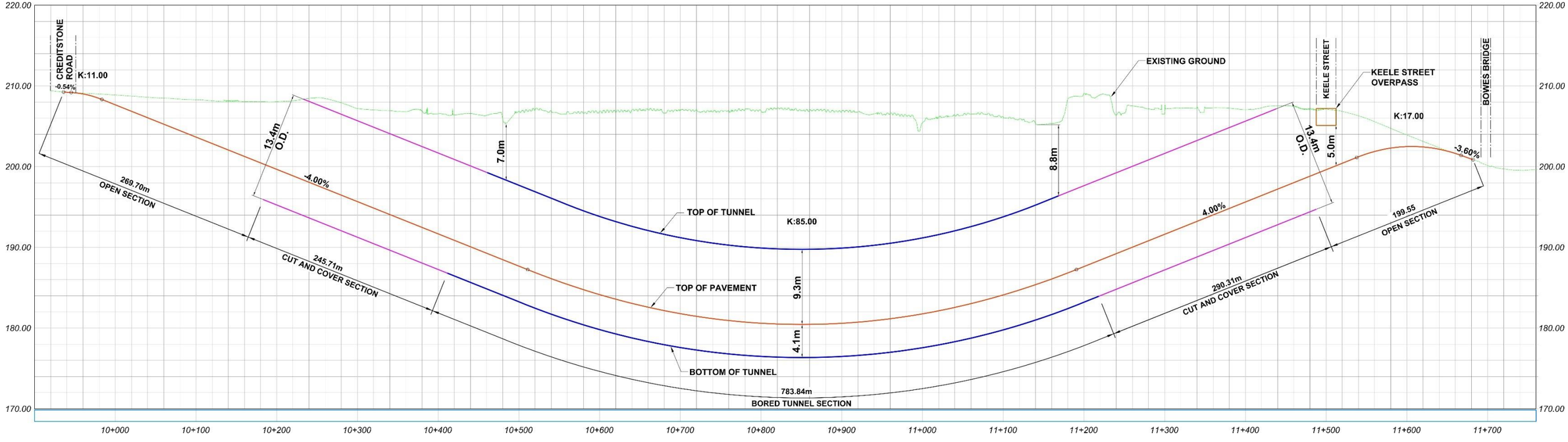


Table 8-2: CN MacMillan Rail Yard Crossing Alternatives Evaluation Table

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
1.0 Socio-Economic					
1.1 Property Impact – Adjacent Businesses (# of Property Areas)	- Minimum 4 adjacent properties are potentially impacted (approximately 13.8 hectares).	- Minimum 3 adjacent properties are potentially impacted (approximately 8.2 hectares).	- Minimum 3 adjacent properties are potentially impacted (approximately 8.2 hectares).	- Minimum 3 adjacent properties are potentially impacted (approximately 8.2 hectares).	- Minimum 3 adjacent properties are potentially impacted (approximately 5.2 hectares). 2 of which are required to provide connections to Keele Street east of the CN MacMillan Rail Yard.
1.2 Access Impact – Adjacent Businesses	- All existing accesses to adjacent businesses will be maintained with minor modifications.	- All existing accesses to adjacent businesses will be maintained with minor modifications.	- All existing accesses to adjacent businesses will be maintained with minor modifications.	- All existing accesses to adjacent businesses will be maintained with minor modifications.	- Minimum 5 existing accesses to adjacent businesses are potentially impacted.
Preference					
Summary	All alternatives result in various degrees of property impacts with Alternative 1A having the largest property requirement; however, the overall impacts in terms of the number of potentially impacted properties are similar in scale.				
2.0 Structural Engineering					

2.1 Structure Type & Requirement	- Span range: 75 m to 130 m
	- Superstructure Height: 6.0 m constant depth for incremental launching
	- Required footprint width for pier foundation: 8.0 m for main fixed pier and 2.0 m for other piers
	- A minimum of 6 piers are required to be constructed within core area of the yard.
		- Span range: 60 m to 80 m
		- Superstructure Height: 3.5 m constant depth for incremental launching
		- Smallest pier foundation footprint: 1.5 m at expansion piers and 4.0 m at fixed piers
		- A minimum of 11 piers are required to be constructed within core area of the yard.
			- Span range: 180 m to 230 m for Extradosed Bridge
			- Maximum Superstructure Height:
			  - At pier: 7.3 m
			  - At midspan: 3.3 m
			  - Approximate Tower Height: 20.0 m
			- Required footprint width for pier foundation: 12.0 m for main fixed pier and 2.5 m for other piers.
				- Span range: 80 m to 140 m
				- Maximum Superstructure Height:
				  - At Pier: 7.2 m
				  - At midspan: 3.2 m
				- Required footprint width for pier foundation: 10.0 m for main fixed pier and 2.5 m for other piers
				- A minimum of 5 piers are required to be constructed within core area of the yard.
					- East and west open approaches are a total of 470 m long.
					- East and west cut and cover tunnel are a total of 535 m long.
					- Tunnel length is 780 m with the tunnel invert at each portal about 20 m below ground surface.
					- The radius of the tunnel is 13.4 m including the roadway,

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
			- A minimum of 4 piers are required to be constructed within core area of the yard. - Towers above the deck need to be evaluated for safety and impact on the Pearson Airport and Transport Canada regulations or height restrictions related to airport landing glide slopes.		emergency walkway and ventilation allowance. - A total of three tunnels are provided. Each of the two outside tunnels allow for a single direction of travel. Reversible lanes are provided in the middle tunnel.
2.2 Constructability	- Pier foundation construction may require track protections and temporary disruption to adjacent tracks. Less disruption is expected than Alternative 1B due to lesser number of piers and foundations to be constructed. - Incremental launching method to be used for superstructure construction where the girders to be launched from the temporary platform area, and as such, the disruption of CN operation to be minimized during superstructure construction. - Special launching method and monitoring system need to be developed and further investigated for launching 130 m long girders. Only few structures have been constructed worldwide for launching 130 m long girders	- Pier foundation construction may require track protections and temporary disruption to adjacent tracks. More disruption is expected than other alternatives due to largest number of piers and foundations to be constructed. - Incremental launching method to be used for superstructure construction where the girders to be launched from the temporary platform area, and as such, the disruption of CN operation to be minimized during superstructure construction. - Temporary platform will be required for girder and launching nose assembly. A minimum of 85 m platform length is required. - Lead time for girder fabrication and delivery to the temporary platform will be required.	- Pier foundation construction may require track protections and temporary disruption to adjacent tracks. Less disruption is expected than any other alternatives due to least number of piers and foundations to be constructed. - Balanced segmental construction method to be used for superstructure construction where the girders to be cantilevered to both sides from the pier and tower utilizing prestressing tendons and cables; therefore, the disruption of CN operation to be minimized during superstructure construction. - Knowledge and labour to construct this bridge is not entirely available in Ontario. “Outside” assistance would be required. Similar cable supported bridges have been built in Ontario recently (Nipigon Bridge).	- Pier foundation construction may require track protections and temporary disruption to adjacent tracks. Less disruption is expected than Alternatives 1 and 1A due to a smaller number of piers and foundations to be constructed. - Balanced segmental construction method to be used for superstructure construction where the girders to be cantilevered to both sides from the pier utilizing prestressing tendons and therefore, the disruption of CN operation to be minimized during superstructure construction. - Knowledge and labour to construct this bridge is available in Ontario. Similar construction methodology has been employed recently on the Fairway Road Bridge (Region of Waterloo). In	- The Tunnel Boring Machine will be launched from one end to the other. The excavated material will be removed by muck cars and disposed off-site. - Ground improvement is needed to stabilize the ground and minimize ground movement and ground loss outside of the core area of the yard. - A monitoring program is required to monitor ground response within the core area of the yard. Rail operations will be maintained at all time during construction, although minor disruption to a single track maybe required. Track re-ballasting may be needed occasionally to maintain track vertical alignment. - Personnel entry into working chamber of the boring machine is required if obstructions (boulders) are

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
	(Typical span for the launching method is up to 85 m). As such, more difficulties and challenges are expected than other alternatives. - Temporary platform will be required for girder and launching nose assembly. A minimum of 130 m platform length is required. - Lead time for girder fabrication and delivery to the temporary platform will be required.	- Less difficulties and challenges are expected than other alternatives due to short span bridge construction with the use of conventional launching method.		addition, MTO is planning to build other segmental concrete bridge.	encountered. The machine will be equipped with personnel and equipment locks and fitted for compressed air entry. - Complex and challenging construction requirements comparing to the other alternatives.
2.3 Construction Access	- Existing CN maintenance//access road might be utilized as an access for the foundation and pier construction. - New temporary access road for temporary CN track crossing would need to be installed as required (Less temporary crossing would be required than Alternative 1B due to the lesser number of foundations and piers). - Temporary work platform to assemble launching nose and girders will require the parking/storage area on the west of CN yard during construction.	- Existing CN maintenance/access road might be utilized as an access for the foundation and pier construction. - New temporary access road for temporary CN track crossing would need to be installed as required (More temporary crossing would be required than other alternatives due to the greatest number of foundations and piers for this alternative). - Temporary work platform to assemble launching nose and girders will require the parking/storage area on the west of CN yard during construction.	- Existing CN maintenance/access road might be utilized as an access for the foundation and pier construction. - New temporary access road for temporary CN track crossing would need to be installed as required (Least temporary crossing would be required than other alternatives due to least number of foundations and piers required for this alternative.	- Existing CN maintenance/access road might be utilized as an access for the foundation and pier construction. - New temporary access road for temporary CN track crossing would need to be installed as required (Less temporary crossing would be required than Alternatives 1 and 1A due to lesser number of foundations and piers).	- The access with be from areas outside of the yard. Temporary access may be required for monitoring purposes during construction within the core area of the yard.

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
Preference					
Summary	In terms of construction access, the alternatives with more piers would require more complex access strategy; however, it is determined that the access to the bridge piers can be accommodated for all alternatives and construction access is not considered to be a critical factor in selecting the preferred alternative. Alternative 4 has the most complex and challenging construction requirements, thus is the least preferred alternatives. Alternative 1B is the most preferred alternative as it is the least difficult structure type to construct. Alternative 2 is the second least preferred as special knowledge and construction method are required. Alternatives 1A and 3 are similar in the terms of degrees of difficulties to construct and are the second most preferred alternatives.				
3.0 CN Operation					
3.1 Track Displacement (Permanent/Temporary)	- Relatively large number of tracks may be required to be temporarily realigned during construction as this alternative has the second largest number of piers.	- Permanent displacement or realignment of the service tracks on the west side of the yard may be required. - Temporary realignment of the service tracks on the east side of the yard may be required during construction. - Largest number of tracks may be required to be temporarily realigned during construction as this alternative has the largest number of piers.	- Temporary realignment of the service tracks on the east side of the yard may be required during construction. - Least number of tracks may be required to be temporarily realigned during construction as this alternative has the least number of piers.	- Temporary realignment of the service tracks on the east side of the yard may be required during construction. - Relatively low number of tracks may be required to be temporarily realigned during construction as this alternative has less piers than Alternatives 1, 1A and 2.	- Long-term displacement or realignment of the service tracks on the east and west side of the yard may be required. - No permanent displacement of tracks is expected within the core area of the yard.
3.2 CN Daily Operation Impact	- Relatively high potential for temporary disruption to tracks adjacent to pier locations as construction as this alternative has the second largest number of piers. - Relatively high level of coordination with CN for flagging will be required during construction. - Relative short-term disruption of CN operation during launching of steel	- Highest potential for temporary disruption to tracks adjacent to pier locations as this alternative has the largest number of piers. - Highest level of coordination with CN for flagging will be required during construction. - Short term disruption of CN operation during launching of steel girders. After girder launching is completed, relatively short duration of overhead construction over	- Lowest potential for temporary disruption to tracks adjacent to pier locations as this alternative has the least number of piers. - Lowest level of coordination with CN for flagging will be required during construction. - Longest duration of overhead construction over live traffic is expected as this alternative has the longest span length.	- Relatively low potential for temporary disruption to tracks adjacent to pier locations as this alternative has less piers than Alternatives 1, 1A and 2. - Relatively low level of coordination with CN for flagging will be required during construction. - Relative Long duration of overhead construction over live traffic is expected as this	- Ongoing monitoring of track stability required during construction. - Impacts to daily operation of the core area of the yard is not expected. - Minor disruption of a single track is expected for installation of instrumentation prior to tunnel construction.

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
	girders. After girder launching is completed, relatively short duration of overhead construction over the live train traffic is expected to install formworks for bridge deck construction. A “netting” system will be installed prior to the formwork installation to prevent the workers and construction debris/equipment from falling on the train tracks.	the live train traffic is expected to install formworks for bridge deck construction. A “netting” system will be installed prior to the formwork installation to prevent the workers and construction debris/equipment from falling on the train tracks.	- A “netting” system will be incorporated into the balanced segmental construction method to prevent the workers and construction debris/equipment from falling on the train tracks during construction.	alternative has the second longest span length. - A “netting” system will be incorporated into the balanced segmental construction method to prevent the workers and construction debris/equipment from falling on the train tracks during construction.	
3.3 CN Internal Access Road Impact	- Interference with traffic along the existing access roads is expected during construction. - Loss of pavement width along the access road to the mechanic shop due to the placement of the pier.	- Interference with traffic along the existing access roads is expected during construction. - Loss of pavement width along the access road to the mechanic shop due to the placement of the pier. - One access road on the east side of yard is potentially blocked by the pier.	- Interference with traffic along the existing access roads is expected during construction. - One access road on the east side of yard is potentially blocked by the pier.	- Interference with traffic along the existing access roads is expected during construction. - One access road on the east side of yard is potentially blocked by the pier.	- Access roads on the west and east edges of the yard are required to be realigned. - Impacts to the access roads are not expected within the core area of the yard.
3.4 Yard Security	- Potential for public to observe CN operation from the structure or throw objects into the yard. Barrier / screening may be installed.	- Potential for public to observe CN operation from the structure or throw objects into the yard. Barrier / screening may be installed.	- Potential for public to observe CN operation from the structure or throw objects into the yard. Barrier / screening may be installed.	- Potential for public to observe CN operation from the structure or throw objects into the yard. Barrier / screening may be installed.	- No security concerns.
3.5 Flexibility for Future track relocation	- Relative low flexibility is provided for as this alternative provides second smallest clear spacing between each pier.	- Flexibility of future track relocations will be very limited due to the limited clear spacing between each pier.	- The most flexibility will be provided as this alternative provides the largest clear spacing between each pier.	- Relatively more flexibility is provided as this alternative provides larger clear spacing between each pier than Alternatives 1, 1A and 2.	- No impact to the flexibility for future track relocation within the core area of the yard.

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
3.6 Utilities Impact	- Relatively high potential of utility impacts as this alternative has the second largest number of piers.	- Highest potential of utility impacts as this alternative has the largest number of piers.	- Lowest potential of utility impacts as this Alternative has the least number of piers.	- Relatively low potential of utility impacts as this alternative has less number of piers than Alternative 1, 1A and 2.	- Relatively high potential of underground utility impacts.
3.7 Maintenance/Inspection Accessibility	- Inspection catwalk will be provided and biennial inspection using bridge master will be required to avoid access to CN MacMillan Rail Yard. - No special consideration required for inspection and maintenance schedule.	- Inspection catwalk will be provided and biennial inspection using bridge master will be required to avoid access to CN MacMillan Rail Yard. - No special consideration required for inspection and maintenance schedule.	- Inspection can be done from inside of boxes and catwalk will be provided for exterior inspection. - High level of maintenance and inspection for towers and cables are expected.	- Inspection can be done from inside of boxes and catwalk will be provided for exterior inspection. - No special consideration required for inspection and maintenance schedule.	- Dedicated operational approach is required where trained human operators will be monitoring the tunnel 24/7. - Periodic tunnel closures are required to allow for system maintenance and repairs.
Preference					
Summary	Impact to CN operation is considered to be a key factor in selecting the preferred alternative. Alternatives with a greater number of piers would have higher impact to the CN operation. Alternative 4 is the most preferred alternative as it has minimum impact to CN operation during and post construction; whereas, Alternative 1B is the least preferred due to the largest number of piers. Alternatives 1A, 2 and 3 require 6 piers, 5 piers and 4 piers, respectively, resulting in similar impacts to CN operations.				
4.0 Transportation & Other Considerations					
4.1 Geometrics (Alignment and Profile)	- The equivalent design speed is equal or great than 70 km/h on both approaches of the structure.	- The equivalent design speed is equal or great than 70 km/h on both approaches of the structure.	- The equivalent design speed is equal or great than 70 km/h on both approaches of the structure.	- The equivalent design speed is equal or great than 70 km/h on both approaches of the structure.	- The equivalent design speed is equal or great than 70 km/h on both approaches of the structure.
4.2 Traffic Operation (i.e. Impact to Adjacent Intersection)	- Temporary impacts to Langstaff Road/Creditstone Road intersection and Langstaff Road/Keele Street intersection during construction.	- Temporary impacts to Langstaff Road/Creditstone Road intersection and Langstaff Road/Keele Street intersection during construction.	- Temporary impacts to Langstaff Road/Creditstone Road intersection and Langstaff Road/Keele Street intersection during construction.	- Temporary impacts to Langstaff Road/Creditstone Road intersection and Langstaff Road/Keele Street intersection during construction.	- Temporary impacts to Langstaff Road/Creditstone Road intersection. - Langstaff Road will go under Keele Street east of the Yard. Alternative access from Langstaff Road to Keele Street will be provided via slip

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
					ramps (a 'jug-handle' intersection)
4.3 Active Transportation	- Active Transportation facilities can be accommodated.	- Active Transportation facilities can be accommodated.	- Active Transportation facilities can be accommodated.	- Active Transportation facilities can be accommodated.	- Sidewalk and bike-lanes cannot be accommodated within a tunnel.
4.4 Safety	- No new challenges to incident management is anticipated.	- No new challenges to incident management is anticipated.	- No new challenges to incident management is anticipated.	- No new challenges to incident management is anticipated.	- Significant safety concerns for explosive goods transportation within the tunnel. - Emergency egress/access will be provided and the installed ventilation system capacity is ultimately determined by requirement for emergency smoke control during a tunnel fire incident. - Emergency plan will be in place.
Preference					
Summary	Alternative 4 has the greatest impact to the adjacent intersections as alternate connection from Keele Street is required due to the grade separation at Keele Street. Active Transportation facilities will not be accommodated in the tunnel due to significant safety concerns and the difficulties in providing emergence egress/access. The discontinuity of active transportation under Alternative 4 is not consistent with York Region's policy to enhance the active transportation network. Other alternatives result similar transportation improvements.				
5.0 Cost					
5.1 Capital Cost (in 2018 dollars)	$180 M	$145 M	$210 M	$200 M	$949 M
5.2 Maintenance Cost	$18 M	$14 M	$21 M	$20 M	$8 M - $10 M
Preference					
Summary	The cost for Alternatives 4 is significantly higher compared to the other alternatives. The costs for all the other alternatives are in a similar range with Alternative 1B being the lowest and Alternative 2 being the highest. Alternative 1A has the second lowest cost.				

Factors/Criteria	Alternative 1A - Steel Box Girder Bridge – Long Spans (South Alignment)	Alternative 1B - Steel Box Girder Bridge – Short Spans (South Alignment)	Alternative 2 - Extradosed Bridge (South Alignment)	Alternative 3 - Post-tensioned Segmental Concrete Bridge (South Alignment)	Alternative 4 - Tunnel Option (Central Alignment)
Overall Preference	**Recommended**				
Overall Summary	Alternative 4 has the least impact to CN operation; however, the cost is not economically feasible, therefore it is not considered to be a preferred alternative. Amongst Alternatives 1A, 1B, 2 and 3, Alternative 1B has the greatest impact to CN operation, and therefore it is not considered to be a preferred alternative. The remaining alternatives (1A, 2 and 3) all have similar socio-economic and transportation impacts and similar impacts to CN operation. Given Alternative 1A has the lowest cost of the remaining three alternatives and is the simplest structure to construct, **Alternative 1A is selected as the technically preferred alternative.**				

8.6 Consideration of Highway 400 Interchange Improvements

Based on findings from the traffic analysis completed as part of the Langstaff Road Class EA study, improvements on the Langstaff Road / Highway 400 interchange would support future growth in York Region and the overall needs in the Region's future transportation network. Through the review of various Highway 400 / Langstaff Road interchange alternatives and associated traffic analysis completed as part of the Class EA study, as well as consultation with MTO and City of Vaughan, it was acknowledged that the planning and design of the Highway 400 / Langstaff Road interchange will be a complex undertaking. The extent of the improvements associated with the Highway 400 / Langstaff Road interchange is expected to span well beyond the immediate area of Highway 400 / Langstaff Road, and could potentially include a core/collector system. Preliminary design concepts, analysis, and design challenges/concerns completed during the Class EA study have been compiled and submitted to York Region, to serve as a base line for any future studies.

With the design and analysis conducted as part of this Class EA study, the Ministry has not accepted the proposed interchange concept at this time. The Highway 400 / Langstaff Road interchange improvements will not be included as part of the current Langstaff Road Class EA study and may be subject to a future study.

8.7 Preliminary Preferred Design Alternative

Improvements to Langstaff Road is outlined below. There are specific focus areas that have been further refined as described in **Section 8.9**.

Based on the evaluation of the various design components for the improvements on Langstaff Road presented in the previous sub-sections in **Chapter 8 (i.e. Sections 8.1 to 8.5)**, a Preliminary Preferred Design was developed for public review at Open House 2 (OH2) in November 2018. The design plan encompassed the following key aspects:

- Widen Langstaff Road to six general-purpose lanes from Weston Road to Highway 7.
- Provide sidewalk and cycle track separated by planting zone on both sides of Langstaff Road;

- Construct overpass structure (Steel Box Girder Bridge – Long Spans) across CN MacMillan Rail Yard, along the south alignment;
- Construct overpass structure (Langstaff Road over rail tracks) at Metrolinx GO Transit Barrie Line crossing;
- Replace Bowes Bridge at the West Don River crossing;
- Intersection improvements which include extending turning lane storage, and adding dedicated right-turn lanes at intersections with a bus stop;
- Intersection design compliant with *Accessibility for Ontarians with Disabilities Act*;
- Identify general footprint for YRT amenity consideration, subject to future YRT service plan; and
- Streetscape / landscape enhancements, mitigation / replacement for street tree removals and other amenities (benches, gathering areas).

The Project Team was in consultation with MTO regarding the consideration of Highway 400 / Langstaff Road interchange improvement at the time of OH2. At OH2, it was noted to the public that Highway 400 / Langstaff Road interchange improvements were to be confirmed. Subsequent to OH2 (as noted in **Section 8.6**), the planning for the Highway 400 / Langstaff Road interchange improvements will be subject to a future corridor study.

8.8 Consultation During Phase 3

8.8.1 Open House 2 (November 28, 2018)

The public consultation aspects of the Langstaff Road Class EA study are documented in **Chapter 2**, and are summarized here as they specifically relate to Phase 3 of the Class EA process.

A summary of the feedback received related to the transportation needs assessment and the assessment of alternative planning solutions, as presented at OH1 is provided in **Chapter 7**.

Open House 2 was held on November 28, 2018. The purpose of the OH2 was to present the Preliminary Preferred Design Alternative for proposed improvements on Langstaff Road as noted in the previous section.

Comments received and Region responses are provided in **Appendix C**. The key feedback received around OH2 included the following general themes:

- Crossing of CN MacMillan Rail Yard is generally well supported, and public recognizes there is a need for a crossing;
- Support for Highway 400 / Langstaff Road interchange improvements;
- Improvements to signal timing on other Regional Roads;
- Improvements to Active Transportation (AT) facilities and AT connection;
- Concerns regarding traffic/truck infiltration on residential roads and on Langstaff Road west of Weston Road;
- Questions regarding congestion on other parallel corridors and north-south crossing roads; and
- Concerns regarding property impacts.

8.8.2 Stakeholder and Agency Meetings During Phase 3

Chapter 2 documents all meetings with stakeholders and agencies during the Class EA study. Meetings convened during Phases 3 of the Class EA study included:

- MTO (6 meetings – November 30, 2017, March 22, 2018, August 8, 2018, August 13, 2019, March 26, 2021; July 22, 2021 and one Design Workshop – October 4, 2018);
- City of Vaughan (3 meeting – December 12, 2017, September 18, 2018, July 15 2021)
- CN Rail (3 meetings – November 1, 2017, May 28, 2018, December 21, 2020);
- TRCA (1 meeting – April 5, 2018); and
- Metrolinx (1 meeting – January 19, 2018)
- Property Owners
    - 8500 Keele Street (1 meeting, February 5, 2021)
    - 8470 Keele Street (2 meetings, December 6, 2018, January 30, 2019)
    - 8575 Keele Street (1 meeting, February 24, 2020)
    - 2777 Langstaff Road (1 meeting, October 28, 2020)
    - 65 Basaltic Road (1 meeting, December 6, 2018)
    - 2180 Langstaff Road (1 meeting, February 14, 2019)

8.9 Confirmation of Preferred Design Plan

8.9.1 Langstaff Road Active Transportation Facility from Dufferin Street to Highway 7

Langstaff Road is proposed to be widened to six lanes from Weston Road and Dufferin Street. From Dufferin Street to Highway 7, Langstaff Road is proposed to remain as the existing 4-lane road through this section. There are existing sidewalks on both sides of Langstaff Road between Dufferin Street and Highway 7.

The proposed typical cross-section of Langstaff Road between Weston Road and Dufferin Street includes a cycle track in the boulevard and a sidewalk on both sides of the road, separated by a tree planting zone.

At OH2, one of the comments collected inquired about the continuity of the cycling facility on Langstaff Road east of Dufferin Street. Subsequently, a high-level screening analysis of the provision of active transportation facility improvements on Langstaff Road between Dufferin Street and Highway 7 was carried out and the following four alternatives were considered:

- Option 1: 3.0 m multi-use path (MUP) on both sides;
- Option 2: Sidewalk and cycle track on the south side, separated by planting zone, and maintaining existing sidewalk on the northside side;
- Option 3: Sidewalk and on-street bike lane on both sides; and
- Option 4: Sidewalk and cycle track on both sides, separated by planting zone (i.e. same as Langstaff Road Cross-Section west of Dufferin Street).

Table 8-3 presents the high-level evaluation of the active transportation facility on Langstaff Road from Dufferin Street to Highway 7. Option 4 was selected as the preferred alternative as it provides active transportation facility enhancement and connection between Dufferin Street and Highway 7 on both sides of the road, which would provide continuous connectivity of the active transportation network between Weston Road and Highway 7. Option 4 underwent further refinements after being selected in order to maintain the existing ditch/green space and the existing sidewalks where feasible. The preferred alternative includes cycle track on both sides, separated by ditch/green space, while maintaining the existing sidewalk on both sides, as illustrated by **Exhibit 8-11**. The active transportation facility extension between Dufferin Street and Highway 7 is incorporated in the Preferred Design Plan which is discussed in **Chapter 8.9.2** of the ESR.

Exhibit 8-11: Langstaff Road Proposed Cross-Section from Dufferin Street to Highway 7

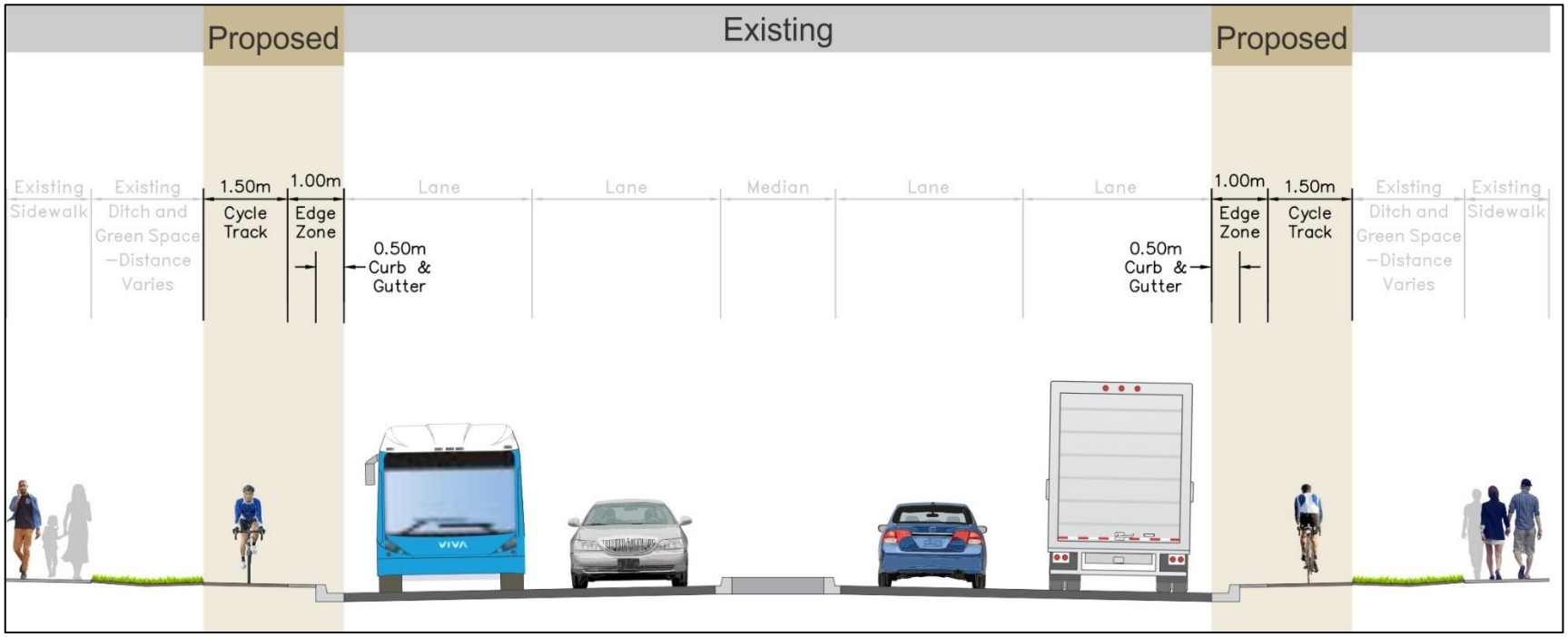


Table 8-3: Langstaff Road Active Transportation Facility Evaluation Table from Dufferin Street to Highway 7

Factors/Criteria	Option 1 3.0 m multi-use path (MUP) on both sides		Option 2 Sidewalk and cycle track on the south side, separated by planting zone, and sidewalk on the northside side		Option 3 Sidewalk on both sides, on-street bike lane on both sides		Option 4 Sidewalk and cycle track on both sides, separated by planting zone (i.e. same as Langstaff Road Cross-Section west of Dufferin Street)	
	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments
Planning Policies								
Consistency with Planning Policies – York Region	▶ The York Region 2016 TMP identifies this segment of Langstaff Road as a separated cycling facility (bikeways separated from traffic by more than just a painted line and may consist of bollards or delineators, mountable or barrier curbs, planters, concrete medians etc.). Types of separated facilities can include cycle tracks, raised bike lanes, or multi-use trails).							
	√	▶ This Option satisfies the classification as a separated cycling facility.	√	▶ This Option satisfies the classification as a separated cycling facility.	X	▶ This Option does not satisfy the classification as a separated cycling facility.	√	▶ This Option satisfies the classification as a separated cycling facility.
Consistency with Planning Policies – City of Vaughan	▶ The City of Vaughan Pedestrian and Bicycle Master Plan (2007) identifies the segment of Langstaff Road from Dufferin Street to Pleasant Ridge Avenue as a Community Multi-use Boulevard Pathway (CMBP) facility.							
	√	▶ Consistent with the City of Vaughan Planning Policies	√	▶ Consistent with the City of Vaughan Planning Policies	X	▶ Not consistent with the City of Vaughan Planning Policies	√	▶ Consistent with the City of Vaughan Planning Policies
Active Transportation Operation								
Separation between cyclists and motor vehicle traffic lane	√	▶ Offers full separation between cars and cyclists.	√	▶ Offers full separation between cars and cyclists.	X	▶ Does not offer separation between cars and cyclists.	√	▶ Offers full separation between cars and cyclists.
Separation between cyclists and pedestrians	X	▶ Does not provide separation between cyclists and pedestrians on either side of the roadway.	√	▶ Provides full separation between cyclists and pedestrians on both sides of the roadway.	√	▶ Provides full separation between cyclists and pedestrians on both sides of the roadway.	√	▶ Provides full separation between cyclists and pedestrians on both sides of the roadway.
Reduce conflicts between turning motorists and cyclists	√	▶ Conflicts are minimized between turning motorists and cyclists.	√	▶ Conflicts are minimized between turning motorists and cyclists.	X	▶ Potential conflicts with turning motorists and cyclists	√	▶ Conflicts are minimized between turning motorists and cyclists.
Connection to Existing and Planned Active Transportation Facilities	▶ Langstaff Road connects to the section of Highway 7, where cyclists are currently using the paved shoulder/boulevard. York Region noted that cycle tracks is anticipated to be added to Highway 7 in 2023/2024, with short section of the road transitioning to on-street bike lanes. ▶ Multi-use path is proposed on both sides of Dufferin Street as part of recently completed Dufferin Street Class EA study between Langstaff Road and Teston Road. ▶ The York Region 2016 TMP identifies Dufferin Street as a separated facility. Currently, cyclist are using the paved shoulder/boulevard south of Langstaff Road. ▶ The proposed Langstaff Road cross-section west of Dufferin Street has a 1.5 m cycle track and a 1.5 m sidewalk separated by 2.0 m planting zone on both sides.							

Factors/Criteria	Option 1 3.0 m multi-use path (MUP) on both sides		Option 2 Sidewalk and cycle track on the south side, separated by planting zone, and sidewalk on the northside side		Option 3 Sidewalk on both sides, on-street bike lane on both sides		Option 4 Sidewalk and cycle track on both sides, separated by planting zone (i.e. same as Langstaff Road Cross-Section west of Dufferin Street)	
	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments
	O	▶ Consistent with proposed and planned facilities on Dufferin Street. ▶ Somewhat consistent with the facilities on Langstaff Road west of Dufferin Street except the planting zone separating the cycle track and sidewalk. ▶ Not consistent with the existing facilities on Highway 7 and Dufferin Street south of Langstaff Road.	O	▶ Consistent with proposed and planned facilities on Dufferin Street only on one side. ▶ Somewhat consistent with the facilities only on one side of Langstaff Road west of Dufferin Street except the planting zone separating the cycle track and sidewalk. ▶ Not consistent with the existing facilities on Highway 7 and Dufferin Street south of Langstaff Road. ▶ Cyclist would be required to cross Langstaff Road to access the MUP on one side of the Langstaff Road east of Dufferin Street.	X	▶ Not consistent with proposed and planned facilities on Dufferin Street and Langstaff Road west of Dufferin Street. ▶ Would require transition from on road to off-road on Dufferin Street and Langstaff Road. ▶ Not consistent with the existing facilities on Highway 7 and Dufferin Street.	√	▶ Consistent with proposed facilities on Langstaff Road west of Dufferin Street and provide continuity to Highway 7.
Impacts to Existing Land Use								
Opportunities to improve streetscaping	O	▶ Does not preclude improvements to streetscaping. However, may be limited to available space within the existing right-of-way following the implementation of the 3 m MUP.	√	▶ Does not preclude improvements to streetscaping. ▶ Planting zone is being proposed between sidewalk and cycle track.	√	▶ Does not preclude improvements to streetscaping. However, may have less opportunity for planting zone compare to other alternatives.	√	▶ Does not preclude improvements to streetscaping. ▶ Planting zone is being proposed between sidewalk and cycle track.
Impacts to Utilities and Illumination	X	▶ Impact to the hydro poles on the north side and illumination poles on the south side.	O	▶ Impact to illumination poles on the south side.	√	▶ No impact.	X	▶ Impact to the hydro poles on the north side and illumination poles on the south side.
Impacts to existing grading	X	▶ Impacts to existing ditches on both sides. Ditches may be filled and replaced with storm sewer (i.e.	O	▶ Impact to existing ditches only on one side (south side). Existing ditches will be regraded to match to	O	▶ Existing shoulder will be paved to accommodate the on street bike lanes. Minor local impact to the	O	▶ Impact to existing ditches on both sides. Existing ditches will be regraded to

Factors/Criteria	Option 1 3.0 m multi-use path (MUP) on both sides		Option 2 Sidewalk and cycle track on the south side, separated by planting zone, and sidewalk on the northside side		Option 3 Sidewalk on both sides, on-street bike lane on both sides		Option 4 Sidewalk and cycle track on both sides, separated by planting zone (i.e. same as Langstaff Road Cross-Section west of Dufferin Street)	
	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments	Evaluation	Comments
		changing from rural to urban cross-section).		the active transportation facilities.		existing ditches. Existing ditches will be regraded to match to the on-street bike lanes.		match to the active transportation facilities.
Operation and Maintenance								
Opportunities for winter maintenance	O	▶ Would require two passes, on both sides, to clear full MUP width with smaller equipment.	O	▶ If cycle track were to be maintained during winter, two passes would be required to keep cycle track and sidewalk clear with smaller equipment.	√	▶ Allows for winter maintenance without having to make multiple/additional passes with snow clearing equipment. On street bike lanes will be cleared as part of the snow removal on the road.	O	▶ If cycle track were to be maintained during winter, two passes on both sides would be required to keep cycle track and sidewalk clear with smaller equipment.
Overall	O		O		X		√ **This is the preferred alternative**	

Legend		
Good	Fair	Poor
√	O	X

8.9.2 Langstaff Road Canadian National Railway (CN) MacMillan Rail Yard Crossing Alignment

The preliminary preferred Langstaff Road alignment follows the south alignment across the CN MacMillan Rail Yard, as discussed in **Section 8.5**. This alignment would impact the building located at 2777 Langstaff Road directly, immediately west of the CN MacMillan Rail Yard. The Project Team met with the property owner and its representatives on October 28, 2020 and agreed to review shifting the roadway alignment to avoid direct impact to the building, recognizing there is very limited flexibility to modify the tangent portion of the Langstaff Road alignment due to the various constraints within the rail yard and bridge constructability.

Following the meeting, Langstaff Road alignment was refined to avoid impacting the building by modifying the approach horizontal curves radii while maintaining the same tangent portion of alignment across the CN MacMillan Rail Yard. This alignment modification is incorporated in the Preferred Design Plan.

9 PROJECT DESCRIPTION

The Preferred Design Plan for the Langstaff Road Improvements between Weston Road and Highway 7 is described in this section and depicted on **Plates 1 to 24**, included in **Appendix A**.

9.1 Major Features

The Preferred Design Plan for Langstaff Road between Weston Road and Highway 7 includes the following aspects:

- Widen Langstaff Road to six general-purpose lanes from Weston Road to Highway 7;
- Provide sidewalk and cycle track separated by planting zone on both sides of Langstaff Road from Weston Road to Dufferin Street and provide cycle track on both sides from Dufferin Street to Highway 7 separated by ditch/green space while maintaining the existing sidewalk on both sides;
- Construct overpass structure (Steel Box Girder Bridge – Long Spans) across CN MacMillan Rail Yard, along the south alignment;
- Construct overpass structure (Langstaff Road over rail tracks) at Metrolinx GO Transit Barrie Line crossing;
- Replace Bowes Bridge at the West Don River crossing;
- Intersection improvements which include extending turning lane storage, and adding dedicated right-turn lanes at intersections with a bus stop;
- Intersection improvements for pedestrians and cyclists, such as cross-rides, reduced curb radii (where technically feasible), signal heads, etc.;
- Intersection design compliant with *Accessibility for Ontarians with Disabilities Act*;
- Identify general footprint for YRT amenity consideration, subject to future YRT service plan; and
- Streetscape / landscape enhancements, including street trees (with consideration for proper growth medium and soil volumes), mitigation / replacement for street tree removals and other amenities (benches, gathering areas).

9.1.1 Design Criteria

A 60 km/h design speed is applied for the Langstaff Road improvements except for the segment between Creditstone Road to Keele Street, where a 70 km/h design is applied. The design criteria are listed in **Table 9-1** and **Table 9-2**. The specific design elements are discussed in further details under the corresponding sub-sections of this section.

Table 9-1: Design Criteria (Langstaff Road)

Road Design Parameters	Present Conditions	Design Standards	Proposed Standards
Design Classification	UAU60	UAD60	UAD60 [a]
Posted Speed	60 km/h	60 km/h	60 km/h
Design Speed	60 km/h	60 km/h	60 km/h
Minimum Stopping Sight Distance	> 85 m	85 m	85 m
Equivalent Minimum 'K' Factor	15 Crest; 15 Sag	11 Crest; 8 Sag	15 Crest; 8 Sag
Grades Maximum	4%	6%	6%
Radius Minimum	190 m	150 m	190 m
Maximum Rate of Super Elevation	5%	4%	4%
Pavement Width	4 Through Lanes @ 3.5 m	4 Through Lanes @ 3.3 m 2 Curb Lanes @ 3.5 m	4 Through Lanes @ 3.3 m 2 Curb Lanes @ 3.5 m
Median Width	Varies	2.8 m	2.8 m
Right-of-Way Width	Varies	36 m	36 m
Provision for Pedestrians and Cyclists	Sidewalk only	Separated facilities (YRTMP)	1.5 m sidewalk 1.5 m cycle track Separated by 1.0 m

Table 9-2: Design Criteria (Between Creditstone Road and Keele Street)

Road Design Parameters	Present Conditions	Design Standards	Proposed Standards
Design Classification	UAU60	UAD70	UAD70
Posted Speed	60 km/h	60 km/h	60 km/h
Design Speed	60 km/h	70 km/h	70 km/h
Minimum Stopping Sight Distance	> 85 m	85 m	85 m
Equivalent Minimum 'K' Factor	15 Crest; 15 Sag	17 Crest; 10 Sag	26 Crest; 15 Sag
Grades Maximum	4%	6%	4%
Radius Minimum	190 m	200 m	200 m
Maximum Rate of Super Elevation	5%	4%	4%
Pavement Width	4 Through Lanes @ 3.5 m	4 Through Lanes @ 3.3 m 2 Curb Lanes @ 3.5 m	4 Through Lanes @ 3.3 m 2 Curb Lanes @ 3.5 m
Median Width	Varies	2.8 m	2.8 m
Right-of-Way Width	Varies	36 m	36 m
Provision for Pedestrians and Cyclists	Sidewalk only	Separated facilities (YRTMP)	1.5 m sidewalk 1.5 m cycle track Separated by 1.0 m

9.1.2 Horizontal Alignment

The proposed horizontal alignment of Langstaff Road generally follows that of the existing alignment on either side of the CN MacMillan Rail Yard, from Weston Road to Creditstone Road and from Keele Street to Highway 7. The design speed for these two segments is 60 km/h. There are a number of locations where the horizontal alignment is proposed to be shifted slightly to the north or south to best fit within the existing 36 m right-of-way and minimize property impacts where feasible.

Between Keele Street and just east of Planchet Road, the proposed horizontal alignment is shifted to north by a maximum shift of approximately 5.0 m, to avoid direct impact to the Langstaff Cemetery (Old St. Stephen's Cemetery) located immediately south of Langstaff Road, just west of the Planchet Road intersection.

From Creditstone Road easterly, the proposed Langstaff Road horizontal alignment swings to the south to follow the preferred CN MacMillan Rail Yard crossing 'South Alignment' and swing to the north as it approaches Keel Street to match the existing horizontal alignment of Langstaff Road at Keele Street. The design speed for this segment of Langstaff Road is 70 km/h. The increase in design speed is provide a safer horizontal geometry for drives to maneuver through the curves while either climbing upgrade or going downgrade on the approaches of the CN MacMillan Rail Yard crossing structure. The proposed horizontal curve radii are 200 m based on a superelevation rate of 4%.

9.1.3 Vertical Alignment

The proposed Langstaff Road generally follows the existing road profile where possible. Changes to the road profile are proposed at the CN MacMillan Rail Yard crossing, West River crossing and Metrolinx GO Transit Barrie Line crossing. The proposed vertical alignment elements at each crossing location are summarized in **Table 9-3**. For details and general arrangement of the respective structure, see **Section 9.1.7**.

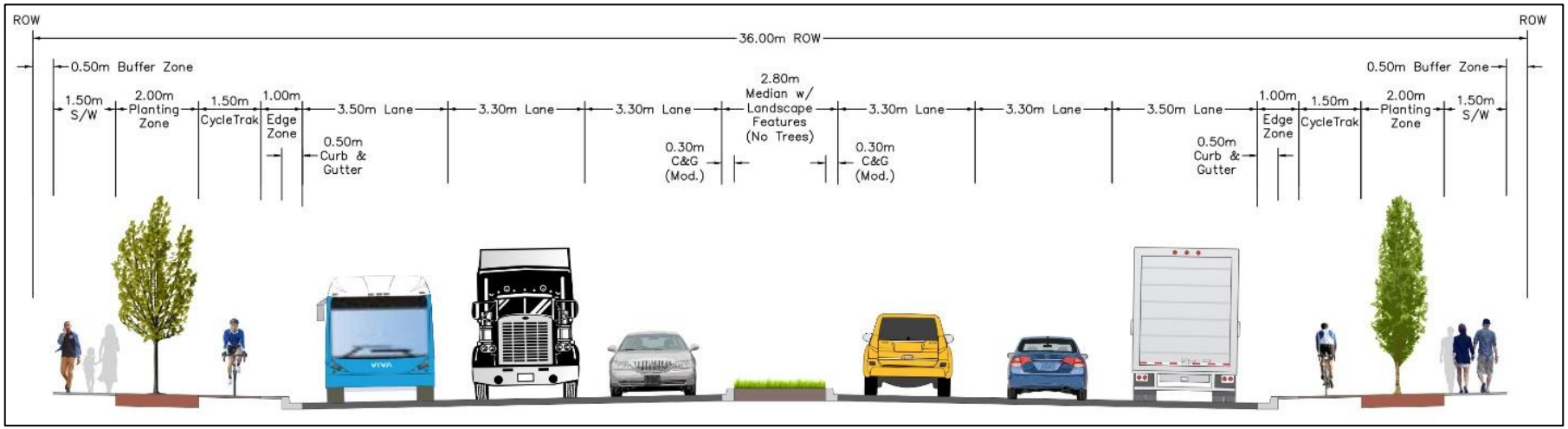
Table 9-3: Proposed Vertical Alignment Elements at Crossing Locations (from west to east)

Location	Grade (%)	Equivalent Minimum 'K' Factor	Grade (%)
CN MacMillan Rail Yard Crossing	4%	26 (crest); 15 (sag)	-4%
West Don River Crossing	-4%	26 (sag); 48 (sag)	-0.9%
GO Transit Barrie Line Crossing	5.4% / 6%	15 (crest); 8 (sag)	-6%

9.1.4 Typical Cross-Sections

Langstaff Road has a designated right-of-way width of 36 m per York Region Official Plan. The roadway widening can largely be accommodated within the existing right-of-way. The typical cross-section for Langstaff Road between Weston Road to Highway 7 is presented on **Exhibit 9-1**.

Exhibit 9-1: Langstaff Road Typical Cross-Section from Weston Road to Highway 7



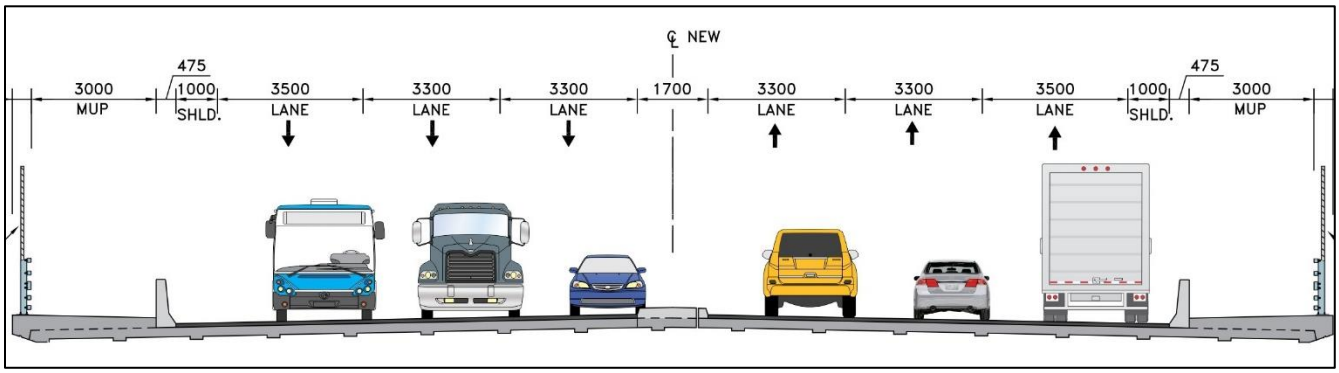
Langstaff Road will be constructed as a 6-lane urban road and the cross-sectional elements typically consists of:

- Three general-purpose lanes in each direction. The lane width for outside lanes is 3.5 m and the lane width for the remaining lanes is 3.3 m;
- A raised median with a typical width of 2.8 m;
- A 1.5 m sidewalk and 1.5 m cycle track separated by a 2.0 m planting zone behind the 0.5 m curb and gutter and 1.0 m edge zone in each direction.

Langstaff Road cross-section is reduced at overpass bridge locations by removing the 2.0 m planting zone between the sidewalk and the cycle track for a smaller footprint. The sidewalk and cycle track will be combined as a multi-use path at the overpass bridge. A barrier will be provided between the shoulder and the multi-use path. The Langstaff Road typical cross-section at overpass structure locations is presented on **Exhibit 9-2**. For details and general arrangement of the respective structure, see **Section 9.1.7**.

On the approaches to the CN MacMillan Rail Yard structure (west and east), the lane width is proposed to be increased to 3.75 m for all six general-purpose lanes along the horizontal curves with radii of 200 m. The 3.75 m lane width was confirmed by checking the swept patch of WB-20 type of tractor-trailer via AutoTURN.

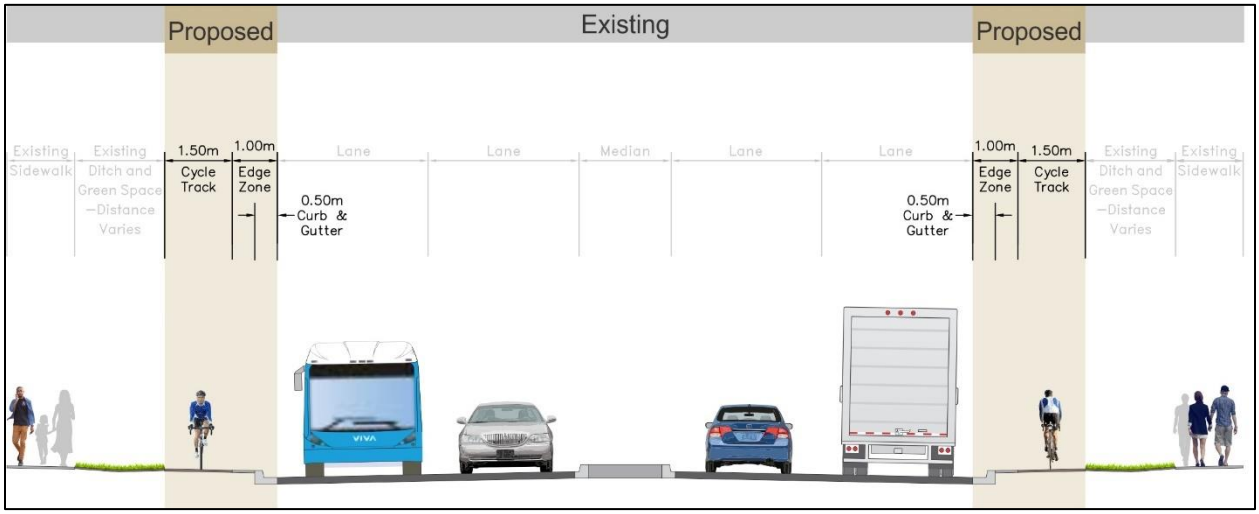
Exhibit 9-2: Langstaff Road Overpass Bridge Typical Cross-Section



Langstaff Road will remain as a 4-lane cross-section from Dufferin Street and Highway 7. A 1.5 m cycle track separated by the existing ditch/green space while maintaining the existing sidewalk on both sides is proposed to be implemented on

Langstaff Road from Dufferin Street to Highway 7. The proposed Langstaff Road cross-section from Dufferin Street to Highway 7 is presented on **Exhibit 9-3**.

Exhibit 9-3: Langstaff Road Typical Cross-Section from Dufferin Street to Highway 7



9.1.5 Active Transportation

Active Transportation (AT) facilities on Langstaff Road are based on recommendation in the York Region Pedestrian and Cycling Master Plan (2008) and the York Region Transportation Master Plan (2016). The facilities will accommodate cyclists and pedestrians and will provide connections within the overall active transportation system in the Region. This will support and encourage active transportation use in the community for pedestrians and cyclists.

As presented in the previous section, the sidewalk and cycle track will be separated by a planting zone. This type of separated AT facility will be provided from Weston Road to Highway 7 on the south side of Langstaff Road. On the north side of Langstaff Road, the separated AT facility will be provided from Weston Road and Dufferin Street. Between Dufferin Street and Highway 7, the existing sidewalk will be maintained with no additional cycling facility to avoid major utility impacts. The separation between sidewalk and cycle track will be removed on overpass bridges and at bus stop locations for a smaller footprint. The AT facility is proposed to go behind the bus pads at transit stop locations.

During detailed design, connections of AT facilities to future facilities on major north-south cross-street will be considered; for example, at Weston Road, Edgeley Boulevard, Millway Avenue, Jane Street, Creditstone Road, Keele Street, Staffern Drive / North Rivermede Road, Dufferin Street and Highway 7.

The implementation of active transportation facilities, including intersection treatment,

will be finalized during detailed design in consultation with the City of Vaughan and taking into consideration the most current design guidelines at the time.

It should be noted that a portion of the City of Vaughan Bartley Smith Greenway Trail is located in the proximity of Langstaff Road near Planchet Road. The City is currently undergoing a feasibility study in closing the gap of the Bartley Smith Greenway Trail between McNaughton Road and Rutherford Road. It is expected that the City will be reviewing other gaps along the trail in the future including potential connection or crossing at Langstaff Road. Consideration about planning status of the Bartley Smith Greenway Trail should be included in detailed design and the relevant technical agencies will be consulted at that time. Considerations should include a trail underpass at Bowes Bridge and associated connections to Langstaff Road.

9.1.6 Transit

The York Region TMP identifies Langstaff Road as part of the ultimate Frequent Transit Network, providing transit service every 15 minutes; in addition, as discussed in **Section 3.2.4**, the TMP also identifies Langstaff Road as a goods movement corridor. The provision of additional general-purpose curb lanes is considered to be more preferred in addressing the future transportation needs on Langstaff Road. Through consultation with York Region Transit (YRT) as part of the Class EA study, the recommendation of general-purpose curb lanes was accepted; however, it is requested by YRT that a dedicated right-turn lane be provided at bus stop locations at intersections. It is also confirmed that all bus stops should be located on the near side of the intersection. For the purpose of the study, bus stops have been identified and included as part of the Recommended Plan at each intersection between Weston Road and Dufferin Street. Further review and consultation with YRT will be required in detailed design to confirm the exact bus stop locations subject to future transit service plan, types of transit amenities, etc.

9.1.7 Structures

As part of the Langstaff Road Class EA study, the following structures are proposed along Langstaff Road (from west to east). The Preliminary Structural Design Reports. can be found in **Appendix L** for the respective structure:

- CN MacMillan Rail Yard Structures;
- Bowes Bridge (West Don River Structure); and
- Metrolinx GO Transit Barrie Line Structure.

The design of all three structures will be subject to update and modification during detailed design. The following design codes and references will be used during detailed design including the Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-19, MTO Structural Manual 2016, MTO directives and standards and Ontario Provincial Standard Specification (OPSS).

9.1.7.1 Canadian National Railway (CN) MacMillan Rail Structures

Currently, Langstaff Road terminates on either side of the CN MacMillan Rail Yard. Through the Langstaff Road Class EA study, it is proposed that a structure be provided across the CN MacMillan Rail Yard to provide additional east-west capacity and active transportation facilities.

Geotechnical Investigation and Foundations Requirements

A Preliminary Geotechnical Investigation Report has been completed by Thurber Engineering Ltd., included in **Appendix M**. Geotechnical and foundations findings associated with the CN MacMillan Rail crossing structures can be found in the Geotechnical Investigation Report. It should be noted that the findings are preliminary only as access to the CN MacMillan Rail Yard was not permitted by CN Rail at the time of Class EA study.

Therefore, the preliminary foundation design recommendations do not necessarily reflect the actual conditions at the locations of the foundation units, and should be considered for their general implications. A detailed drilling program will be required to confirm conditions at each individual foundation unit during detailed design.

Proposed Structures

Details associated with the proposed CN MacMillan Rail Yard crossing structures can be found in **Appendix L1**.

The proposed CN MacMillan Rail Yard crossing main structures are Steel Box Girder Bridges, as shown in **Exhibit 9-4**. The main bridge spans from pier 2 to pier 8, which is largely on the straight portions of the horizontal and vertical alignments, will be constructed with a launching method where the girder segments will be assembled and slid to the final position by the hydraulic jacking system from the temporary launching platform area which will be constructed in advanced of launching at the west side of the main bridge spans. A 6 m deep steel box section was selected to ensure the strength and stability of the structure during the launching process.

The approach spans from west abutment to pier 2, and from pier 8 to east abutment, are on the curved portions of the horizontal and vertical alignments. The approach spans will be constructed with the conventional crane erection method from the ground at the approaches after the removal of the temporary launching platform. The approaches beyond bridge limit will be constructed with the Retained Soil System (RSS) walls to minimize the property impact.

A rigid frame type structure was selected to accommodate the high approach fills and to meet the desirable vertical clearance of the tracks. The structure is to be constructed on a curved portion of the horizontal alignment and on a constant 4 % upgrade of the vertical alignment.

The cross-section comprises the following, from north to south:

- 0.46 m north pedestrian/cyclist railing
- 3.00-4.00 m north multi-use path
- 0.475 m north concrete barrier wall
- 1.00 m shoulder
- (3.50 m ~ 3.75 m) + (3.30 m ~ 3.75 m) + (3.50 m ~ 3.75 m) three westbound lanes
- 1.700 m raised median
- (3.50 m ~ 3.75 m) + (3.30 m ~ 3.75 m) + (3.500m ~ 3.75 m) three eastbound lanes

- 1.00 m shoulder
- 0.475 m south concrete barrier wall
- 3.00 m south multi-use path
- 0.460 m south pedestrian/cyclist railing

An observation screening treatment is requested by CN to prevent roadway users from observing CN operations from the overhead structures will be further reviewed during detailed design.

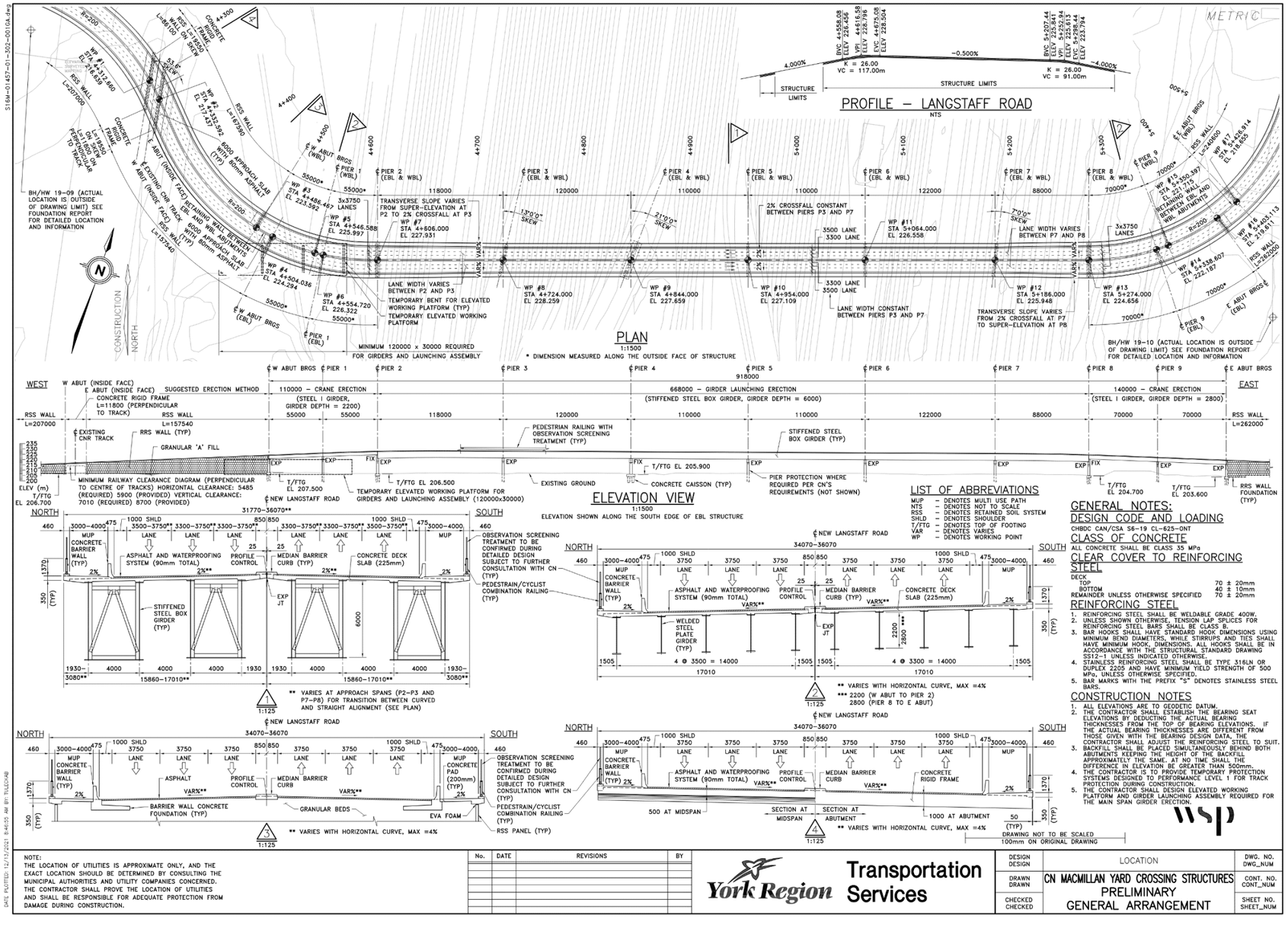
Construction Staging

The construction staging of the CN MacMillan Rail Yard crossing structure is reviewed at a high-level. The detailed staging strategy is to be reviewed in detailed design phase and through further consultation with CN. The construction could be carried out in three main stages. The estimated construction duration is approximately 5 years.

Under the first Stage, the foundations and substructures (piers and abutments) within the CN MacMillan Rail Yard are to be constructed and the elevated launching platform with the associated launching assembly can also be constructed simultaneously during the first stage of construction. Under the second stage, the main steel box girders will be launched and positioned to the final location and the superstructure will be completed. Under the final stage, the elevated launching platform will be removed and the approach steel I girders spans, approach RSS wall sections, and the rigid frame structure at the west approach will be constructed.

A high level constructability review was carried out to review construction access, potential impacts to CN operations (permanent and temporary) and mitigation measures at each bridge pier and abutment location. Details on this feasibility review can be found in **Appendix L1.**

Exhibit 9-4: CN MacMillan Rail Yard Crossing Structures General Arrangement Drawing



9.1.7.2 West Don River Crossing – Bowes Bridge

Bowes Bridge is located on Langstaff Road going over the West Don River approximately 180 m east of Keele Street. Constructed in 1964, the existing structure is a single span side-by-side prestressed precast hollow slab structure over the West Don River with a 15° skew to the roadway. The structure spans over the West Don River with a clear span of 10.67 m perpendicular to the bridge. The deck has a total width of 11.9 m and accommodates a single lane in each direction. The 150 mm thick reinforced concrete deck was placed over 500 mm deep precast hollow girders during the rehabilitation in 1995. There are 6.0 m long (measured along the skew), 250 mm thick approach slabs at the east and west ends of the structure. A total depth of 90 mm layers of waterproofing and asphalt are placed on top of the bridge.

The abutments are comprised of cast-in-place reinforced concrete stem walls. The foundation type of the abutment was not identified due to the absence of original drawings. There are retaining walls at each corner of the structure fanning toward the river. The abutments, wingwalls and retaining walls are constructed of reinforced concrete.

An inspection was completed by WSP on June 12, 2018 and the structure was found to be generally in good condition except for some localized areas that are in fair to poor conditions.

Geotechnical Investigation and Foundations Requirements

A Preliminary Geotechnical Investigation Report has been completed by Thurber Engineering Ltd., included in **Appendix M**. Geotechnical and foundations findings associated with the West Don River crossing can be found in the Geotechnical Investigation Report.

Proposed Structure

Details associated with the proposed West Don River crossing structures can be found in **Appendix L2**. A hydraulic assessment was undertaken to determine the needs of the bridge replacement and the sizing requirement of the replacement bridge. Based on the hydrology model, the existing bridge meets the freeboard requirement for the 100-year storm event; however, the Regional Storm overtops Langstaff Road by 1.01 m. As such, the existing structure is proposed to be replaced by a single span bridge with a minimum of 30 m clear span perpendicular to the opening. The details on the hydraulic

assessment are documented in Drainage and Stormwater Management Report included in **Appendix I**.

The General-Arrangement (GA) drawing of the proposed structure is shown in **Exhibit 9-5**. A single span side-by-side precast concrete box girder is proposed at this site for a new Langstaff Road 6-lane configuration. A span length of 32.0 m between the centre of bearings was determined to provide the 30 m clear span required from the hydraulic assessment as described above. An integral abutment configuration is proposed to eliminate the expansion joints at each abutment location and as per the geotechnical recommendations.

The proposed cross-section on the replacement structure comprises the following, from north to south:

- 0.46 m north pedestrian/cyclist railing
- 3.00-4.00 m north multi-use path
- 0.475 m north concrete barrier wall
- 1.00 m shoulder
- 3.50 m + 3.30 m + 3.30 m westbound lanes
- 1.70 m raised median
- 3.30 m + 3.30 m + 3.50 m eastbound lanes
- 1.00 m shoulder
- 0.475 m south concrete barrier wall
- 3.00 m south multi-use path
- 0.46 m south pedestrian/cyclist railing

Based on the project correspondence with Transport Canada's Navigation Protection Program (NPP), it was confirmed that West Don River would be considered as a navigable waterway. The proposed crossing structure can accommodate a navigational clearance of 4 m (Horizontal) x 2.5 m (Vertical), required for motorized boats up to 8.0 m in length; however, it will not be able to accommodate motorized boats larger than 8.0 m in length. Based on high level observation, the West Don River crossings upstream at Rutherford Road and downstream at Rivermede Road are not considered navigable as they are culvert crossings. Therefore, it is highly unlikely to have motorized boats larger than 8.0 m using this portion of the West Don River. Through

correspondence with NPP, NPP has subsequently confirmed that it is generally acceptable to provide a navigational clearance no less than the structures immediately upstream and downstream from the proposed new structure. An absolute determination can only be provided after the NPP has had an opportunity to review the submission, which is to be confirmed in detailed design.

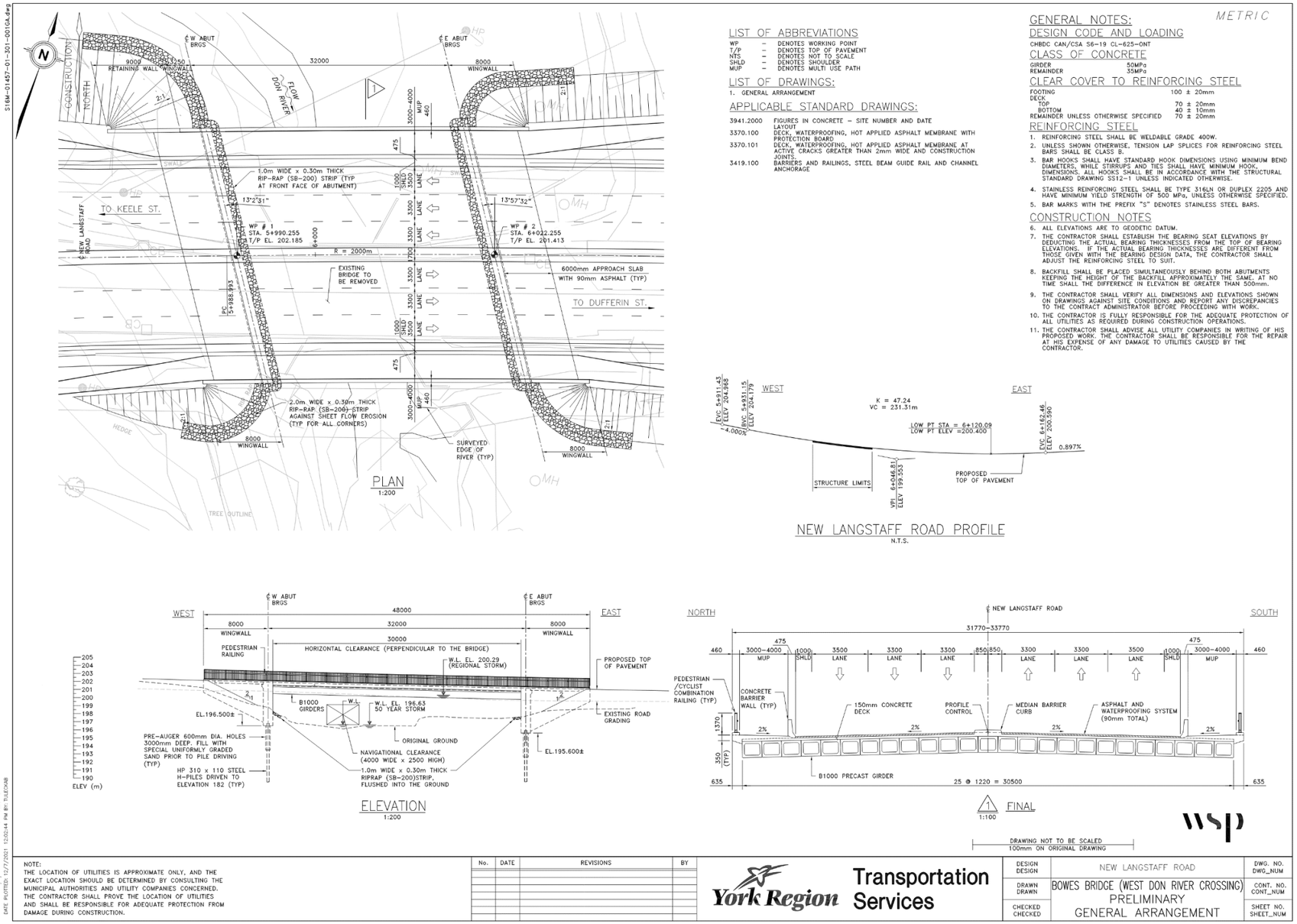
Construction Staging

The replacement of Bowes Bridge could be carried out in two stages:

- Stage 1 - construct the northern portion of the new structure while maintaining the existing two lanes traffic on the existing bridge.
- Stage 2 - Shift the existing two lanes of traffic onto the new structure, remove the existing structure completely and construct the remaining portion of the new structure.

Two construction seasons will likely be required to complete the construction of the bridge. Detail construction staging plan will be confirmed in detailed design.

Exhibit 9-5: Bowes Bridge (West Don River Crossing) General Arrangement Drawing



9.1.7.3 Metrolinx GO Transit Barrie Line Structure

The Metrolinx GO Transit Barrie Line currently crosses Langstaff Road at grade, approximately 730 m east of Keele Street (south of the Rutherford GO Station). Metrolinx currently maintains and operates two tracks and has a plan to expand with an additional track in the future to accommodate future services.

Geotechnical Investigation and Foundations Requirements

A Preliminary Geotechnical Investigation Report has been completed by Thurber Engineering Ltd., included in **Appendix M**. Geotechnical and foundations findings associated with the Metrolinx GO Transit Barrie Line structure can be found in the Geotechnical Investigation Report.

Proposed Structure

Details associated with the proposed Metrolinx GO Transit Barrie Line crossing structure can be found in **Appendix L3**.

The General-Arrangement (GA) drawing of the proposed structure is shown in **Exhibit 9-19: 9-6**. The proposed structure is a single span (34.0 m) precast NU girder bridge. Precast NU girders are typically more economical than steel girders or concrete rigid frames for a given span.

Through consultation with Metrolinx, it was noted that Metrolinx has a plan for a future third track at the Langstaff Road crossing. The span length of 34.0 m between the centre of the bearings was determined to accommodate the future third track on either side of the existing two tracks. As it is unknown at the time of the writing, which side of existing tracks the future third will be located. The location of the future third track is to be confirmed during detailed design through further review and consultation with Metrolinx. This span length is to be reduced once the location of the third track is confirmed during detailed design. Due to the height of the abutment, RSS walls are placed in front of the abutment at each corner of the bridge.

The proposed cross-section on the replacement structure comprises the following, from north to south:

- 0.46 m north pedestrian/cyclist railing
- 3.00-4.00 m north multi-use path

- 0.475 m north concrete barrier wall
- 1.00 m shoulder
- 3.50 m + 3.30 m + 3.30 m westbound lanes
- 1.70 m raised median
- 3.30 m + 3.30 m + 3.50 m eastbound lanes
- 1.00 m shoulder
- 0.475 m south concrete barrier wall
- 3.00-4.00 m south multi-use path
- 0.46 m south pedestrian/cyclist railing

Construction Staging

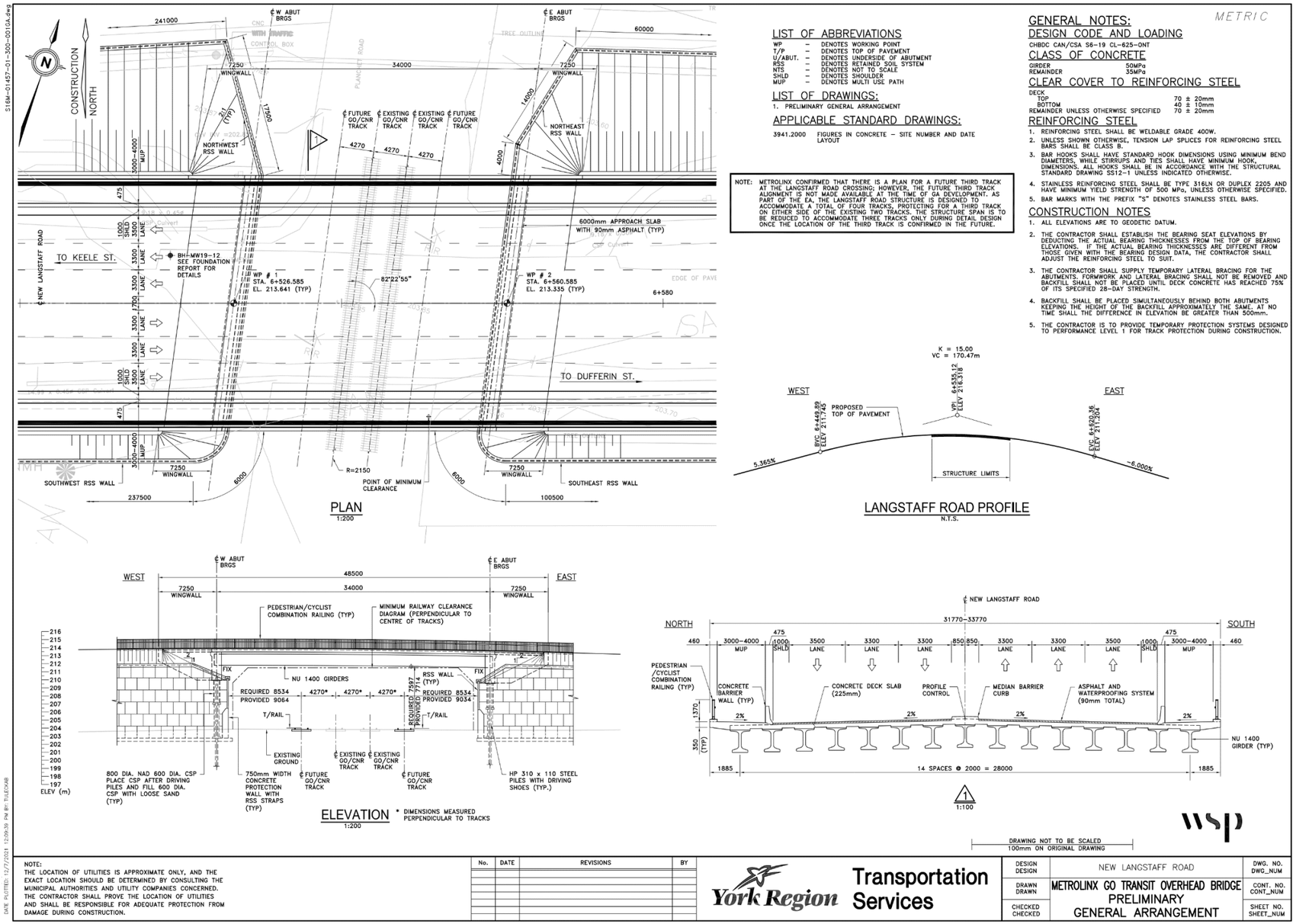
For the construction of the proposed overhead bridge, the portion of Langstaff Road from Planchet Road to Spinnaker Way/Connie Crescent could be closed during construction as all the properties along this segment of Langstaff Road have alternative access from the north-to-south roads and Langstaff Road traffic could be detoured via other roads.

Alternatively, the construction could be completed in two stages:

- Stage 1 – construct the north and south portions of the new structure to the outside of the existing crossing location, while maintaining the existing single lane of traffic in each direction.
- Stage 2 – construct the remaining middle portion of the new structure after the diverting the existing traffic onto north and south portions of the new structure.

Two construction seasons will likely be required to complete the construction of the bridge. Detailed construction staging plan will be confirmed in detailed design.

Exhibit 9-6: Metrolinx GO Transit Barrie Line Overhead Bridge General Arrangement Drawing



9.1.8 Traffic Signals and Illumination

Intersections would be constructed to fulfill *Accessibility for Ontarians with Disabilities Act* (AODA) requirements. Detailed intersection design is to be developed during detailed design. As part of the study, all existing signalized intersections are retained with no additional signalized intersection are proposed.

Langstaff Road would be illuminated, and the illumination requirements will be determined during detailed design to meet the requirements of York Region.

9.1.9 Access

The preferred Langstaff Road cross-section has a raised median from Weston Road to Dufferin Street. Along this section of the road, there are some existing accesses that have full moves onto Langstaff Road; existing full move accesses will be converted to right-in and right-out only access.

In addition, some of the existing accesses will be directly impacted by future structures (i.e. structure over CN MacMillan Rail Yard, West Don River structure and grade separation at Metrolinx GO Transit Barrie Line), including access to 2777 Langstaff Road, 8500 Keele Street, 2180 Langstaff Road, 15 Connie Crescent and Langstaff Park.

The existing access to 2180 Langstaff Road is proposed to be realigned to the east.

The west access to 15 Connie Crescent from Langstaff Road is proposed to be closed due to the grade difference with the proposed Langstaff Road profile. The existing east access to 15 Connie Crescent from Langstaff Road and the existing accesses from Connie Crescent will remain.

For 8500 Keele Street, the existing access from Keele Street will be removed and relocated to Langstaff Road. It should be noted that there will be direct impact to an existing building on 8500 Keele Street as a result of the proposed CN MacMillan Yard crossing, the exact location of the future access will be subject to future site reconfiguration.

Similarly, the existing access to 2777 Langstaff Road east of Creditstone Road will have to be relocated due to the proposed CN MacMillan Yard crossing. The exact location of the future access will be subject to future land use of the property.

Details regarding re-grading and realignment of the other accesses will be confirmed during detailed design.

The existing access to Langstaff Park is proposed to be realigned further west to the Langstaff Road and Planchet Road intersection as the existing access will be impacted by the proposed retaining wall on the west approach of the Metrolinx GO Transit Barrie Line structure. It should be noted that the Preferred Design Plan does not preclude the realignment of the existing access to Langstaff Cemetery (Old St. Stephen's Cemetery) on Langstaff Road to the realigned Langstaff Park access, as requested by City of Vaughan.

9.1.10 Drainage and Stormwater Management

The proposed stormwater management strategy has been developed based on the future conditions of Langstaff Road including the crossing over CN MacMillan Yard, as well as the grade separation at Metrolinx GO Barrie Line. The Drainage and Stormwater Management Repot can be found in **Appendix I**.

Overall, the proposed improvement of Langstaff Road will result in an increase in impervious area compared to the existing land use. Increased pavement areas as a result of the widened road are proposed to be addressed by stormwater quality treatment and quantity control measures designed according to the requirements for the West Don River and Humber River in their respective watersheds. Runoff from the new urbanized roadway will be conveyed by a new storm sewer system located within the road right-of-way.

Within the study area, runoff from the proposed roadway will ultimately discharge to the existing watercourses via storm sewers. The roadway areas result in a significant increase in impervious area which eventually will result in a larger potential for erosion, flood risk, and water quality degradation along the receiving watercourses. Therefore, road runoff needs to be treated before discharging into the receiving watercourses.

Details of the proposed SWM facilities including Stage Storage Analysis of Proposed SWM facilities are documented in the Drainage and Stormwater Management Repot can be found in **Appendix I** and are summarized below. **Exhibits 9-7a to 9-7i** illustrate the proposed drainage conditions.

The proposed stormwater management strategy will include to following to control peak flow:

- Four pipe storage systems within Humber River watershed – east and west of Terecar Drive/Silmar Drive, at Edgeley Boulevard, and west of Millway Avenue;
- One dry SWM pond in the West Don River watershed – north side of the CN MacMillan Yard crossing around Station 4+200 and 4+300;
- One wet SWM pond in the West Don River watershed – at the northeast corner of the Langstaff Road / CN MacMillan Yard crossing at Station 5+535 to 6+640, west of Keele Street; and
- Six pipe storage systems within the West Don River watershed – west of Creditstone Road, west of Planchet Road, east of Spinnaker Way/Connie Crescent, west and east of Staffern Drive / North Rivermede Road, and west of Dufferin Street.

In addition, oil and grit separators (OGS) are provided for quality control at the outlet point of the pipe storage systems before discharging to the respective outlet (i.e. existing storm sewer, Black Creek culvert, West Don River, Westminster Creek culvert, etc.). It is recognized that OGS will not provide enhanced level of quality treatment; however, due to urbanization and property constraints, other treatment train approaches are not practically feasible. Detailed sizing of OGS will be carried out during the detailed design phase.

In terms of water balance, it is required that a minimum of 5 mm of runoff from the site is retained. Most of the proposed roadway will have an urban section with storm sewer systems to convey storm runoff. Therefore, it is not feasible to retain 5 mm of runoff at every section of the proposed roadway. However, measures will be provided wherever feasible using infiltration galleries and exfiltration trenches. Infiltration galleries are subject to soils and groundwater table conditions. They are proposed to be located at most of the intersections along Langstaff Road as illustrated in **Exhibits 9-7a to 9-7i**.

Based on the preliminary assessment, proposed LID measures may potentially be located within the boulevard between the multi-use path and cycle track. Potential LID measures will be further investigated during detailed design.

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- 105 / 4.4ha — CATCHMENT ID / CATCHMENT AREA
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

WESTON RD

TERECAR DRIVE

SILMAR DRIVE

JEVLAN DRIVE

HIGHWAY 400

BLACK CREEK

105
1.63 ha

INFILTRATION GALLERY (IG01)

INFILTRATION GALLERY (IG02)

HSP-1A: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 90 m
INVERT AT U/S = 204.30 m
INVERT AT D/S = 204.12 m
10-YR WSL = 205.31 m
10-YR STORAGE VOLUME = 257 m³
QUALITY CONTROL BY OGS-1

HSP-1B: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 90 m
INVERT AT U/S = 205.53 m
INVERT AT D/S = 205.35 m
10-YR WSL = 206.52 m
10-YR STORAGE VOLUME = 252 m³
QUALITY CONTROL BY OGS-2

110
1.58 ha

Metric Scale
25m 0 50m
Horizontal

wsp

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7a

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- CATCHMENT ID (105) / CATCHMENT AREA (4.4ha)
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

HIGHWAY 400

BLACK CREEK

EDGELEY BLVD

LANGSTAFF ROAD

115
1.00 ha

125
2.27 ha

120
1.24 ha

130
2.08 ha

INFILTRATION GALLERY (IG03)

INFILTRATION GALLERY (IG04)

INFILTRATION GALLERY (IG05)

INFILTRATION GALLERY (IG06)

HSP-2: STORAGE PIPE (SUPER PIPE) SYSTEM FOR QUANTITY CONTROL
3.0m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 180 m
INVERT AT U/S = 204.81 m
INVERT AT D/S = 204.44 m
100-YR WSL = 205.62 m
100-YR STORAGE VOLUME = 640 m³
QUALITY CONTROL BY OGS-3

HSP-3: STORAGE PIPE (SUPER PIPE) SYSTEM FOR QUANTITY CONTROL
3.0m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 220 m
INVERT AT U/S = 204.44 m
INVERT AT D/S = 204.00 m
100-YR WSL = 205.20 m
100-YR STORAGE VOLUME = 792 m³
QUALITY CONTROL BY OGS-3

Metric Scale
25m 0 50m
Horizontal

wsp

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7b

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- CATCHMENT ID (105) / CATCHMENT AREA (4.4ha)
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

MILLWAY AVE

JANE ST

LANGSTAFF ROAD

INFILTRATION GALLERY (IG06)

INFILTRATION GALLERY (IG07)

INFILTRATION GALLERY (IG08)

INFILTRATION GALLERY (IG12)

125 — 2.27 ha

135 — 1.43 ha

130 — 2.08 ha

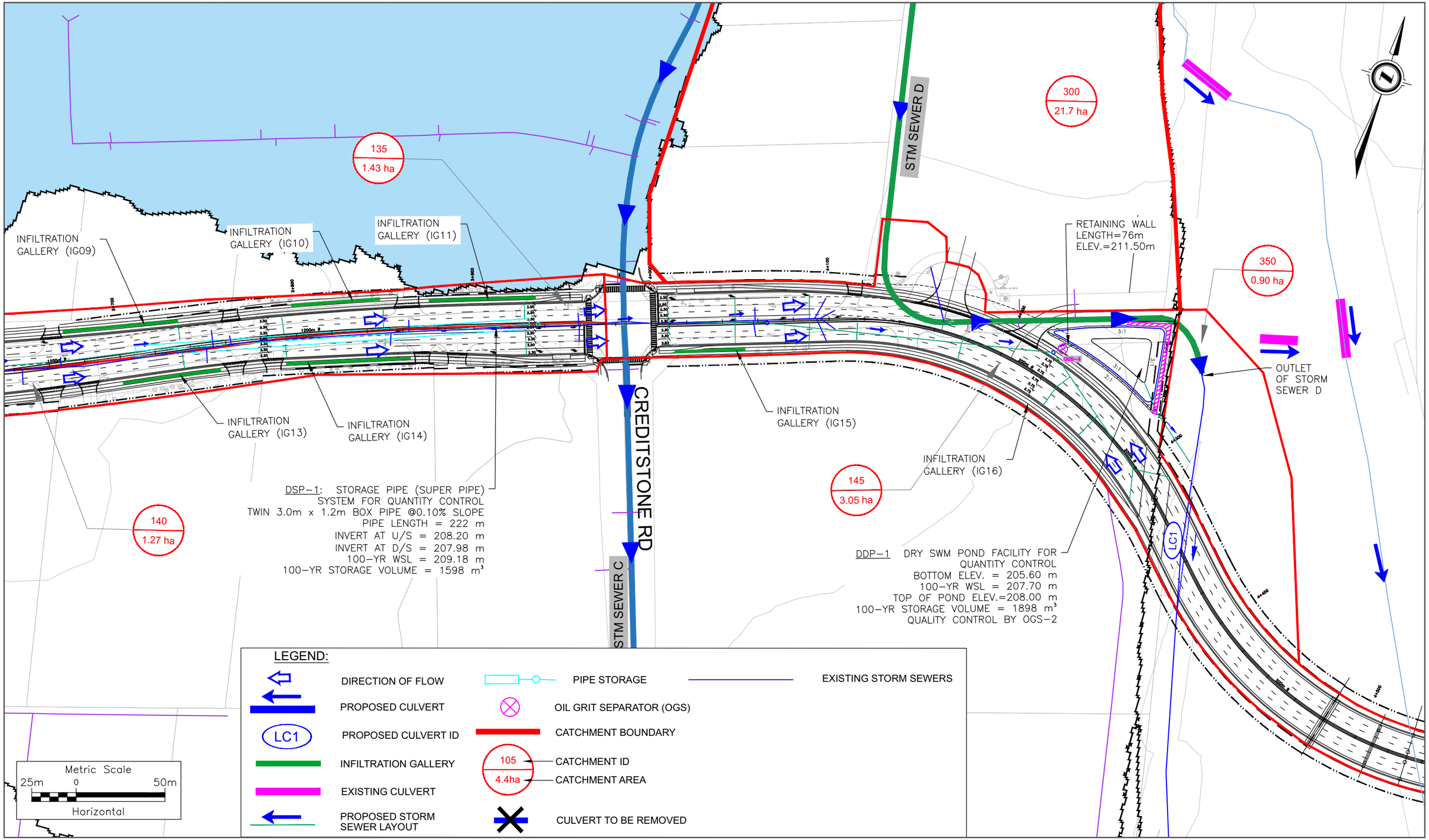
130 — 2.08 ha

140 — 1.27 ha

Metric Scale
25m 0 50m
Horizontal

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7c



LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT

Proposed Drainage Conditions

Exhibit

9-7d

CN MACMILLAN YARD

LANGSTAFF ROAD

LC1

SWM POND C

150
3.81 ha

Metric Scale
25m 0 50m
Horizontal

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- 105 / 4.4ha — CATCHMENT ID / CATCHMENT AREA
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7e

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- CATCHMENT ID (105) / CATCHMENT AREA (4.4ha)
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

KEELE ST

EXFILTRATION TRENCH (ET17)

POND DWP-1

POND BOTTOM: 205.30m
PERMANENT POOL: 206.40m
FOREBAY BERM: 206.40m
TOP OF THE POND LEVEL: 207.50m
100-YR WATER LEVEL: 207.20m
PERMANENT POOL: 206.40m
POND BOTTOM: 205.30m
3.0m BERM ELEV. 208.00m

155 / 0.53 ha

160 / 0.46 ha

150 / 3.81 ha

Metric Scale
25m 0 50m
Horizontal

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7f

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- CATCHMENT ID (105) / CATCHMENT AREA (4.4ha)
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

WEST DON RIVER

PLANCHET RD

GO-BARRIE LINE

165
0.60 ha

180
0.65 ha

190
0.86 ha

185
0.47 ha

195
0.79 ha

170
0.43 ha

REMOVED EXISTING CULVERT

INFILTRATION GALLERY (IG18)

INFILTRATION GALLERY (IG19)

DSP-2: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
TWIN 3.0m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 160 m
INVERT AT U/S = 197.90 m
INVERT AT D/S = 197.58 m
100-YR WSL = 198.78 m
100-YR STORAGE VOLUME = 1152 m³
QUALITY CONTROL BY OGS-4

Metric Scale
25m 0 50m
Horizontal

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7g

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- LC1 — PROPOSED CULVERT ID
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- 105 / 4.4ha — CATCHMENT ID / CATCHMENT AREA
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

GO-BARRIE LINE

SPINNAKER WAY

LANGSTAFF ROAD

CONNIE CRES

190
0.86 ha

195
0.79 ha

205
1.10 ha

210
0.96 ha

REMOVED EXISTING CULVERT

REMOVED EXISTING CULVERT

EXISTING SEWER PIPE
1050mm (42")

DSP-3A: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 125 m
INVERT AT U/S = 202.00 m
INVERT AT D/S = 201.76 m
10-YR WSL = 202.95 m
10-YR STORAGE VOLUME = 346 m³
QUALITY CONTROL BY OGS-6

DSP-3B: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 130 m
INVERT AT U/S = 202.76 m
INVERT AT D/S = 202.50 m
10-YR WSL = 203.67 m
10-YR STORAGE VOLUME = 361 m³
QUALITY CONTROL BY OGS-6

Metric Scale
25m 0 50m
Horizontal

SEE EXHIBIT 10

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7h

LEGEND:

- DIRECTION OF FLOW
- PROPOSED CULVERT
- PROPOSED CULVERT ID (LC1)
- INFILTRATION GALLERY
- EXISTING CULVERT
- PROPOSED STORM SEWER LAYOUT
- PIPE STORAGE
- OIL GRIT SEPARATOR (OGS)
- CATCHMENT BOUNDARY
- CATCHMENT ID (105) / CATCHMENT AREA (4.4ha)
- CULVERT TO BE REMOVED
- EXISTING STORM SEWERS

205
1.10 ha

215
0.58 ha

220
0.65 ha

210
0.96 ha

225
0.60 ha

230
0.70 ha

STAFFERN DRIVE

N RIVERMEDE RD

WESTMINSTER CREEK

WESTMINSTER CREEK

INFILTRATION GALLERY (IG21)

UTILIZE EXISTING OUTLET

INFILTRATION GALLERY (IG22)

EXISTING DRAINAGE FLOW PATH WITH 1.75m WIDE FLAT BOTTOM CHANNEL IS MAINTAINED TO CONVEY THE FLOW FROM 750mm AND 1650mm STORM SEWERS FROM DUFFERIN STREET

LANGSTAFF ROAD

DUFFERIN ST

DSP-3B: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 130 m
INVERT AT U/S = 202.76 m
INVERT AT D/S = 202.50 m
10-YR WSL = 203.67 m
10-YR STORAGE VOLUME = 361 m^3
QUALITY CONTROL BY OGS-6

DSP-4: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
Twin 2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 110 m
INVERT AT U/S = 202.65 m
INVERT AT D/S = 202.43 m
100-YR WSL = 203.52 m
100-YR STORAGE VOLUME = 632 m^3
QUALITY CONTROL BY OGS-7

DSP-5: STORAGE PIPE (SUPER PIPE)
SYSTEM FOR QUANTITY CONTROL
TWIN 2.4m x 1.2m BOX PIPE @0.20% SLOPE
PIPE LENGTH = 100 m
INVERT AT U/S = 202.27 m
INVERT AT D/S = 202.05 m
100-YR WSL = 203.25 m
100-YR STORAGE VOLUME = 553 m^3
QUALITY CONTROL BY OGS-8

Metric Scale
25m 0 50m
Horizontal

LANGSTAFF ROAD ENVIRONMENTAL ASSESSMENT
Proposed Drainage Conditions

Exhibit
9-7i

9.1.11 Geotechnical

A Preliminary Geotechnical Investigation Report has been completed by Thurber Engineering Ltd., included in **Appendix M**. The preliminary report provides guidance with respect to existing geotechnical conditions along the corridor, pavement design, foundation types for structures.

The field investigation for this project was carried out between April 2 and 26, 2019 and comprised a total of sixteen boreholes (Boreholes 19-01 to 19-16) advanced to depths ranging from 3.7 m to 34.1 m.

The preliminary geotechnical recommendations are provided for the design and construction of the roadway improvements and structure foundations. The recommendations are based on the subsurface soil and groundwater conditions encountered during the preliminary investigation. The soil conditions may vary between and beyond the borehole locations. Additional geotechnical investigations are required for detailed design to confirm subsurface conditions and determine exact recommendations for bridge, culvert and grade separation structure foundations, excavations and embankment design in addition to dewatering requirements and soil contamination/environmental risk assessments.

Based on the borehole data, the anticipated traffic volumes, and assuming adequate subgrade drainage, the following preliminary pavement design is recommended for widening and reconstruction of Langstaff Road:

- HL1 – 50 mm
- HDBC (2 lifts) – 140 mm
- OPSS Granular A Base – 150 mm
- OPSS Granular B Type II Subbase – 500 mm

9.1.12 Streetscaping

A “streetscape” can be defined as the design quality and visual effect of a street, which is an aggregate of the streetscape elements that make up the natural and built fabric of the street. Each of these elements contributes to the overarching character of a place and can create and define spaces as distinctive or unique within a neighbourhood or region. The elements of the streetscape such as street trees, lighting, furnishings and signage can provide strong visual cues, linking spaces together, and may even help to

compensate for a lack of cohesion in the built environment. A streetscape that is lined with trees and has a consistent street furniture style will provide a consistent visual image along its length and reflect a continuous space to the user. The repetition of these elements can also create a rhythm in the streetscape that can be continued to other streets within an area, thus defining a distinct district.

A streetscape may also be partially defined by its adjacencies, including natural features. Important natural environment features in the study area include sections of West Don River. Grading and construction activities will be minimized around existing natural features such as trees and vegetated communities where possible to retain the existing character of the landscape.

A series of design techniques should be employed to promote an attractive and contextually appropriate streetscape as outlined below.

Plant Selection

Plant selection for enhancement and restoration planting should provide seasonal interest (i.e. spring flowering, interesting bark for winter appeal, attractive fall colours). Street trees should be planted with regularity along the length of the corridor where feasible. Particular attention should be paid to the growing conditions of these urban trees, giving consideration to continuous planting trenches and the use of structural soil cell technologies to improve tree health and survivability.

At grade separations (e.g. at Metrolinx GO Transit Barrie Line), planting selection should include native species as well as fast and/or deep-rooting woody vegetation to encourage slope stabilization.

Species selection along the corridor should also reflect the different Ecological Land Classifications present where restoration is required, while still being contextually appropriate and tolerant of site conditions, such as salt and drought for roadside areas. Selection of proposed plantings should further reflect changing climate conditions and therefore should consider resistance to drought and winter ice storms as these are becoming potentially more common. Plant materials currently at the southern limit of their natural range should be avoided. Species selection will be in accordance with York Region’s Acceptable Tree Species and Acceptable Shrub and Perennial Species Lists, and will be further reviewed during detailed design.

Boulevards and Medians

Boulevards and medians play an important role in defining the streetscape, providing an element of continuity to the streetscape and offering an area for street trees and other vegetation to grow, further enhancing the street.

Street trees and ornamental grasses along the boulevard will provide a landscaped buffer between the sidewalk and cycle track and increase the year-round visual interest. Street trees within the boulevard should be planted continuously and evenly spaced along the length of the corridor where context permits. A photo rendering of the example landscape features for the boulevard and cycle track is shown on **Exhibit 9-8**.

Ornamental grasses and hardy perennials or shrubs may be contemplated for the median to further enhance the streetscape. Maintaining street trees and other ornamental plantings in the median is a continuous challenge. Species selection for the overall corridor should consider low maintenance, native plants that will tolerate a range of urban and roadside conditions to reduce maintenance requirements and enhance survivability. A photo rendering of the example landscape features for the median is shown on **Exhibit 9-9**. Species selection will be in accordance with York Region's Acceptable Tree Species and Acceptable Shrub and Perennial Species Lists, and will be further reviewed during detailed design.

All planted medians are to be irrigated in accordance with York Region's Dripline Irrigation Design Guidelines, which is available upon request from York Region's Natural Heritage and Forestry.

Lighting

A defining feature of any street is its illumination. This is not only because the quality of light provided can significantly enhance our night environment, but also because the form of the light standard can affect the character of a street during the day. Lighting options in the boulevard and on the bridge (e.g. utilitarian vs decorative), as well as the potential for pedestrian scale lighting will be further reviewed during detailed design. Bridge structure to have enhancements to parapet walls, columns, railings, and illumination; all of which will be further reviewed during detailed design.

Exhibit 9-16: Langstaff Road Example Boulevard and Cycle Track Rendering

Exhibit 9-17: Langstaff Road Example Median Planting Rendering

Street Furnishings

Street furniture is often a design element that can have a great impact on the unity of the streetscape, and the overall character of an area. Often if there is a lack of coordination between elements such as lighting, benches, and trash receptacles it can create a sense of discord, and detract from the sense of place that may otherwise exist. Alternatively, if there is a strong link between the street furniture elements, and they are placed strategically throughout an area, they can be used to identify a space, set it apart from other neighbouring areas, and draw visitors into particular spaces. Details regarding street furnishings will be determined through consultation with the City of Vaughan during detailed design (as part of the Landscape / Streetscape Plan).

There is an opportunity to create a landmark bridge crossing over the CN MacMillan Rail, though there are many functional constraints. A landmark vision requires intense collaboration with CN, City of Vaughan, and York Region for a design that is context-sensitive, while supporting the functions of the second largest rail yard in Canada. A national/international design competition for the bridge crossing could be a means by which a landmark crossing where public art, landscape/architectural, and engineering excellence intersect. Unique to this project are the guard railing on the proposed CN

MacMillan Rail Yard crossing structure which are intended to prevent any objects being dropped from the structure into the rail yard and also screen views. A photo rendering of the CN MacMillan Rail Yard crossing structure and an example of the guard railing is shown on **Exhibit 9-10**. The design of the bridge crossing and the design of these railings should be selected to reflect the character style of the rest of the street furnishings and will be subject to discussion with CN.

Exhibit 9-18: Langstaff Road Crossing of CN MacMillan Rail Yard Rendering

Similar to the CN MacMillan Rail Yard crossing, retaining walls are proposed on the approaches to the Metrolinx GO Transit Barrie Line structure. Photo renderings of the retaining walls and the example of surrounding landscape features are illustrated on **Exhibit 9-11**. It should be noted that the proposed retaining walls on the west approach to the structure are located in close proximity to the soccer fields in Langstaff Park on the south side of the road. The exact setback requirements to the soccer fields and any potential reconfiguration of the soccer fields will be subject to discussion and confirmation with the City of Vaughan. Mitigation due to reduced parkland frontage in the form of compensation for encroached or acquired lands may be required in the form of alternative lands to service local needs or acquisition costs as determined in consultation with the City's Real Estate Department.

Exhibit 9-19: Langstaff Road Grade Separated Crossing of Metrolinx GO Transit Barrie Line Rendering

9.1.13 Utilities

The following utility companies were contacted as part of the study:

- Bell Canada
- Enbridge Gas
- Alectra Utilities
- Rogers
- Telecom
- Zayo

At the time of filing of the ESR, only Hydro One provided a utility markup of its existing high voltage & distribution facilities located south of 407ETR, which will not be impacted by the Preferred Design Plan. The ownerships, the existing utilities locations and municipal services and associated conflicts are to be confirmed during detailed design.

9.1.14 Preliminary Cost Estimate

The breakdown of the preliminary cost estimate is provided in **Table 9-4** to **Table 9-6**. It should be noted that the estimated costs are preliminary only and would be updated during detailed design. The cost estimate below also includes cost items to accommodate for local municipal infrastructure that would be funded by the local municipality.

Table 9-4: Preliminary Cost Estimate from Weston Road to Keele Street

Item Description	Quantity	Unit	Estimated Unit Price	Total
Earth Excavation, Disposal and Boulevard Grading	80,000	m^3	$12.00	$960,000.00
Surface Asphalt SP12.5 (50mm depth)	13,500	t	$90.00	$1,215,000.00
Base Asphalt SP19.0 (140mm depth)	36,200	t	$85.00	$3,077,000.00
Granular "A" (150mm)	40,000	t	$22.00	$880,000.00
Granular "B" (500mm)	122,000	t	$21.00	$2,562,000.00
Concrete Curb and Gutter	15,020	m	$50.00	$751,000.00
Concrete Sidewalk / Median / Platform	22,500	m^2	$50.00	$1,125,000.00
Concrete Strip	3,900	m^2	$55.00	$214,500.00
Cycle Track	7,200	m^2	$30.00	$216,000.00
Storm Sewer Including Catchbasins		L.S.		$3,168,800.00
SWM Facilities		L.S.		$150,000.00
Oil Grit Separators				$280,000.00
Infiltration Gallery				$150,000.00
Storage Pipes		L.S.		$5,750,000.00
Municipal Services (Sanitary and Watermain)		L.S.		$1,359,750.00
Driveway Culverts	370	m	$150.00	$55,500.00
Steel Beam Guide Rail	800	m	$150.00	$120,000.00
Topsoil and Sod	20,000	m^2	$10.00	$200,000.00
Cold Plane existing Pavement	2,000	m^2	$3.00	$6,000.00
Removal of Curb and Gutter	3,900	m	$15.00	$58,500.00
Boulevard Restoration, Tree Planting, Streetscaping	2,900	m	$1,650.00	$4,785,000.00
Illumination				

Item Description	Quantity	Unit	Estimated Unit Price	Total
Permanent		L.S.		$980,000.00
Temporary		L.S.		$280,000.00
Traffic Signals				
Permanent	5	each	$250,000.00	$1,250,000.00
Temporary	5	each	$100,000.00	$500,000.00
Retaining Walls	5,300	m^2	$800.00	$4,240,000.00
Maintenance of Traffic				
Traffic Control		L.S.		$150,000.00
Temporary Widening/Staging		L.S.		$250,000.00
Pavement Markings and Signage		L.S.	$150.00	$582,750.00
Miscellaneous Items (~25% of above items)		L.S.		$8,829,200.00
Subtotal 1				**$44,146,000.00**
Contingency (~20 % of subtotal 1)				$8,829,200.00
Subtotal 2 (subtotal 1 + contingency)				**$52,975,200.00**
CN Yard Crossing Main Structure		L.S.		$184,693,734.00
CN Yard Crossing Rigid Frame Structure		L.S.		$4,636,680.00
Subtotal 3 (structures)				**$189,330,414.00**
Utility Relocation (est. by Consultant)				$2,800,000.00
Subtotal 4 (Subtotal 2+Subtotal 3 + Utility Relocation)				**$245,105,614.00**
Engineering & CA (~25% of Subtotal 4)				$61,276,403.50
ROUNDED TOTAL (rounded excluding HST)				**$306,382,000.00**

Table 9-5: Preliminary Cost Estimate from Keele Street to Dufferin Street

Item Description	Quantity	Unit	Estimated Unit Price	Total
Earth Excavation, Disposal and Boulevard Grading	60,000	m^3	$15.00	$900,000.00
Surface Asphalt SP12.5 (50mm depth)	8,200	t	$90.00	$738,000.00
Base Asphalt SP19.0 (140mm depth)	22,000	t	$85.00	$1,870,000.00
Granular "A" (150mm)	24,000	t	$22.00	$528,000.00
Granular "B" (500mm)	74,000	t	$21.00	$1,554,000.00
Concrete Curb and Gutter	8,600	m	$50.00	$430,000.00
Concrete Sidewalk / Median / Platform	11,300	m^2	$50.00	$565,000.00
Concrete Strip	3,900	m^2	$55.00	$214,500.00
Cycle Track	5,900	m^2	$30.00	$177,000.00
Storm Sewer Including Catchbasins		L.S.		$1,730,000.00
Oil Grit Separators		L.S.		$420,000.00
Infiltration Gallery		L.S.		$500,000.00
Storage Pipes		L.S.		$4,520,000.00
Municipal Services (Sanitary and Watermain)		L.S.		$746,200.00
Driveway Culverts	270	m	$150.00	$40,500.00
Steel Beam Guide Rail	800	m	$150.00	$120,000.00
Topsoil and Sod / Seed	13,500	m^2	$7.00	$94,500.00
Cold Plane existing Pavement	2,000	m^2	$3.00	$6,000.00
Removal of Curb and Gutter	4,900	m	$15.00	$73,500.00
Boulevard Restoration, Tree Planting, Streetscaping	2,200	m	$1,650.00	$3,630,000.00
Illumination				
Permanent		L.S.		$750,000.00
Temporary		L.S.		$220,000.00
Traffic Signals				
Permanent	6	each	$250,000.00	$1,500,000.00
Temporary	6	each	$100,000.00	$600,000.00
Retaining Walls	3,445	m^2	$800.00	$2,756,000.00

Item Description	Quantity	Unit	Estimated Unit Price	Total
Maintenance of Traffic				
Traffic Control		L.S.		$ 100,000.00
Temporary Widening/Staging		L.S.		$ 400,000.00
Pavement Markings and Signage		L.S.		$ 319,800.00
Miscellaneous Items (~25% of above items)		L.S.		$6,375,750.00
Subtotal 1				**$31,878,750.00**
Contingency (~20% of subtotal 1)				$6,375,750.00
Subtotal 2 (subtotal 1 + contingency)				**$38,254,500.00**
Bowes Bridge (West Don River)		L.S.		$5,346,360.00
Metrolinx GO Transit Overhead Bridge		L.S.		$5,693,760.00
Subtotal 3 (structures)				**$11,040,120.00**
Utility Relocation (est. by Consultant)				$2,200,000.00
Subtotal 4 (Subtotal 2+Subtoal 3+Utility Relocation)				**$51,494,620.00**
Engineering & CA (~25% of Subtotal 4)				$12,873,655.00
TOTAL (excluding HST)				**$64,368,000.00**

Table 9-6: Preliminary Cost Estimate from Dufferin Street to Highway 7

Item Description	Quantity	Unit	Estimated Unit Price	Total
Earth Excavation, Disposal and Boulevard Grading	3,900	m^3	$12.00	$46,800.00
Concrete Curb and Gutter	1,410	m	$50.00	$70,500.00
Concrete Sidewalk / Median / Platform	300	m^2	$50.00	$15,000.00
Concrete Strip	600	m^2	$55.00	$33,000.00
Cycle Track	1,660	m^2	$30.00	$49,800.00

Item Description	Quantity	Unit	Estimated Unit Price	Total
Storm Sewer Including Catchbasins		L.S.		$50,000.00
Topsoil and Sod / Seed	300	m^2	$7.00	$2,100.00
Removal of Curb and Gutter	1,395	m	$15.00	$20,925.00
Clearing and Grubbing		L.S.		$20,000.00
Boulevard Restoration, Tree Planting, Streetscaping	260	L.S.	$1,650.00	$429,000.00
Miscellaneous Items (~25% of above items)		L.S.		$184,281.00
Subtotal 1				$921,406.00
Contingency (~20% of subtotal 1)				$184,281.00
Subtotal 2 (subtotal 1 + contingency)				$1,105,687.00
Utility Relocation (est. by Consultant)				$100,000.00
Subtotal 3 (Subtotal 2+Utility Relocation)				$1,205,687.00
Engineering & CA (~25% of Subtotal 3)				$301,421.75
TOTAL (excluding HST)				$1,507,000.00

9.1.15 Property Requirements

Based on the York Region's Official Plan (Map 12), Langstaff Road is designated to have a 36 m right-of-way. Per the Official Plan, York Region may acquire up to 36 m right-of-way along Langstaff Road between Weston Road and Highway 7. Additional land may be acquired to accommodate intersection improvements. Significant efforts have been made during the Class EA study to minimize property impacts where feasible, including:

- Develop the roadway cross-sections that can be accommodated with the existing 36 m rights-of-way (as discussed in **Section 8.2** and **Section 8.3**);
- Recommending a flexible 'best fit' approach to road widening (as discussed in **Section 8.2** and **Section 8.3**);
- During the Class EA study, the project team consulted with affected property owners to optimize the design and modify the preliminary design plan where feasible to reduce impact; and

- Recommending design mitigation measures, such as retaining walls, to minimize the extent of grading in select locations, as depicted on the Preferred Design Plan.

Retaining walls are proposed in the following locations (approximate stationing) in order to avoid / minimize property impacts:

Station Number	Location	Reference to Design Plates in Appendix A
Station 1+559 to 1+618	South of Langstaff Road, just east of Weston Road	1
Station 1+560 to 1+608	North of Langstaff Road, just east of Weston Road	1
Station 3+051 to 3+069	North of Langstaff Road, just west of Millway Avenue	6
Station 4+110 to 4+331	South of Langstaff Road, west approach of CN MacMillan Rail Yard rigid frame structure	9 and 10
Station 4+210 to 4+279	North of Langstaff Road, west of the CN MacMillan Rail Yard rigid frame structure	9 and 10
Station 4+310 to 4+440	North of Langstaff Road, west of the CN MacMillan Rail Yard main structure	10
Station 4+360 to 4+440	South of Langstaff Road, west of the CN MacMillan Rail Yard main structure	10
Station 5+397 to 5+664	South of Langstaff Road, east of the CN MacMillan Rail Yard main structure	13 and 14
Station 5+411 to 5+666	North of Langstaff Road, east of the CN MacMillan Rail Yard main structure	13 and 14
Station 5+945 to 5+980	North of Langstaff Road, west of Bowes Bridge	15
Station 5+970 to 5+987	South of Langstaff Road, west of Bowes Bridge	15
Station 6+025 to 6+040	North of Langstaff Road, east of Bowes Bridge	15
Station 6+014 to 6+040	South of Langstaff Road, east of Bowes Bridge	15
Station 6+281 to 6+530	South of Langstaff Road, west of Metrolinx GO Transit Bridge	16 and 17

Station Number	Location	Reference to Design Plates in Appendix A
Station 6+285 to 6+538	North of Langstaff Road, west of Metrolinx GO Transit Bridge	16 and 17
Station 6+550 to 6+661	South of Langstaff Road, east of Metrolinx GO Transit Bridge	17 and 18
Station 6+558 to 6+629	North of Langstaff Road, east of Metrolinx GO Transit Bridge	17
Station 6+914 to 6+959	North of Langstaff Road, east of Spinnaker Way/Connie Crescent	18 and 19
Station 7+630 to 7+905	North of Langstaff Road, west of Dufferin Street	21 and 22

Despite these measures to avoid property impacts, the Preferred Design Plan will impact about 50 private properties. Approximate property impacts (from west to east) are summarized in **Table 9-7** and are shown in the plates in **Appendix A**. The exact amount of property required at each property will be confirmed during detailed design. Most of property impacts are limited to edge encroachments. On the approaches to the CN MacMillan Rail Yard crossing, property impacts are more significant.

The timeline for property acquisition will be confirmed following the completion of the Class EA study based on the York Region's 10-Year Roads and Transit Capital Construction Program which is approved by Council annually.

Easement will be required to accommodate grading or temporary construction works. The location and extent will be confirmed in detailed design.

Table 9-7: Summary of Property Requirements / Impacts

ID #	Address	General Location	Rounded Area (ha)
1	8401 Weston Road	Southeast quadrant Langstaff Road / Weston Road	0.03
2	3650 Langstaff Road	Northwest quadrant Langstaff Road / Terecar Drive	0.03
3	3603 Langstaff Road	Southwest quadrant Langstaff Road / Silmar Drive	0.03
4	3550 Langstaff Road	Northeast quadrant Langstaff Road / Silmar Drive	0.01

ID #	Address	General Location	Rounded Area (ha)
5	321 Courtland Avenue	Northwest quadrant Langstaff Road / Edgeley Boulevard	0.01
6	3333 Langstaff Road	Southwest quadrant Langstaff Road / Edgeley Boulevard	0.05
7	3350 Langstaff Road	Northwest quadrant Langstaff Road / Edgeley Boulevard	0.01
8	3310 Langstaff Road	Northeast quadrant Langstaff Road / Edgeley Boulevard	0.04
9	3301 Langstaff Road	Southeast quadrant Langstaff Road / Edgeley Boulevard	0.01
10	3280 Langstaff Road	Northeast quadrant Langstaff Road / Edgeley Boulevard	0.02
11	3277 Langstaff Road	Southeast quadrant Langstaff Road / Edgeley Boulevard	0.01
12	3231 Langstaff Road	Southeast quadrant Langstaff Road / Edgeley Boulevard	0.02
13	3240 Langstaff Road	Northeast quadrant Langstaff Road / Edgeley Boulevard	0.02
14	3210 Langstaff Road	Northwest quadrant Langstaff Road / Millway Avenue	0.01
15	668 Millway Avenue	Southwest quadrant Langstaff Road / Millway Avenue	0.03
16	665 Millway Avenue	Southeast quadrant Langstaff Road / Millway Avenue	0.01
17	41 Courtland Avenue	Northwest quadrant Langstaff Road / Jane Street	0.06
18	8400 Jane Street	Southwest quadrant Langstaff Road / Jane Street	0.02
19	2921 Langstaff Road	Southeast quadrant Langstaff Road / Jane Street	0.01
20	3000 Langstaff Road	Northeast quadrant Langstaff Road / Jane Street	0.01
21	2900 Langstaff Road	Northwest quadrant Langstaff Road / Creditstone Road	0.02
22	2841 Langstaff Road	Southwest quadrant Langstaff Road / Creditstone Road	0.01

ID #	Address	General Location	Rounded Area (ha)
23	2800 Langstaff Road	Northwest quadrant Langstaff Road / Creditstone Road	0.01
24	2821 Langstaff Road	Southwest quadrant Langstaff Road / Creditstone Road	0.03
25	965 Creditstone Road	Northeast quadrant Langstaff Road / Creditstone Road	0.04
26	2777 Langstaff Road	Southeast quadrant Langstaff Road / Creditstone Road	0.56
27	CN MacMillan Rail Yard	East of Langstaff Road / Creditstone Road; west of Langstaff Road / Keele Street	Easement agreement subject to negotiation with CN during detailed design
28	8400 Keele Street	Northwest quadrant Langstaff Road / Keele Street	0.12
29	8470 Keele Street	Southwest quadrant Langstaff Road / Keele Street	1.79
30	8500 Keele Street	Southwest quadrant Langstaff Road / Keele Street	0.59
31	8555 Keele Street	Northeast quadrant Langstaff Road / Keele Street	0.03
32	8575 Keele Street	Northeast quadrant Langstaff Road / Keele Street	0.01
33	2195 Langstaff Road	Southeast quadrant Langstaff Road / Keele Street	0.01
34	2180 Langstaff Road	Northeast quadrant Langstaff Road / Keele Street	0.13
35	N/A (Langstaff Park)	South of Langstaff Road / Planchet Road	0.17
36	Vacant Lot east of 2180 Langstaff Road	Northeast quadrant Langstaff Road / Keele Street	0.14
37	10 Planchet Road	Northwest quadrant Langstaff Road / Planchet Road	0.01
38	25 Planchet Road	Northeast quadrant Langstaff Road / Planchet Road	0.02
39	15 Connie Crescent	Southwest quadrant Langstaff Road / Connie Crescent	0.03

ID #	Address	General Location	Rounded Area (ha)
40	16 Spinnaker Way	Northwest quadrant Langstaff Road / Spinnaker Way	0.01
41	31 Spinnaker Way	Northeast quadrant Langstaff Road / Spinnaker Way	0.03
42	14 Connie Crescent	Southeast quadrant Langstaff Road / Connie Crescent	0.01
43	172 Connie Crescent	Southwest quadrant Langstaff Road / North Rivermede Road	0.01
44	20 Staffern Drive	Northwest quadrant Langstaff Road / Staffern Drive	0.01
45	10 North Rivermede Road	Southwest quadrant Langstaff Road / North Rivermede Road	0.06
46	21 Staffern Drive	Northeast quadrant Langstaff Road / Staffern Drive	0.04
47	1681 Langstaff Road	Southeast quadrant Langstaff Road / North Rivermede Road	0.01
48	1531 Langstaff Road	Southwest quadrant Langstaff Road / Dufferin Street	0.01
49	Parcel between 1531 Langstaff Road and 8484 Dufferin Street	Southwest quadrant Langstaff Road / Dufferin Street	0.01
50	8484 Dufferin Street	Southwest quadrant Langstaff Road / Dufferin Street	0.01

9.2 Implementation Strategy

The design plan and profile will be further refined during future detailed design. The implementation of the Preferred Design Plan may be carried out in a phased approach as follows:

- *Interim widening of Langstaff Road from 2 lanes to 4 lanes from Dufferin Street to Highway 7.* This improvement is identified as part of York Regional Council approved Roads Capital Acceleration Reserve Fund (2019). The construction is anticipated to start within the next 10 years, subject to the completion of this Class EA study.

- *Active transportation facility improvements from Dufferin Street to Highway 7.* The improvements will be within the existing right-of-way which is considered a "pre-approved" project and does not require a Class EA study. The construction timing is be subject to Region's funding availability.
- *Other proposed improvements on Langstaff Road.* The remaining improvements identified as part of this Class EA study (listed below) are considered longer-term improvements, as they are not included in York Region's current 10-year capital plan. York Region's 10-year capital plan is reviewed and approved by York Region Council each year.
    - Widen Langstaff Road to six general-purpose lanes from Weston Road to Highway 7;
    - Construct overpass structure (Steel Box Girder Bridge – Long Spans) across CN MacMillan Rail Yard, along the south alignment; and
    - Construct overpass structure (Langstaff Road over rail tracks) at Metrolinx GO Transit Barrie Line crossing.

9.2.1 Interim 4-Lane between Keele Street and Dufferin Street

Langstaff Road may be widened from the existing 2-lane cross-section to a 4-lane cross-section between Keele Street to Dufferin Street, prior to widening to six lanes as noted above. A high-level 4-lane concept plan was developed as part of study which is included in **Appendix B**. The 4-lane plan is to be confirmed in detailed design.

9.2.1.1 Horizontal and Vertical Alignment

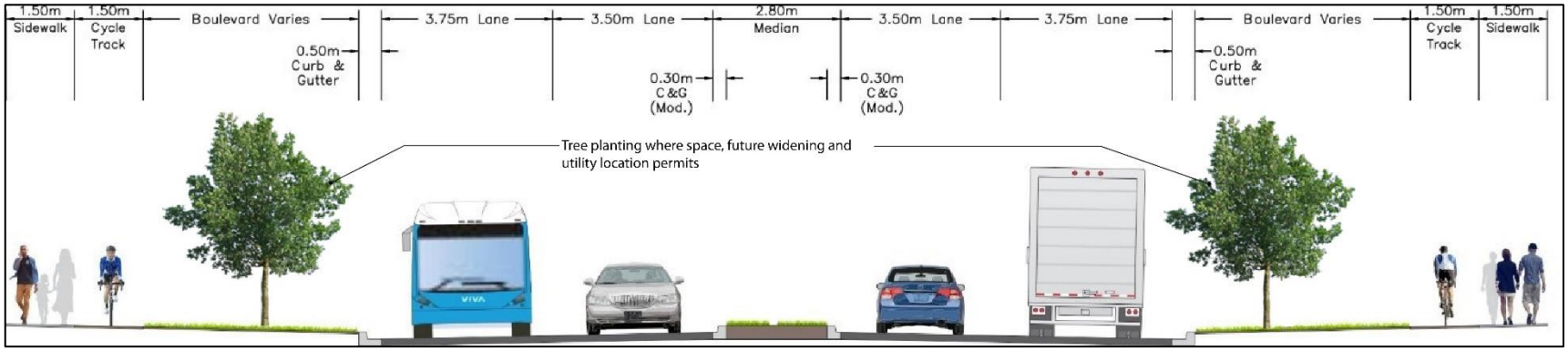
The horizontal alignment generally follows the preferred horizontal alignment identified as part of the 6-lane plan for this section of Langstaff Road from Keele Street to Dufferin Street.

The vertical alignment also follows the preferred vertical alignment identified as part of the 6-lane plan from Keele Street to Planchet Road, where Langstaff Road is raised to accommodate the Bowes Bridge replacement at the West Don River crossing. East of Planchet Road, the vertical alignment profile generally follows the existing road profile. The crossing at the Metrolinx GO Transit Barrie Line crossing will be retained as an at-grade crossing as determined in consultation with Metrolinx. Metrolinx will be further consulted during detailed design.

9.2.1.2 Typical Cross-Section and Active Transportation Provision

The typical cross-section of the interim 4-lane conceptual plan is shown on **Exhibit 9-12**. In addition to the existing sidewalk, a cycle track is added in each direction. The proposed design has been developed to keep the existing sidewalk where feasible and minizine the number of hydro poles to be removed. The 4-lane widening can generally be accommodated within the existing right-of-way with minor property requirements at intersections.

Exhibit 9-20: Langstaff Road Interim 4-Lane Typical Cross-Section



9.2.1.3 Bowes Bridge Replacement (West Don River Crossing)

Replacing Bowes Bridge is proposed to be included as part of the interim 4-lane plan. The bridge may be constructed to accommodate the ultimate 6-lane cross-section. The additional lane width required for the future 6-lane condition will be barriered off. There may be opportunities to consider public art, streetscaping or active transportation enhancement in the interim using the “over built” space. The treatment of the additional width is to be confirmed during detailed design.

10 ENVIRONMENTAL EFFECTS, MITIGATION MEASURES AND COMMITMENTS TO FUTURE WORK

Section 6.1 provides an overview of current and future land uses within the study area, as well as economic activities and planned urban intensification in the surrounding area within the City of Vaughan such as the Vaughan Metropolitan Centre. The existing businesses, as well as future growth and development within the City will directly benefit from the Preferred Design Plan to provide for additional east-west capacity and a more efficient transportation multi-modal transportation network.

As noted in **Chapter 9**, this Class EA study recommends the following for the Langstaff Road corridor:

- Widening to a 6-lane road with a 1.5 m cycle track and a 1.0 m buffer on each side of the road from Weston Road to Dufferin Street;
- Langstaff Road extension / bridge over the CN MacMillan Rail Yard;
- A bridge replacement at West Don River; and
- An overpass at the Metrolinx GO Transit Barrie Line.

It is acknowledged that the detailed design and construction of the Langstaff Road improvements may take place in multiple phases given the scale of the project and Regional Council funding priorities. Components of the project such as the grade separation with the Metrolinx GO Transit Barrie Line and the crossing over CN MacMillan Rail Yard are projected to be long-term infrastructure improvements. The mitigation measures and commitments identified as part of the Class EA study will be reviewed and confirmed in each detailed design phase subject to mandates of the respective agencies, regulations and guidelines, land use and other applicable factors current at that time. This section summarizes the impact, preliminary mitigation measures and commitments to future work under the respective technical areas.

A list of permits and approval is provided in **Section 10.10**.

10.1 Socio-Economic Environment

10.1.1 Property Requirements

Environmental Effects and Mitigation Measures

Impacts to individual properties as a result of the proposed improvements on Langstaff Road are discussed in **Section 9.1.15**. The Preliminary Design Plan for the proposed improvements on Langstaff Road was developed based on a "best fit" alignment along the existing corridor to minimize property impacts where feasible. Retaining walls have been proposed at selected location to minimize property impact.

Commitments to Future Works

10.1.1.A The timeline for property acquisition will be confirmed following the completion of the Class EA study based on the York Region's 10-Year Roads and Transit Capital Construction Program which is approved by Council annually.

10.1.1.B Additional property / permanent easement may be required during detailed design for the purpose of infrastructure (e.g. retaining wall) inspection and maintenance, and temporary construction yards. Impacts to private properties including potential reconfiguration of parking areas will be confirmed during detailed design.

10.1.1.C The type and exact location of proposed retaining walls as shown in the Design Plates in **Appendix A** will be confirmed during detailed design.

10.1.2 Access

Environmental Effects and Mitigation Measures

Some of the properties and businesses along Langstaff Road currently have full move access (left and right turns) onto the roadway. With the proposed widening on Langstaff Road, there will be a raised median as part of the future road cross section. Therefore, all existing full move access will become right-in/right-out access only.

In addition, existing access from Langstaff Road to 2777 Langstaff Road, 8500 Keele Street, 2180 Langstaff Road and 15 Connie Crescent will be directly impacted by the future structures over CN MacMillan Rail Yard, the West Don River bridge and the grade separation at Metrolinx GO Transit Barrie Line. The Preliminary Design Plan

reflects a proposed approach to providing long-term access to these businesses via alternate access from side streets.

Commitments to Future Works

10.1.2.A Details regarding the reconstruction and closure of existing accesses will be subject to future review during detailed design. Access plan and (re)design of existing accesses will adhere to York Region Access Guidelines.

10.1.2.B During construction, access to existing businesses, residential areas, public parks and recreational trails will be maintained. Should any short-term temporary closures be required, necessary notification will be provided in advance of the closure. Emergency access will be maintained at all times.

10.1.2.C For future developments that are currently subject to site plan approval or those that will be under future planning application process, the provision of an access to/from the Langstaff Road will be subject to review and approval by the City of Vaughan, York Region, and other relevant technical agencies.

10.1.3 Provision for Pedestrians and Cyclists

Environmental Effects and Mitigation Measures

Currently, sidewalks are provided at selected segments on Langstaff Road within the study area. The recommended improvements on Langstaff Road including the crossing over CN MacMillan Rail Yard and the grade separation (overpass) at the Metrolinx GO Transit Barrie Line are intended to support and promote all modes of transportation including provision for pedestrians and cyclists. A sidewalk and a cycle track are proposed on both sides of the road, between Weston Road to Dufferin Street.

Commitments to Future Works

10.1.3.A Further details, including intersection crossing treatments, and the timing of construction timing will be finalized during detailed design in consultation with the respective local municipalities and taking into consideration the most current design guidelines and objectives at the time. The design should incorporate existing green infrastructure where feasible, maximize the potential to increase the north-south linkage opportunities, and enhance the pedestrian experience through innovative softscape and hardscape solutions.

10.1.3.B Consideration will be made for cross-street planned and existing facilities at intersections. Intersections will be constructed with the objective of improving conditions for pedestrians and cyclists, including provisions for cross-rides, reduced curb radii (where technically feasible), signal heads, etc.

10.1.3.C Existing sidewalk on Langstaff Road will remain open during construction. Should temporary closures be required, necessary notification will be provided in advance of the closure.

10.1.3.D All intersections will be constructed with the objective of meeting AODA standards.

10.1.4 Streetscape and Landscape

The Tree Inventory Report can be found in **Appendix H** which detailed the conditions and potential impacts to existing trees along the Langstaff Road corridor.

Environmental Effects and Mitigation Measures

The proposed improvements of Langstaff Road is expected to result in the removal of 420 trees where trees are located within the limits of exaction for the road widening and implementation of active transportation facilities. Of the 420 trees, 224 are within the Region's right-of-way and 196 are within private properties. The Preliminary Design Plan for the proposed improvements on Langstaff Road was developed based on a "best fit" alignment along the existing corridor to minimize impacts to existing trees where feasible.

Opportunities for streetscape have been identified in the boulevards and raised median of Langstaff Road, as shown in the Preliminary Design Plan and Appendix A.

Commitments to Future Works

10.1.4.A A detailed Landscape / Streetscape Plan will be developed during detailed design. The Streetscape Plan will adhere to York Region's streetscape design objectives, as well as the Region's Designing Great Streets Guidelines (2019) and the Region's Street Tree and Forest Preservation Guidelines, as it pertains to tree protection, removals, and encroachment within the Regional right-of-way.

10.1.4.B Tree removals will be confirmed during detailed design and will follow best practices for preservation and protection, as well as any by-laws and permit requirements by York Region and the City of Vaughan.

10.1.4.C All tree removals must be coordinated in accordance and compliance with the Migratory Bird Convention Act (MBCA). To reduce the possibility of contravention of the MBCA, vegetation removal should be scheduled to occur outside of the bird nesting season of March 31 to August 31. (Also see **Section 10.4.2.1** Tree Inventory)

10.1.5 Noise and Vibration

While much of the study area consist of industrial and commercial land uses, there are existing residential land uses east of Dufferin Street and west of Weston Road. Representative receptor locations with reverse frontages along Langstaff Road have been identified and modelled to demonstrate the worst-case sound level; a total of 14 receptor locations were identified. The Noise Assessment Report can be found in **Appendix N** of the ESR. The noise assessment was carried out in accordance with the Ontario Ministry of Transportation (MTO) / Ministry of the Environment Conservation and Parks (MECP) Noise Protocol, as well as the York Region Standard Operating Procedures for Traffic Noise (July 2010).

Environmental Effects and Mitigation Measures

Based on the projected future sound levels resulting from the proposed undertaking on Langstaff Road, the change projected absolute noise levels of all 14 representative receptors would be less than 5 dBA; however, the absolute noise levels are projected to be over 60 dBA. Noise mitigation measures in the form of noise barrier walls have been investigated at all representative receptor locations, in accordance with the York Region guidelines. These measures were deemed not technically feasible, as they do not achieve the minimum noise reduction target of 6 dBA.

In terms of potential vibration impacts, ground-borne vibration is less common from rubber-tired vehicles, especially due to light weight passenger vehicles operating on smooth pavement at city speeds. Heavier vehicles, such as Class 8 trucks, have a higher potential do have the potential to generate ground-borne vibrations, however, the highest percentage of heavy trucks in the area is 2.7%. The United States Department of Transportation Federal Highway Administration (FHWA) has assessed the impact of operational traffic induced vibrations at highway speeds and has concluded that both measured and predicted vibrations are less than any known criteria (FHWA, 2017).

FHWA states that normal living activities, such as closing doors and walking across floors, within buildings could create greater levels of vibration than highway traffic. Therefore, at speeds well below 100 km/h (Langstaff Road is to be posted at 60 km/h), ground-borne vibration is expected to be insignificant.

Commitments to Future Works

Based on findings from the Noise Assessment, the provision of noise barriers is not proposed as part of the undertaking on Langstaff Road.

10.1.5.A In terms of construction noise, the potential for construction noise issues will be further reviewed during detailed design when construction methodology and schedule is fully developed. Construction activities will conform to York Region and City of Vaughan Noise Control By-Laws.

10.1.5.B All equipment shall be properly maintained to limit noise emissions. As such, all construction equipment will be operated with effective muffling devices that are in good working order. The Contract Documents will contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to be in effect. In the presence of persistent noise complaints, all construction equipment will be verified to comply with MECP NPC-115 guidelines. In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measured during construction may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration will be given to the technical, administrative and economic feasibility of the various alternatives.

10.1.5.D Complaints from construction will be investigated according to the provisions of the existing Region's noise policies.

10.1.6 Air Quality Assessment

An Air Quality Assessment has been completed as part of the Langstaff Road Class EA study and can be found in **Appendix O** of the ESR. The objective of the assessment was to quantify how the proposed undertaking on Langstaff Road will affect air quality in the future. The Air Quality Assessment targeted the section of Langstaff Road between Highway 7 and Dufferin Street since this is the only section with sensitive receptors in proximity to the roadway.

Environmental Effects and Mitigation Measures

The emission modelling was based on the U.S Environmental Protection Agency's roadway traffic emissions model, MOVES version 2014b, and the dispersion modelling was based on the US EPA's dispersion model AERMOD version 16216r. The background concentrations were estimated using air quality monitoring data collected by Environment and Climate Change Canada (ECCC).

A Future No-Build (i.e., without the proposed undertaking on Langstaff Road) and Future-Build (i.e., with the proposed undertaking on Langstaff Road) scenarios were considered. The differences between the two scenarios represent the change in air quality due to the project. For both the Future No-Build and Future Build scenario, vehicle emissions were represented using projected 2041 traffic volumes and 2041 vehicle emission factors.

Three worst-case air contaminants were chosen to assess the effects of the project on the surrounding air quality: NO_2, $PM_{2.5}$ and benzene.

The proposed project is expected to increase local air contaminant levels. $PM_{2.5}$ and benzene exceed their thresholds for the annual averaging time, at the most impacted receptor location for both the Future Build and Future No-Build scenarios. Predicted exceedances of the threshold is caused by the elevated background concentrations in the study area. $PM_{2.5}$ background accounts for 94% of the concentration at the worst-case receptor. The background concentration for benzene exceeds the threshold without contributions from the roadway.

Through the comparison of the Future No-Build and the Future Build scenarios, the proposed improvements to Langstaff Road will not have significant impacts on nearby receptors.

While the Langstaff Road project itself is not expected to result in negative impact to the air quality in the study area, on a broader scale, York Region has a regional wide approach to air quality to manage emissions and greenhouse gases through sustainable transportation infrastructure planning and implementation.

York Region Approach to Regional Air Quality

York Region is committed to ensuring the environmental health of its residents. In addition to the Ontario initiatives, York Region's Corporate Air Quality Strategy, as approved by Council in 2008, identifies region-wide initiatives (not just road corridor

specific) which support the management of emissions and greenhouse gases. The Corporate Air Quality Strategy can be viewed at: http://www.york.ca/wps/wcm/connect/yorkpublic/fcfe024d-f5d6-4678-aece-f703f3c96a8a/York+Regional+Corporate+Air+Quality+Strategy.pdf?MOD=AJPERES

Regional initiatives in support of the Corporate Air Quality Strategy are on-going and include the Transportation Master Plan – a key planning policy document that guides the Langstaff Road Class EA study. The TMP plans for a more sustainable region by actively taking steps to move more people by public transit, carpooling, on foot and by bicycle and thus shift the focus away from single occupant motor vehicles to more sustainable travel modes. To support increased transit operations, the Region is planning on implementing road improvements including rapid transit and transit priority corridors.

As a signatory to the Clean Air Council (CAC) Inter-Governmental Declaration on Clean Air & Climate Change, York Region was also recognized for meeting targets of the CAC 2012-2014 Inter-Governmental Declaration on Clean Air & Climate Change, including meeting the active transportation plan target. One of the four priority action areas identified in the 2015-2018 Inter-Governmental Declaration on Clean Air & Climate Change in accordance with the development of healthy, lower carbon and sustainable communities is: Development and implementation of active transportation and transportation demand management into transportation planning, policy and decision making.

The 20/20 Way to Clean Air is another program supported and implemented by the Region. This program provides the link between air pollution, energy use, climate change and public health and acts as a guide to help participants cut down vehicle emissions and home energy use. In support of this, York Region offers active transportation options and programs including:

- Metrolinx Smart Commute Program: This Transportation Demand Management program offers services to employers interested in promoting carpooling, transit and other sustainable means of transportation to their workforce for commuting purposes. The goal is to reduce traffic congestion and vehicle emissions throughout the GTA and surrounding areas;
- Public Transit: YRT / Viva and GO Transit;
- School Transportation Options: Green Communities Active and Safe Routes to School; and

- Tips to Reduce Energy Use on the Road.

York Region's Moving to 2020: YRT/VIVA 2016-2020 Strategic Plan identifies how they will address and implement York Region's transit needs over the next five years, including connecting to expanding GO Transit train services. Key initiatives of this plan include frequent transit network, connections with GO Transit, service expansion, and increase transit ridership.

The recommendations from the Langstaff Road Class EA study support various Region initiatives and plans to help improve the overall air quality in the Region by implementing active transportation options that reduce emissions. The proposed cycle track and sidewalk along the Langstaff Road corridor provide the necessary infrastructure to support multi-modal travel and active transportation. The new Langstaff Road crossing over CN MacMillan Rail Yard will also provide opportunities for future transit operation improvements and a more efficient transit system.

York Region is actively mitigating air pollutants through extensive tree planting initiatives. The planting of trees and vegetation promotes healthy and sustainable communities. There will be opportunities for tree planting and landscape features in the boulevards as part of the proposed Langstaff Road improvements. Regional and local municipalities throughout Ontario are working with MECP in taking on tree and vegetation planting initiatives to mitigate air quality impacts resulting from the growing population and increasing traffic volumes. For over 15 years, York Region continues to be pro-active in its region-wide and transportation corridor-specific tree-planting initiatives. The addition of trees creates and maintains healthy natural environments that promote healthy, sustainable communities. The York Region Official Plan sets out a woodland cover goal of 25%. York Region is working to achieve the goal through various programs, such as York Region's Greening Strategy, York Region's Streetscape Program, Municipal Streetscape Partnership Program and Towards Great Regional Streets:

- The Greening Strategy provides a framework for restoring habitat, increasing forest cover, securing Greenlands and their linkages and promoting and protecting the natural environment. One of its targets is planting a minimum of 70,000 trees and shrubs annually. Over 91,000 trees were planted in 2014 and over 95,000 trees were planted in 2015 under the Greening Strategy.
- York Region's Streetscape Program has an objective to achieve the successful coordination of the road, sidewalks, trails, walking and transit facilities within Regional road corridors. Achieving universal accessibility, focusing on pedestrian

comfort to encourage walking and cycling are of prime importance. To establish an environment that is welcoming to all modes of transportation, the program is focused on increasing the number of trees within the boulevards and medians and optimizing street tree health to improve air quality and reduce energy use.

- The Municipal Streetscape Partnership Program (MSPP) assists York Region's nine local municipalities in cost sharing on streetscape design projects on Regional roads. The Region commits up to $1 million annually towards this program. This funding program is critical to the success of streetscape design in York Region. The MSPP benefits both local municipalities and York Region in achieving higher quality streetscape design within our communities.
- York Region developed its Towards Great Regional Streets – A Path to Improvement design guidelines to formalize requirements for its roads so that they are consistent throughout the Region. Key requirements include enhanced tree planting and landscaping in the boulevards and medians, cycling facilities, sidewalks and Transit/HOV lanes.

Commitments to Future Works

10.1.6.A York Region is committed to continuing the above noted initiatives in future detailed design for the proposed undertaking on Langstaff Road.

10.1.6.B During construction of the roadway, dust is the primary contaminant of concern. Other contaminants including NOx and VOC's may be emitted from equipment used during construction activities. Due to the temporary nature of construction activities, there are no air quality criteria specific to construction activities. However, the Environment Canada "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" document provides several mitigation measures for reducing emissions during construction activities.

10.1.6.C Mitigation techniques discussed in the document include material wetting or use of chemical suppressants to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust and equipment washing. It is recommended that these best management practices be followed during construction of the roadway to reduce any air quality impacts that may occur. It is noted that MECP recommends that non-chloride dust suppressants be applied. MECP also recommends referring to the following publication in developing dust control measures: Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. Report prepared for Environment Canada. March 2005.

10.1.7 Climate Change

Environmental Effects and Mitigation Measures

The MECP guide Consideration of Climate Change in Environmental Assessment in Ontario sets out ministry expectations and supports the province's Climate Change Action Plan by outlining climate change considerations for environmental assessment studies.

The guide notes ‘climate consideration’ within a project means that consideration has been given to methods to reduce greenhouse gas emissions and developing a design that is more resilient to future changes in climate and helps maintain the ecological integrity of the local environment in the face of a changing climate. Specifically, proponents are encouraged to consider mitigation (how the project might mitigate climate change) and adaptation (measures to adapt to climate change or make the project more resilient to the effects of climate change). Considering how a project may contribute to climate change, through its greenhouse gas emissions or its effects on the natural landscape, is important to the planning process as it allows proponents to consider climate mitigation measures to avoid, minimize, or offset such effects.

To mitigate potential effects during the construction phase of the project, the following best practices, or the most current best practices, will be implemented:

- Develop and implement detailed erosion and sediment control measures to be carried out during all construction phases in order to limit the amount of sediment/laden material entering receiving drainage systems.
- Dust suppression techniques to be employed for the duration of construction activities.
- A traffic staging plan will be developed during detailed design to accommodate local access and through traffic during congestion in alternate routes. Opportunities to reduce idling twill be considered further during detailed design.
- Potential effects to consider pertaining to construction include the greenhouse gas (GHG) emissions associated with the construction period, including the physical machinery and equipment, travel distance and time for construction workers to travel to and from the site, and sourcing building materials. The construction vehicle movement and access to the site are to be described in the contract documents to be prepared in detailed design. Idling and hours of work conditions will also be considered within the contract documents.

To mitigate potential effects during the operational phase of the project, aligning with best practices for infrastructure design, practices such as more frequent monitoring and maintenance and improvement of road design to be more climate change resistant are recommended. In addition, measures to adapt to climate change impacts and minimize impacts to individuals using Langstaff Road in the future may include (but are not limited to):

- Erosion protection techniques developed during detailed design to limit the extent of channel and bank erosion in the vicinity of the watercourse crossings along the study corridor.
- As the amount of impervious surface areas will increase, appropriate stormwater capacity should be considered to mitigate additional runoff, climate change and the likelihood of extreme precipitation.

York Region Approach to Considering Climate Change

York Region's approach to considering climate change is guided by provincial policies (Growth Plan and Provincial Policy Statement), and embedded in several of the policies as discussed in **Chapter 3** of this report including the:

- Province's Growth Plan;
- Provincial Policy Statement;
- York Region Official Plan; and
- York Region Transportation Master Plan.

The project-specific recommendations outlined in **Chapter 8.7** of this report directly support many of these policies and involve measures that will aid the Region in mitigating climate change. For example, the key objective the Langstaff Road Class EA study is to provide additional east-west capacity and transportation linkage on regional roads which would provide multi-modal choices for all road users (i.e. pedestrians, cyclists, transit and auto), and goods movement, and reduce overall congestion in the study area.

Commitments to Future Works

10.1.7.A York Region is committed to continuing the above noted approach regarding climate change in future detailed design for the proposed undertaking on Langstaff Road.

10.2 Archaeology

A Stage 1 Archaeological Assessment was completed for the Langstaff Road Class EA study and can be found in **Appendix E**.

Environmental Effects and Mitigation Measures

Much of the corridor along Langstaff Road is considered to have no archaeological potential due to previous disturbance such as the construction of roadways, adjacent development, as well as ditching and buried infrastructure. Areas in the proximity of the West Don River valley are considered to have archeological potential.

The Preliminary Design Plan for the proposed improvements on Langstaff Road was developed based on a “best fit” alignment along the existing corridor to minimize impacts to lands with archaeological potential such as the West Don River valley.

Commitments to Future Works

Recommendations and commitments for future work are summarized below.

- **10.2.A** Additional archaeological assessment is not required for those areas visually determined to be disturbed including: Langstaff Road, Weston Road, Jane Street, Keele Street, Dufferin Street, Highway 7, and Highway 400, and the numerous side streets within the study corridor, as well as housing, commercial, and industrial developments. Additionally, all areas assessed as low and permanently wet do not require further assessment.
- **10.2.B** Additional archaeological assessment is not required for those areas previously subject to archaeological assessment, where it has been determined that archaeological potential no longer exists.
- **10.2.C** One historic cemetery is located within the study corridor, and should be avoided by the proposed undertaking. Currently, the limits of the cemetery are not known. If future impacts are proposed within 10 m of the cemetery, a cemetery investigation program is required. The cemetery investigation program must involve mechanical topsoil removal within the proposed area of impact for a minimum of 10 m beyond the known cemetery limits to confirm there are no burials outside of the known cemetery limits. However, if proposed development impacts are more than 10 m from the edge of the cemetery, the development impacts are considered to pose no threat to the

cemetery. Regardless, it is recommended that a temporary barrier be erected around nearby cemeteries and that “no go” instructions be issued for all onsite crews as a precautionary measure.

- **10.2.D** The remainder of the study area contains archaeological potential and will require a Stage 2 Archaeological Assessment prior to any ground disturbing activities:
    - Since the areas identified as holding archaeological potential are comprised of wooded greenspace along rivers, woodlots, and public parklands, ploughing is not feasible. As a result, the portion of the study corridor with archaeological potential must be subject to a test pit survey as per Section 2.1.2 of the Standards and Guidelines for Consultant Archaeologists (Ministry of Heritage, Sport, Tourism and Culture Industries [MHSTCI, formerly Ministry of Tourism, Culture and Sport (MTCS)] 2011:31).
    - The portion of the property not subject to the property inspection (rail yard) must be subject to a combination survey comprised of a mixture of test pit survey and visual assessment, as per Section 2.1.8 of the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011:38).
- **10.2.E** According to York Region’s Official Plan ROPA 6, where there is the potential for lands to contain an ossuary, it is recommended that burial avoidance strategies be implemented to attempt to mitigate any negative impacts to unknown ossuary locations. Based on the ossuary potential model, several large portions of the study area have the potential to contain as ossuary.

10.3 Built Heritage

A Cultural Heritage Assessment Report was prepared based on the preferred alignment alternative and can be found in **Appendix F**.

Environmental Effects and Mitigation Measures

The Preliminary Design Plan for the proposed improvements on Langstaff Road was developed based on a “best fit” alignment along the existing corridor to minimize impacts to built heritage resources where feasible.

While there will be no direct impact to the Langstaff Cemetery (Old St. Stephen’s Church Cemetery) at 2077 Langstaff Road, the existing setting and character of the

cemetery will change due to the widening of Langstaff Road and the introduction of the sidewalk, as well as an access drive to the property on the south side of the road.

Commitments to Future Works

10.3.A The Region shall consult with the City of Vaughan to determine if the completion of a Cultural Heritage Impact Assessment is required by the City of Vaughan, using the City's guidelines, for the Langstaff Cemetery to address the impact of the proposed road widening on Langstaff Road adjacent to the cemetery.

10.3.B If construction will affect any cultural heritage properties or resources, York Region will consult with the City of Vaughan prior to any construction activities.

10.4 Natural Environment

The Natural Environment Report for the Langstaff Road Class EA study is provided in **Appendix G**. Preliminary mitigation recommendations are summarized below and will be finalized during detailed design.

In general, mitigation of negative effects to the natural environmental features is applied throughout the Class EA process as the alignment and then the structural design alternatives are developed, refined and evaluated. Some negative effects cannot be completely avoided; therefore, additional mitigation measures are identified in order to minimize these effects. This section outlines the potential environmental effects of the Langstaff Road preferred plan on natural environmental features, mitigation measures to address the potential impacts and commitment to future works.

Critical functions for local and regional ecosystems are provided for by natural physical and ecological processes. Crossing designs at watercourses, where permissions to enter were granted, are designed to consider the TRCA Valley and Stream Corridor Guideline and Fish and Wildlife Crossing Guidelines which consider the terrestrial and aquatic wildlife movement needs and the transport of nutrients and energy and the conveyance of runoff and meltwater. These locations include Don River West Branch and the Tributary of Westminster Creek. The proposed new culvert (LC1) of an unnamed tributary of West Don River was not assessed in the field (permission to enter was not granted during the Class EA study), as such design details do not include specific ecological considerations. No proposed changes to the current Westminster Creek crossing are anticipated and the Black Creek crossing will be addressed in a future study.

It should be noted that the proposed undertaking on Langstaff Road, including the extent of the direct impacts as a result of design details for the roadway and bridges and their associated grading requirements (e.g., cross-sections, road and structural embankment slopes, drainage requirements, grading limits), and therefore the assessment of their associated impacts, are preliminary. This impact assessment will be further developed and finalized during detailed design, with consultation with relevant agencies.

The associated mitigation measures recommended herein, which are designed for avoiding or minimizing intrusion as well as minimizing potential for secondary and indirect effects, will also be refined and finalized at that stage. The mitigation measures developed during detailed design will be included in the Contract Documents for implementation during construction.

10.4.1 Fisheries and Aquatic Resources

Environmental Effects and Mitigation Measures

The crossing of West Don River is proposed to be replaced to accommodate the future widening of Langstaff Road to six lanes. Impacts associated with the replacement of Bowes Bridge include habitat enclosure, which would require the direct removal of riparian vegetation, indirect loss of in-stream vegetation through shading, modification of bed and bank conditions, and temporary disturbance of habitat within the vicinity of the work zone. The affected riparian vegetation is comprised of culturally influenced vegetation such as: cattails, goldenrod, and various riparian trees, and the stream habitat is dominated by flats with mainly coarse substrates, typical of the study reaches and vicinity. No sensitive or unique habitat elements will be affected by the proposed design of the replacement bridge, which supports direct fish use (up and downstream). The proposed design will maintain fish movement as well as wildlife provide for enhance wildlife movement through the new structure given the longer span. There is likely to be no permanent footprint impact of the replacement bridge below the high-water level.

The replacement bridge will span the active channel. Pre-construction channel conditions will be re-instated following the excavations required to install the footings, and transitioned smoothly with the upstream and downstream channel section. The design of the bank restoration will be a collaborative effort with the project water resources team, fluvial geomorphologists and fisheries biologists as appropriate and depending on the degree of disturbance, to be compatible and transition smoothly with

the existing channel section up and downstream. The site-specific design will be developed during detailed design.

Installation of any required rock protection or embankment encroachment into edges of the bankfull channel elevation such that it is inset to match the existing bankfull channel profile and transition smoothly with the existing channel profile. If required, any channel hardening should use bio-engineering techniques such as vegetated rock buttresses.

Commitments to Future Works

10.4.1.A It is unlikely that the Tributary of Westminster Creek holds a permanent fish population; as such impacts associated with the channel widening would be limited to potential indirect effects during construction. The one Largemouth Bass and one Brown Bullhead observed near the downstream culvert outlet likely originate from the SWM pond east of the woodlot, north of Langstaff Road (east of Dufferin Street). It is possible that the fish were carried downstream at a time the SWM pond overflowed. These specimens likely travelled through the piped section from the SWM pond and into the culvert crossing under Dufferin Street. No exceptional spawning, rearing, or feeding habitat was noted in the tributary. It is recommended that at the onset of detailed design, a site reconnaissance visit be completed to confirm that the tributary functions to provide flows and allochthonous inputs to direct fish habitat to Westminster Creek downstream. The proposed channel widening will maintain flow conveyance and important nutrient and sediment inputs into the downstream waterway.

10.4.1.B The channel widening of the tributary and associated culvert replacements will be designed and installed so as to transition smoothly with the up and downstream channel section and avoid development of erosion and downstream sediment transfer.

10.4.1.C To determine whether death to fish and/or HADD of fish habitat may occur, a review under the Fisheries Act of each watercourse will be required when the works are finalized and a sound understanding of the construction techniques and impacts are determined. If the proposed detailed design will impact fish habitat (below the 2-year flow), then works should be reviewed under the *Fisheries Act* and, if required, a Request for Review to DFO shall be submitted. If it is confirmed that the Tributary of Westminster Creek does not support a permanent population of fish; then the widening of this feature is unlikely to result a Fisheries Act Authorization; however, a Request for Review (RfR) should be submitted to DFO with an outline of measures to protect fish and fish habitat downstream.

10.4.1.D Potential indirect effects associated with the works, include temporary disturbance during the construction period with associated potential for erosion and downstream sediment transport during periods of higher flow and temporary diversion of flows, as well as disturbance of any fish using the work zone, which is most likely limited to the West Don River.

The following summarizes the general commitment to future works relevant to the proposed specific works and character of the watercourses, in order to minimize potential impacts during and following construction activities:

- **10.4.1.E** Comprehensive erosion and sediment control (ESC) measures will be specified in the Contract Document. TRCA's Erosion and Sediment Control Best Management Practices (2019) should be used as a reference when developing appropriate ESC measures.
    - Perimeter silt fence (or appropriate containment measures) will be installed between the work areas and all reaches of the watercourses where works are required, including ditch and drainage works that drain to watercourses that support direct or indirect fish use.
    - The fencing will be properly installed and regularly inspected and maintained. It will be left in place and maintained until all surfaces contributing drainage to these watercourses are fully stabilized.
    - All exposed and newly constructed soil surfaces will be stabilized using appropriate means in accordance with the characteristics of the soil material and slope conditions.
    - These surfaces will be fully stabilized and re-vegetated as quickly as possible (and at a maximum within 45 days) following completion of the works.
- **10.4.1.F** The construction access and work areas and associated requirements for removal of riparian vegetation, will be minimized to the extent required for the construction activities, delineated in the field using the properly installed protective measures, re-stabilized and where appropriate (e.g., riparian areas) re-vegetated following construction.
- **10.4.1.G** A warmwater construction timing window (no in-water works between April 1st and June 30th) will be used for in-stream works in the watercourses that support bait or forage fish as well as the other watercourses that provide only indirect habitat but support direct fish use at some point

downstream of the crossing (or as updated based on fish use during detailed design).

- **10.4.1.H** Appropriate 'temporary flow passage' measures (e.g., considering substrate and flow conditions, specific construction methods, timing and duration of works etc.) will be developed and implemented to isolate the temporary instream construction zones to maintain clean flow downstream of the works:
    - Where dam and pump measures are used, the withdrawal points for any dam and pump temporary flow passage systems will be properly sited and designed to prevent intake of silt or fine bed materials, and the discharge points sited and designed to prevent erosion and any sediment resuspension.
    - If temporary flow bypass channels are required in some cases (e.g., due to flow volumes), these features will be sited and designed to minimize impacts to terrestrial and riparian vegetation, and all disturbed areas will be fully rehabilitated following construction. Specific attention will be paid to the tie-in points with the existing channel both during use and as a component of the rehabilitation.
    - Where temporary flumes are used, they will be sized with specific consideration of the timing and duration of flow.
    - Where there is no flow in a watercourse at the time of construction, temporary flow management measures will be used or maintained on-site and available for immediate installation in the event of a storm and commencement of flow.
- **10.4.1.I** All hoses drawing water from a watercourse supporting fish use will be screened to prevent potential entrainment of fish.
- **10.4.1.J** Any fish stranded within the temporary work zones in those watercourses that support fish will be removed using appropriate techniques by qualified individuals and released downstream of the temporary work zones under a Licence to Collect licence from the local NDMNRF office.
- **10.4.1.K** All construction-related activities will be controlled so as to prevent entry of any petroleum products, debris or other potential contaminants/deleterious substances, in addition to sediment as outlined above, to the watercourses. No storage, maintenance or re-fueling of equipment will be conducted near the watercourses.

- **10.4.1.L** Only clean materials free of fine erodible particulate matter will be placed in the water for temporary construction measures (e.g. coffer dams will be constructed of 'pea gravel' bags, geotextile fabric, sheet pile or other clean material) or permanent works (e.g. substrate material or scour protection, fill for waterbody crossings).
- **10.4.1.M** During any temporary dewatering required for works, appropriate energy dissipation and settling/filtration measures will be used for discharge of dewatering water to ensure no erosion or sediment release occurs in the watercourses or drainage features. The dewatering plan will include properly sized, designed and sited temporary filtration facilities. Discharge points for release of dewatering discharge will be sited and designed to prevent erosion and ensure only clean flow is released to the watercourses.
- **10.4.1.N** Any temporarily stockpiled soil, debris or other excess materials, and any construction-related materials, will be properly contained in areas separated at least 30 m from the watercourses.
- **10.4.1.O** All construction materials, excess materials and debris will be removed and appropriately disposed of following construction.
- **10.4.1.P** No equipment shall ford or otherwise enter any watercourse except as specified in the future Contract or unless authorized by the appropriate environmental agency/permit.
- **10.4.1.Q** An environmental inspector experienced in working around watercourses will be responsible for ensuring the erosion and sediment control measures are functioning effectively and being maintained, and all of the other general mitigation measures are being implemented as intended. The inspector will ensure all environmental mitigation and design measures are properly installed/constructed and maintained, and appropriate contingency and response plans are in place and implemented if required.
- **10.4.1.R** All details for aquatic and terrestrial passage both during construction and post-construction (final design) will need to be discussed with TRCA and should comply with the TRCA Valley and Stream Corridor Guideline and Fish and Wildlife Crossing Guideline for Bowes Bridge replacement and work associated with the Tributary of Westminster Creek. If during detailed design, there are any changes proposed for the existing crossing over Westminster Creek, the new structures should comply with these guidelines.

- **10.4.1.S** The design and implementation of mitigation and restoration measures should aim to improve the level of ecosystem services provided by the Natural System, as per TRCA's Living City Policies (2014).

10.4.2 Vegetation

Environmental Effects and Mitigation Measures

Direct and indirect impacts on the vegetation will be largely confined to the existing ROW. Vegetation communities within or adjacent to the ROW consist primarily of Cultural Meadow, thicket and woodland, anthropogenic habitats considered common and widespread across the broader landscape. None of the potentially impacted vegetation communities are considered rare in Ontario.

Following construction, similar vegetation is expected to regenerate naturally in those areas of the corridor temporarily disturbed for construction and staging. Based on the initial design, negative impacts from the construction and staging of the proposed works on these features are likely to be minimal, indirect, or temporary. The proposed works in the vicinity of the Significant Woodland will occur only west of Dufferin Street within the actively maintained ROW, and will not be impacted by the proposed works. Many of the regionally significant plants are associated with the Significant Woodland, or are otherwise located outside of the anticipated area of impacts. Further, many of the species in the vicinity of the Don River West Branch are of anthropogenic origin, as they were planted as part of restoration efforts. The remainder of the species are anticipated to regenerate naturally in those areas of the corridor temporarily disturbed for construction and staging. Generally, vegetation communities within the existing rail corridor consist primarily of Cultural Meadow, considered common and widespread across the broader landscape, and support no other sensitive species. The vegetation to be removed or disturbed consists primarily of early successional and disturbance-tolerant species. None of the potentially impacted trees, vegetation communities, associated species recorded or expected in the area, or their habitat values are rare or limited within the broader landscape surrounding the project. Following construction, similar vegetation is expected to regenerate naturally in those areas of the ROW temporarily disturbed for construction and staging.

As with most construction activities, there is potential for indirect impacts to adjacent retained vegetation features during construction and following construction when the

trail is in use and being actively maintained. These indirect impacts may include, but are not limited to, the following:

- Vegetation clearing / damage beyond the working area / rail corridor,
- Spills of contaminants, fuels and other materials that may reach semi-natural areas, and;
- Impacts of trail use (increase anthropogenic disturbance including disruption to wildlife, trash, the introduction of invasive species, etc.) and maintenance (ongoing vegetation clearing, use of salt in slippery conditions if maintained in the winter, etc.).

Commitments to Future Works

The following general commitments to future works are recommended to minimize effects to the local vegetation communities and their associated habitat functions:

- **10.4.2.A** The areas of vegetation to be cleared and the adjacent areas to be retained will be clearly delineated, to minimize unnecessary vegetation effects and avoid incidental effects as a result of temporary stockpiling, debris disposal and access.
- **10.4.2.B** Stabilize and re-vegetate exposed surfaces within 45 days of completion of works at those locations. Plantings will follow the recommendations on landscape plans, to be developed at detailed design and will include native species suitable to the site conditions.
- **10.4.2.C** Clearly delineate vegetation clearing zones and vegetation retention zones (i.e., using fencing) on both the construction drawings and in the field with the Contract Administrator prior to clearing and grading. Equipment, materials and other construction activities will not be permitted in vegetation retention zones.
- **10.4.2.D** The Contract Administrator will be notified in the event the Contractor needs to clear additional vegetation beyond the above limits, as specified in the Contract Documents, and these limits will be reviewed in the field for acceptability.
- **10.4.2.E** If tree removals are necessary, fell trees and shrubs to be removed into the existing work area, to avoid disturbance to retained vegetation and habitats.

- **10.4.2.F** Dispose of cut material through chipping or other appropriate means.
- **10.4.2.G** Avoid all unnecessary traffic, dumping and storage of materials over tree root zones adjacent to the right-of-way.
- **10.4.2.H** Conduct vehicle maintenance and fueling at the designated and properly contained maintenance areas in the works yards or at commercial garages located well away from retained vegetation areas.
- **10.4.2.I** Remove and dispose of all spoil and other construction-related debris following construction in appropriately designated areas.
- **10.4.2.J** Implement environmental inspection during construction to ensure that all mitigation measures are implemented properly, maintained and repaired, and remedial measures are initiated where warranted.
- **10.4.2.K** To control the establishment and / or proliferation of non-native or invasive species during construction, consider adhering to the Clean Equipment Protocol for Industry.
- **10.4.2.L** Consider the use of salt alternatives for path maintenance in icy weather, such as sand, particularly in proximity to wetland areas.
- **10.4.2.M** Consider opportunities for vegetation compensation / enhancement plantings to address vegetation removals. This could include incorporating removal of invasive species and planting native species. The tree inventory to be completed during detailed design should include measures for tree compensation.
- **10.4.2.N** The design and implementation of mitigation and restoration measures should aim to improve the level of ecosystem services provided by the Natural System, as per TRCA's Living City Policies (2014).

10.4.2.1 Tree Inventory

Also see **Section 10.1.4** regarding tree removal impacts and associated mitigation measures, as well as commitments to future works.

Environmental Effects and Mitigation Measures

A majority of vegetation found on site is immature to semi-mature and characterized by native and non-native deciduous and coniferous trees that majority have been planted.

A minimal number of trees have been identified as potential removals (Ash and Buckthorn). Removal and impacts to vegetation within the limits of the proposed right-of-way, grading and construction to be confirmed during detailed design. It is likely some removals will be required to accommodate the road improvements. No SAR or regionally rare trees were observed within the study area.

Commitments to Future Works

York Region's Street Tree and Forest Preservation Guidelines will be used as it pertains to tree protection, removals, and encroachment within the Regional right-of-way. The following is a list of practical considerations for the construction phase of the project that applies to all trees that may be impacted by the construction:

- **10.4.2.1.A** Tree protection fencing will be maintained until all construction is completed, soils are stabilized and all of the equipment has been removed from the site.
- **10.4.2.1.B** Prior to the commencement of tree removals, all limits of the locations of the tree preservation fencing must be clearly staked in the field, installed per approved plans, and approved by the Contract Administrator. All trees within the tree preservation zone must be left standing. The tree removals must be coordinated in accordance and compliance with the *Migratory Birds Convention Act* (MBCA), from March 31 to August 31.
- **10.4.2.1.C** All removals must be felled into the work area to ensure that damage does not occur to the trees within the tree preservation zone.
- **10.4.2.1.D** Upon completion of the tree removals, all felled trees are to be removed from the site, and all should be brush chipped. All brush, roots and wood debris must be shredded into pieces that are smaller than 25 mm in size to ensure that any insect pests that could be present within the wood are destroyed.
- **10.4.2.1.E** The Canadian Food and Inspection Agency (CFIA) has issued a prohibition of movement where the Emerald Ash Borer (EAB) (*Agrilus planipennis*) has been confirmed. EAB has been found within the Region of York and the City of Vaughan has been identified as part of the EAB Regulated Area encompassing most of Ontario and a portion of western Quebec. This directive pertains to the movement of regulated materials (including but not limited to ash wood or bark and ash wood chips or bark chips) from a regulated area. EAB

regulated articles moving out of a regulated are must be accompanied by a Movement Certificate issued by the CFIA. Refer to the EAB Regulated Areas of Canada found on the CFIA website.

- **10.4.2.1.F** Ash materials may be removed from the site and disposed of within the 'Regulated Area' (see CFIA website for the 'Regulated Area' limits). Should it be necessary to dispose of Ash products outside of a 'Regulated Area' a 'Movement Certificate' will be required from CFIA prior to transport.

- **10.4.2.1.G** Tree protection fencing must be constructed and installed as per details on the approved Tree Preservation Plan. Upon installation of the fencing, the Contractor will contact the Contract Administrator to review and approve the fencing and its location prior to commencement of any grading work.

- **10.4.2.1.H** Areas within the tree preservation zone (TPZ) are not to be used for any type of storage (e.g. storage of debris, construction material, surplus soils, and construction equipment). No trenching or tunneling of underground services shall be located within the TPZ or dripline of trees designated for preservation within or adjacent to the construction zone.

- **10.4.2.1.I** No grade changes shall occur within the TPZ unless approved as part of this report. In the event that any grade changes may occur, either as a cut or fill situation, the consulting arborist must be notified prior to such work occurring to ensure that all precautions to preserve the tree are made.

- **10.4.2.1.J** Trees shall not have any rigging cables or hardware of any sort attached or wrapped around them, nor shall any contaminants be dumped within the protection areas. Further, no contaminants shall be dumped or flushed where they may come into contact with the feeder roots of the trees.

- **10.4.2.1.K** In the event that it is necessary to remove additional limbs or portions of trees after construction has commenced, in order to accommodate the construction, the consulting arborist is to be informed and under their direction the removal is to be executed carefully and in full accordance with arboricultural techniques, by a certified arborist.

- **10.4.2.1.L** Root exploratory excavation or root sensitive excavation and root pruning. Applied to trees where the proposed works will encroach into the Tree Protection Zone.

- **10.4.2.1.M** Soil decompaction through aeration. Where compaction may occur within a reduced Tree Protection Zone, expose soil using Air Spade or Air Knife or similar and install mulch and sand to improve aeration.

Root Pruning Practices

- **10.4.2.1.N** All approved root pruning is to take place by or under the supervision of an arborist and in accordance with good arboricultural practices.
- **10.4.2.1.O** Pruned root ends shall be neatly and squarely trimmed and the area shall be backfilled with clean native fill as soon as possible to prevent desiccation and promote root growth.
- **10.4.2.1.P** The exposed roots shall not be allowed to dry out and an appropriate watering schedule shall be undertaken (e.g. water bi-weekly to field capacity between June 1st and September 15th) so that the roots maintain optimum soil moisture during construction and backfilling operations.
- **10.4.2.1.Q** Backfilling shall occur immediately and shall be with clean uncontaminated topsoil from approved source. It is recommended that texture of backfill be coarser than existing soils, and the backfill comes into clean contact with existing soils, i.e. remove air pockets, sod, etc.

Branch Pruning Practices

- **10.4.2.1.R** All limbs damaged or broken during the course of construction should be pruned cleanly, utilizing by-pass secateurs in accordance with approved horticultural practices. Should there be a potential risk of transfer of disease from infected to non-infected trees, tools must be disinfected after pruning each tree by dipping in methyl hydrate. This practice is particularly important during periods of tree stress and when pruning many members of the same genera, within which a disease could be spread quickly (i.e. Verticillium Wilts on Maples or Fireblight on genera of the Rosaceae family).
- **10.4.2.1.S** All pruning cuts should be made to a growing point such as a bud, twig or branch, cut just outside the branch collar (the swollen area at the base of the branch that sometimes has a bark ridge), and perpendicular to the branch being pruned rather than as close to the trunk as possible. This minimizes the site of the wound. No stubs should be left. Poor cut location, poor cut angle and torn cuts are not acceptable.

- **10.4.2.1.T** Extensive pruning is best completed before plants break dormancy. Pruning should be limited to the removal of no more than one third (1/3) of the total bud and leaf bearing branches. Pruning should include the carful removal of:
    - Deadwood,
    - Branches that are weak, damaged, diseased and those which will interfere with construction activity,
    - Secondary leaders of conifers,
    - Trunk and root suckers,
    - Trunk waterspouts, and
    - Tight V-shaped or weak crotches (included unions).
- **10.4.2.1.U** Any branches that overhang the work area and require pruning are to be pruned using good arboricultural practices utilizing by-pass secateurs in accordance with approved horticultural practices and/or American National Standard (ANSI) A300 (Part 1) – 2008 Pruning.
- **10.4.2.1.V** The Contractor must report immediately any damage to trees such as broken limbs, damage to roots, or wounds to the main trunk or stem system so that the damage can be assessed immediately.

Construction Implementation

- **10.4.2.1.W** Pre-Construction: A site meeting will be held with the Contractor and Contract Administrator to review the clearing limits and confirm the installation location for the temporary tree protection fence. Tree removal along the tree retention limit must be carefully felled away from the tree protection limit and into the construction/development area. Stumps adjacent to trees identified for retention are to be flush cut and not chipped or grubbed in order to avoid impacts to retained trees.
- **10.4.2.1.X** Construction: Periodic inspections will be undertaken by the site supervisor to ensure that the mitigation measures are being maintained during construction. The temporary protection fence is to be maintained throughout the entire construction period. No equipment storage, flushing of fuel, washing of construction equipment, and storage of spoil or construction debris is to occur behind the temporary protection fence. To avoid root zone impacts on trees to be retained, excavated material will be stored against the tree protection barrier.

- **10.4.2.1.Y** Post-Construction: The temporary protection fence will be removed last after all the construction has ended, soils are stabilized and all of the equipment has been removed.

Migratory Bird Protection

- **10.4.2.1.Z** Nesting migratory birds are protected under the *Migratory Birds Convention Act* (MBCA, 1994) and Regulations.
- **10.4.2.1.AA** No work is permitted to proceed that would result in the destruction of nests or eggs, or the wounding or killing of bird species protected under the MBCA and/or Regulations under the Act. It is the responsibility of the proponent and/or Contractor to ensure compliance with the MBCA. Guidance for assessing potential risk of MBCA contravention and other relevant information is found on Environment Canada's website: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html
- **10.4.2.1.BB** In general, it is recommended that activities which could result in an MBCA contravention be conducted outside of the area-specific, in this case 'C1', "Regional Nesting Period", March 31 to August 31. See nesting period and calendars here: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html
- **10.4.2.1.CC** If works are proposed within that Regional Nesting Period, the proponent must demonstrate due diligence, including an evaluation of risk (per Environment Canada guidelines at the referenced web links) and appropriate avoidance / mitigation measures. This is a site-specific analysis based on habitat, species recorded / expected and potential risk due to activities.

10.4.3 Wildlife

Environmental Effects and Mitigation Measures

Impacts to wildlife and wildlife habitat are limited to local incremental impacts since the road improvement works involve the widening of an existing road. There will be some direct removals outside of the ROW, along the edges of existing cultural vegetation communities required within the study area and the wildlife habitat associated with these communities will therefore also be affected. These vegetation communities generally support common wildlife habitat types and the majority of the wildlife species observed along and in the vicinity of the study area are common, tolerant species,

impacts to which can be managed through the implementation of the mitigation measures. Impacts to wildlife are not expected to be significantly different than those of the existing roadway. Since Langstaff Road is an existing road, wildlife are already adapted to some degree to its general interference with movement, and some road mortality already occurs. A minor increase in local wildlife road mortality may occur as a result of the wider roadway platform and general increases in traffic volumes. However, the wider platform may also deter wildlife from attempting to cross and driver visibility should be improved so that vehicle mortality may not actually increase. In addition, the new Bowes Bridge will be wider and will accommodate a pedestrian trail connection on one side which will provide an improved safer crossing opportunity for wildlife. Based on the common wildlife present within the vicinity of the Tributary of Westminster Creek, it is anticipated that pre and post wildlife movement through the existing and proposed culvert under Dufferin Street will be maintained. The new Bowes Bridge does not preclude the planning of a north-south trail connection (Bartley Smith Greenway system). When the City proceeds with the planning and design of the trail extension, it is anticipated there will be further consultation with the Region.

Commitments to Future Works

10.4.3.A The mitigation measures outlined above will minimize effects to vegetation and protect adjacent vegetation areas and will also protect the associated wildlife habitat functions. However, it is also necessary to ensure the protection of wildlife that may nest or otherwise use areas where construction is proposed and other wildlife that might be encountered incidentally during construction.

The following commitments are recommended for the protection of wildlife in general in future works:

- **10.4.3.B** Any wildlife incidentally encountered during construction will not be knowingly harmed and will be allowed to move away from the construction area on its own if at all possible.
- **10.4.3.C** In the event that an animal encountered during construction does not move from the construction zone, or is injured, the Contract Administrator will be notified.
- **10.4.3.D** Where dead or dying trees are not required to be removed, they will be left standing as valuable wildlife habitat. Where tree removal is required but space allows for the trunk to be retained (potentially including hazard trees), the tree may be limbed / topped and the trunk left standing.

- **10.4.3.E** All details for terrestrial passage both during construction and post-construction (final design) will need to be discussed with TRCA and should comply with the TRCA Valley and Stream Corridor Guideline and Fish and Wildlife Crossing Guideline for Bowes Bridge replacement and the Tributary of Westminster Creek culvert replacement and channel widening. If during detailed design, there are any changes proposed for the existing crossing over Westminster Creek, the new structures should comply with these guidelines.
- **10.4.3.F** The design and implementation of mitigation and restoration measures should aim to improve the level of ecosystem services provided by the Natural System, as per TRCA's Living City Policies (2014).

Migratory Nesting Prevention Strategy

10.4.3.G Nesting migratory birds are protected under the *Migratory Birds Convention Act* (MBCA, 1994). No work is permitted to proceed that would result in the destruction of active nests (nests with eggs or young birds), or the wounding or killing of bird species protected under the MBCA and / or Regulations under that Act.

10.4.3.H In order to protect nesting migratory birds, in accordance with the MBCA, the Contract Administrator will:

- Ensure that no active nests (nests with eggs or young birds) will be removed or disturbed in accordance with the MBCA. The "Regional Nesting Period" for this area is March 31st to August 31st, as identified on the Environment Canada website by "nesting zone" C1: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html

10.4.3.I Adherence to this mitigation measure for MBCA compliance will also serve to avoid impacts to SAR bird species (i.e. Barn Swallow) potentially nesting on bridges and culverts or elsewhere in the work area or vicinity. Bird nesting exclusion measures installed on the Bowes Bridge is not deemed necessary due to the lack of nesting evidence.

10.4.3.J If Barn Swallows build a nest within any culvert or bridge in the study area while the works are occurring, construction must cease until the young have fully fledged or the nest is no longer active. A 30 m buffer will be implemented around the structure and active nest to avoid harassment to Barn Swallows until the young have fully fledged.

10.4.4 Species of Conservation Concern

Environmental Effects and Mitigation Measures

One wildlife SAR (Monarch) was confirmed within the study area. There is moderate to high potential for an additional six wildlife SAR to occur within the study area. Potential impacts to these species can be summarized as follows:

- Monarch: No direct impacts to this species are anticipated. Although some concentrations of milkweed (breeding habitat) were identified within the study area, these generally occurred outside of the ROW. Impacts on foraging habitat (flowering plants) are expected to be minor and temporary. Areas of disturbance along the ROW are expected to naturally regenerate following construction, including milkweed and other foraging vegetation. Additionally, monarchs are unlikely to be impacted as foraging visitants. Although impacts to monarch habitat will be avoided or mitigated where possible, Monarch habitat is not protected under the ESA (2007), and the NDMNRF has confirmed that no further review under the ESA is required.
- Wood Thrush and Eastern Wood-pewee: No direct impacts to these species are anticipated. Although relatively common, these species primarily use interior forest communities and are therefore unlikely to be impacted indirectly, for example by noise or dust. No direct impacts to the forest edges or interiors are anticipated, and the species will not be impacted.
- Barn Swallow: No direct impacts to this species are anticipated. The impacts on foraging habitat are expected to be minor and temporary and Barn Swallows are unlikely to be impacted as foraging visitants. As noted above, there is limited potential for this species to nest underneath the Bowes Bridge, however no nesting activity was observed. No other suitable nesting habitat exists within the study area. No direct impacts to this species are anticipated, and species-specific mitigation measures are not warranted.
- Common Nighthawk: No direct impacts to this species are anticipated. Removal of buildings with flat-topped rooves, which constitutes breeding habitat, is not anticipated. The impacts on foraging habitat are expected to be minor and temporary and these species are unlikely to be impacted as foraging visitants.
- Two Bat Species (Little Brown Bat, Northern Long-eared Bat): No direct impacts to these species are anticipated. The impacts on foraging habitat are expected to be minor and temporary and these species are unlikely to be impacted as

foraging visitants. Potential day roosting habitat is present within the study area, however disturbance to this habitat will be minimal, or temporary in the case of disturbance of foraging habitat (i.e. construction noise, etc.). Suitable maternity roost trees are not present within the areas of vegetation removal and are unlikely to occur at the edge of the forested units (Units 1 and 4), where no removals are proposed. Personal communication with the NDMNRF (Bohdan Kowalyk, Management Biologist, pers. comm. Feb 2018) has confirmed that no further review under the ESA is required.

Commitments to Future Works

While there are no specialized habitat elements for SAR species within the areas of impacts, there is potential for some species to move through the study area during construction, and therefore, be encountered and disturbed or possibly harmed incidentally by construction activities. Therefore, there is some risk of harm to these species. To protect SAR generally, all relevant protection, handling and NDMNRF notification protocols will be adhered to:

- **10.4.4.A** In the event that a SAR, or potential SAR, is found within the construction area, the Contractor will immediately cease all work that could potentially harm the animal and will notify the Contract Administrator, as these animals are protected under the ESA (2007). The Contract Administrator or his Environmental Inspector will then contact the NDMNRF SAR Biologist for direction.
- **10.4.4.B** For SAR birds generally, the implementation of the mitigation measures outlined above for MBCA compliance will avoid impacts to SAR bird species potentially nesting or foraging in the vicinity of the work area.
- **10.4.4.C** The Bowes Bridge, which provides habitat for Barn Swallow, should be surveyed to confirm the absence of nesting.
- **10.4.4.D** A survey of the study area to determine if Butternut trees are within the impacted area.
- **10.4.4.E** The design and implementation of mitigation and restoration measures should aim to improve the level of ecosystem services provided by the Natural System, as per TRCA's Living City Policies (2014).

10.5 Drainage and Stormwater Management

10.5.1 Drainage

Environmental Effects and Mitigation Measures

The proposed road improvement of Langstaff Road, including the crossing of the CN MacMillan Yard and the grade separation at the Metrolinx GO Barrie Line will increase runoff from the road corridor due to an increase in impervious areas. Due to increase in imperviousness, the 100-year peak flow increases up to 24% from existing along Langstaff Road. Therefore, to reduce the impacts of sediment loading as well as increased peak flow into the receiving watercourses, stormwater management measures are required for runoff quality and quantity control.

Within the study area, runoff from the proposed roadway will ultimately discharge to the existing watercourses via storm sewers. The roadway areas result in a significant increase in impervious area which eventually will result in a larger potential for erosion, flood risk, and water quality degradation along the receiving watercourses. Therefore, road runoff needs to be treated before discharging into the receiving watercourses.

The proposed stormwater management strategy will include four pipe storage systems within Humber River watershed, one dry SWM pond and one wet SWM pond in the West Don River watershed, and six pipe storage systems within the West Don River watershed, as well as oil and grit separators (OGS) for quality control at the outlet point of the pipe storage systems before discharging to the respective outlet (i.e. existing storm sewer, Black Creek culvert, West Don River, Westminster Creek culvert, etc.). It is recognized that OGS will not provide enhanced level of quality treatment; however, due to urbanization and property constraints, other treatment train approaches are not practically feasible. Detailed sizing of OGS will be carried out during the detailed design phase.

In terms of water balance, it is required that a minimum of 5 mm of runoff from the site is retained. The require volume for 5 mm runoff retention is 1479 m^3. Based on preliminary assessment, an approximate volume of 670 m^3 could be potentially provided avoiding conflicts with existing utilities.

Commitments to Future Works

The following will be reviewed further during the detailed design phase:

- **10.5.1.A** Updated hydraulic modelling will be undertaken for all crossings during the detailed design phase.
- **10.5.1.B** Hydraulic analysis for Bowes Bridge will be further reviewed according to TRCA's most updated hydraulic model in the detailed design phase.
- **10.5.1.C** Detailed investigation and design of low impact development and water balance measures. Based on seasonal groundwater table and soil conditions, locations and sizes of LID water balance measures could vary.
- **10.5.1.D** Review conflict with existing and new utilities.
- **10.5.1.E** The potential increase of the footprint of infiltration galleries to maximize retention volume in an effort to get additional retention volume.
- **10.5.1.F** Field testing of hydrogeological conditions such as site-specific percolation rates, depth of bed rock, depth of seasonally high groundwater table, etc.

Based on the preliminary assessment, proposed LID measures may potentially be located within the boulevard between the multi-use path and cycle track. Potential LID measures will be further investigated during detailed design.

- **10.5.1.G** Ecological inventory to be completed at the proposed new culvert crossing (LC1) of an unnamed tributary to determine that the crossing considers appropriate requirements outlined in the TRCA Valley and Stream Corridor Guideline and Fish and Wildlife Crossing Guideline.
- **10.5.1.H** The total area for natural feature loss including all grading, fill, outfall connections from road drainage, and Low Impact Developments should be quantified to inform compensation requirement by TRCA through their Guideline for Determining Ecosystem Compensation.

10.5.2 Fluvial Geomorphology

Fluvial geomorphological assessment for the Langstaff Road Class EA study was carried out. The details of the geomorphological assessments are included in the Geomorphological Erosion and Meander Belt Width Assessment Report, which can be found in **Appendix I** Drainage and Stormwater Management Report, Appendix D.

Environmental Effects and Mitigation Measures

Culvert and water crossings at Westminster Creek and West Don River were evaluated in the context of limiting or mitigating impact to creek form and function. Crossings are to achieve the following:

- Address potential channel migration
- Maintain sediment transport processes for frequent storm events
- Provide a span that is respectful of potential future channel erosion / migration
- Maintain velocity differentials through the culvert for frequent storm events
- Be placed away from actively migrating meanders
- Be placed along a stable and straight length of channel at a perpendicular angle to the watercourse.

Given these considerations, it is recommended that the existing crossing spans 6.8 m at Westminster Creek, be maintained at a minimum. The current crossing size is appropriate as it is straight and armoured with gabion baskets and/or concrete meshing, and therefore are not expected to migrate laterally. Furthermore, the crossing is in good condition and fully encompass the existing average channel bankfull widths.

With regards to the West Don River, present channel alignment did not suggest any further planimetric adjustment towards the road. It is recommended the current crossing span of 11 m be improved upon to a minimum of 15 m in width. The additional 4 m would provide a buffer against any potential erosion issues to the crossing footings, as the channel currently contacts both walls of the existing crossing. The addition of an overbank buffer would also permit passage for terrestrial wildlife and allow for a future trail recreational connection beneath Langstaff Road. As part of the Langstaff Road Class EA study, it is recommended that the West Don River will be replaced with a 30 m span structure as noted in **Section 9.1.7.2** of the ESR.

Commitments to Future Works

10.5.2.A It is important to note that further amendment to the recommended crossing spans is possible. In the case where only a portion of the suggested width can be provided due to other design considerations (e.g., the presence of subsurface infrastructure or the shallowness of the road), the incorporation of channel bioengineering may also help to reduce a given crossing span while maintaining channel form and function.

10.6 Sediment and Erosion Control

Environmental Effects and Mitigation Measures

Uncontrolled erosion and sedimentation occurring during construction can result in a loss of topsoil, a disruption of nearby watercourses and a degradation of downstream water quality. During construction, erosion and sedimentation control measures should be implemented to prevent the migration of soils from the site.

Commitments to Future Works

The following recommendations should be considered when developing the detailed Erosion and Sedimentation Control drawings:

General

- **10.6.A** Daily inspections are to be carried out particularly after rain events and repairs.
- **10.6.B** Any in-water work that is necessary must be conducted in dry conditions within the appropriate fisheries timing window indicated by the TRCA.

Vegetative

- **10.6.C** All areas not subject to active construction 30 days after area grading should be top soiled and seeded as per Special Provision 572S01 (OPSS 572) immediately after completion of such grading.
- **10.6.D** Immediately following seed application, a straw erosion control blanket should be installed on any exposed slopes adjacent to sensitive features, as per OPSS 572.05.07, 572.05.08 and 572.07.04.05.
- **10.6.E** The erosion control matting / blankets shall be fully biodegradable.
- **10.6.F** Finished slopes will be graded to an acceptable slope and planted according to applicable TRCA Guidelines. Large cuts should be terraced to minimize surface erosion.

Structural

- **10.6.G** As construction proceeds, diversion swales should be graded where needed along the right-of-way boundaries to intercept drainage from external areas and direct it away from exposed surfaces.

- **10.6.H** The locations of sediment / dewatering traps should be confirmed in the field by the on-site inspector and environmental inspector.
- **10.6.I** Temporary sedimentation traps should be sized based on 125 m^3/ha of drainage area.
- **10.6.J** The integrity of all sediment trapping devices will be monitored regularly (at least weekly, and immediately following rain events) and properly maintained; such structures will be removed only after the soils of the construction areas have been stabilized and then only after the trapped sediments have been removed.
- **10.6.K** The Contractor will identify a contingency plan for accidental sediment release.
- **10.6.L** All culvert work should be conducted “in the dry” and inside NDMNRF’s timing window for fisheries where applicable.
- **10.6.M** All dewatering for culvert installation should be directed to a sediment / dewatering trap.
- **10.6.N** Straw bale flow and/or rock checks should be provided in roadside ditches, especially in all ditches immediately upstream of their discharge into a watercourse.
- **10.6.O** Additional erosion control works may be required during the course of construction. These may consist of silt fences, swales, and/or diversion berms. The location and need for these works will need to be established in the field.
- **10.6.P** Temporary silt fencing should be installed:
    - Around sensitive vegetative features.
    - Approximately 2 m from the final toe-of-slope for the roadway embankment widening areas.
    - Runoff from excavated areas or unvegetated soil will not be permitted to discharge off site or directly into active or temporary watercourses or any natural areas.
    - Heavy duty silt fence should be used at crossings locations where rare species are present.
    - The Contractor should abide by the requirements set out in the *Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Guideline for Urban Construction* (December 2006).

The integration of these measures will minimize the impacts of erosion and sedimentation during the construction of Langstaff Road.

10.7 Hydrogeology

The Hydrogeological Assessment Report is provided in **Appendix J**.

Environmental Effects and Mitigation Measures

In order to widen Langstaff Road, and other associated work with municipal services, utility relocation, and new structures, construction dewatering will or may be required, as per the following:

- Construction dewatering is interpreted to be required for any grade separated crossing for Langstaff Road to cross the CN MacMillan Rail Yard.
- Construction dewatering is interpreted to be required for any grade separation work at the railroad crossing between Langstaff Road and the Metrolinx GO Transit Barrie Line tracks.
- Construction dewatering is interpreted to be required while building bridge and culvert structures around creeks, which includes reconstruction of the Langstaff Road bridge over the West Don River, and potential modification to the culvert at Westminster Creek. Temporary creek diversions may be required during these works as well, particularly culvert works;
- An existing creek flowing within the roadside ditch along the north side of Langstaff Road, from the intersection of Dufferin Street towards Westminster Creek, would likely need to be relocated potentially requiring temporary construction dewatering as well as temporary flow diversion (detailed design may consider re-routing the ditch through storm sewers; subject to review with TRCA);
- Construction dewatering is interpreted to be required to reconstruct, improve, or re-locate below-ground municipal services (sanitary sewers, sanitary force mains, water mains, and storm sewers); and
- Additional works may require temporary construction dewatering (signpost foundations, or road cut excavations).

The proposed reconstruction and widening of Langstaff Road will require widening of the bridge crossings over the West Don River, and potentially the culvert crossings for Westminster Creek. This work will likely also require relocating an existing creek,

currently flowing within the roadside ditch, from Dufferin Street towards Westminster Creek, as noted in fourth bullet above. There are also isolated smaller wetlands alongside Langstaff Road, in the vicinity of Dufferin Street (on a property with an older residential home), as well as along Langstaff Road, east of the Langstaff Cemetery (Old St. Stephen's Cemetery), and west of the Metrolinx GO Transit Barrie Line, in Langstaff Park. The West Don River, Westminster Creek, and the identified tributary to Westminster Creek are all identified as warmwater creeks.

Source Water Protection

Review of the CTC Approved Source Protection Plan (December 2015) indicates that the section of Langstaff Road, between Weston Road and Highway 7, does not pass through any municipal wellhead protection areas (WHPA) or intake protection zones (IPZ); however, it is within the well head protection area (WHPA) Q1/Q2 of moderate risk. This well head protection area has been established to protect groundwater recharge to regional aquifer units which are generally used as a source of groundwater.

Commitments to Future Works

10.7.A Work in or near watercourses will require appropriate fisheries timing restrictions for the protection of warm water fish, as directed by TRCA, as well as sediment and erosion control best management practices (BMPs) to ensure that soil and sediment-laden water does not enter watercourses and riparian areas alongside creeks.

10.7.B As part of the construction for the proposed road crossing, dewatering may be required during road and bridge construction, for below-grade excavations. Construction dewatering rates are likely to be low in glacial till and glaciolacustrine sediments; however, higher dewatering rates will result where there are saturated lenses of coarser grained materials (localized shallow aquifers), or where excavations intercept more regionally continuous deeper aquifers, particularly the Oak Ridges Moraine Complex. Site- specific geotechnical investigations will be required to affirm construction dewatering requirements, with particular attention to determining if groundwater is under artesian conditions in aquifers beneath river valleys, such as the West Don River.

10.7.C In terms of Source Water Protection, although it is interpreted that all properties in the area have municipal water and wastewater servicing, there may be some properties with water supplies for auxiliary uses, particularly within the industrial

lands, and potentially within the CN MacMillan Yard, which was constructed before municipal servicing existed. As such, targeted door-to-door water well surveys should be undertaken during the detailed design phase in areas where construction dewatering is anticipated for proposed works.

10.7.D Additional site-specific geotechnical and hydrogeological investigations will be required once further design details have been developed, to confirm local area conditions.

10.7.E Sodium adsorption ratios may be high with shallow soils along roadways, attributed to the application of road salt for winter road maintenance. Best practices outlined in York Region's Winter Maintenance Program will be implemented to minimize the impacts of road salt.

10.8 Contamination Overview

The Contamination Overview Study Report is provided in **Appendix K.**

Environmental Effects and Mitigation Measures

Of the 89 Areas of Potential Environmental Concerns (APECs) identified in the COS, 73 APECs identified were categorized as high potential for environmental impacts and 16 APECs identified were categorized as moderate potential for environmental impacts.

Commitments to Future Works

10.8.A If property acquisitions are required within APECs with high or moderate potential for contamination, it is recommended that property specific Phase One Environmental Site Assessments (ESAs) (and Phase Two ESAs, if necessary) be completed in such areas in support of the property acquisitions. With respect to road construction activities and management of surplus/excess soil, a soil contaminant investigation, where excavation is proposed, be carried out by a qualified environmental consultant to assess soil quality in support of surplus/excess soil management in areas within or in close proximity to APECs with high potential for contamination. This recommendation should be reviewed and refined during detailed design.

10.8.B All other areas not included as APECs indicate land use features considered to have a low potential for environmental impacts. No additional environmental investigations are recommended for APECs with a low potential for contamination.

10.8.C In regard to the newly introduced Ontario Regulation (O.Reg.) 406/19: On-Site and Excess Soil Management, since the proposed improvements on Langstaff Road is an infrastructure project, it may be exempt from certain requirements of O.Reg.406/19. However the following should be noted:

- The background documents ordered as part of the Contamination Overview Study may need to be updated to determine if there are land use changes to the Site and surrounding study area that could impact the quality of the excess encountered during construction.
- Prior to the removal of soil from the Project Area, some form of site / soil characterization will be required to facilitate the off-site management as described in the Soil Rules under O.Reg.406/19. As such, the soil contaminant investigation recommendation in the areas of high and moderate APECs still applies.

10.8.D All waste generated during construction must be disposed of in accordance with provincial requirements.

10.8.E Although groundwater quality is reported as generally good, water has been influenced by sodium and chloride (road salt use). In addition, the sodium adsorption ratios may be high with shallow soils along roadways, attributed to the application of road salt for winter road maintenance. Best practices outlined in York Region's Winter Maintenance Program will be implemented to minimize the impacts of road salt.

10.9 Design and Construction

Environmental Effects and Mitigation Measures

Currently, the lack of connectivity at the CN MacMillan Rail Yard severely limits the contribution that Langstaff Road can make to the overall east-west arterial road network. The at-grade crossing at the GO Transit Barrie Line also impacts the efficiency of this route.

Langstaff Road, between Highway 400 and Dufferin Street, is identified as part of York Region's Strategic Goods Movement Network (SGMN). This strategic network is intended to facilitate safe and efficient movement of goods to and from key origins and destinations including Provincial highways, intermodal rail yards and commercial and

industrial employment areas. Langstaff Road is designated as a Primary Arterial Goods Movement Corridor in the SGMN.

The proposed improvements on Langstaff Road as described in **Chapter 9** support future transportation needs for the regional road network in providing additional east-west capacity and reduce congestion in other east-west corridors (i.e. Rutherford Road and Highway 7), provide multi-modal choices for all road users (i.e. pedestrian, cyclists, transit and auto), as well as support goods movement.

The Preliminary Design Plan for the proposed improvements on Langstaff Road was developed based on a “best fit” alignment along the existing corridor to minimize impacts to adjacent properties, built heritage resources, archaeological resources, and natural environment resources where feasible.

Commitments to Future Works

Commitments to future works specific to each technical disciplines are summarized in previous sections in this chapter. This section summarizes the commitment to future works associated with general design and construction of the proposed undertaking on Langstaff Road.

10.9.A During the detailed design stage and prior to construction, York Region will be responsible for obtaining approval from the MECP for stormwater management and sewage works. Permit approval will be required from TRCA for all culvert installations, watercourse realignments, structures, site alteration, etc. within areas regulated pursuant to Ontario Regulation 166/06.

10.9.B A permit will likely be required from MECP under the *Endangered Species Act* and will be confirmed subject to MECP input to the Information Gathering Form. The MECP Species at Risk Branch can be contacted at SAROntario@ontario.ca.

10.9.C It is intended that the works proposed are executed in such a manner, which to the fullest possible extent, minimizes any adverse effects on the natural environment of the project area. The Contractor will be responsible to ensure all their personnel are sufficiently instructed so that the work is carried out in a manner consistent with minimizing environmental impact. The Region will assign a qualified environmental inspector whose responsibility will be to ensure compliance with the environmental objectives.

Disposal of Excess Material

10.9.D Surplus excavated material shall be removed to locations arranged by the Contractor. Prior to the disposal of any surplus excavated material, the Contractor will provide the Engineer with a sketch of the dumping site(s) showing access thereto. A written statement from the property owner(s) agreeing to allow the disposal of fill on the property must be approved by the Engineer. Furthermore, the placement of fill within any area associated with valleys, wetlands, shorelines and other hazardous lands that are regulated pursuant to Ontario Regulation 166/06 requires the written permission of TRCA.

10.9.E MECP's current guidance document "On-Site and Excess Soil Management" (O.Reg. 406/19) will be adhered to for all activities associated with the management of excess soil during construction.

10.9.F The Contractor is responsible for obtaining all approvals.

10.9.G Upon completion of the disposing, levelling and grading of surplus excavated material on any property, the Contractor shall obtain a written statement from the property owner(s) releasing the Contractor and Region from any claims and accepting the condition of the property as satisfactory.

Measures for Proper Tree Removal and Preservation of Residual Plant Communities

10.9.H A Tree Protection Plan will be developed during detailed design. This plan will provide guidelines for protecting trees during construction, as well as minimizing soil compaction and making wise use of the removed timber resource. The plan will also include recommendations for during and post-construction maintenance including hazard tree monitoring, pruning, insect and disease control, aerating, watering and mulching. Also see terrestrial mitigation and timing window under **Section 10.4**.

Mud and Dust Control

10.9.I The Contractor shall take such steps as may be required to prevent dust nuisance resulting from his operations. The Contractor shall be responsible for all dirt and mud that is tracked onto the roadways from vehicles entering or leaving the job site. The Contractor shall, upon request from the Engineer, immediately proceed with cleanup operations, or in the opinion of the Engineer, the Contractor has not or cannot sufficiently remove the mud from the road, the Engineer will proceed with the necessary clean up.

Construction of Crossing Over CN MacMillan Yard

Given the central geographic location of the CN MacMillan Yard to the Langstaff Road Class EA study area and the importance of the Yard's operation to its North American customers, CN has been one of the key stakeholders on the Langstaff Road Class EA study since its commencement in late 2016. The Project Team met with representatives from CN through all phases of the Class EA study process (six meetings in total). CN had the opportunity to provide feedback at each meeting and regular touch point. CN's preference is not to have a crossing over the MacMillan Yard and noted more specific concerns such as associated impacts on safety to public, rail operations and CN future maintenance including surface runoff, pedestrians accessing/viewing/impact CN operations, incidents/accidents impacting CN operation, maintenance and repair/rehabilitation strategy, anti-terrorism precautions, challenges and complexities of construction, erection or launching of spans would cause complete shutdowns of the yard, as well as installation of piers would both temporarily and permanently impact capacity of the yard.

10.9.J York Region is committed to address CN's ongoing concerns in future detailed design. Within the context of the Langstaff Road Class EA study, development of the design alternatives across the CN MacMillan Yard was based on input from CN, best available information at the time of the study in combination with technical expertise from the structural and rail specialists on the Project Team, as well as direction from York Region. The above-noted concerns by CN have been incorporated and addressed at a level that is suitable in the context of a planning study through the development of the general arrangement of the structure, landscape plan, stormwater management strategy and construction cost estimate. The extension of Langstaff Road through the CN MacMillan Yard is a long-term initiative for York Region and therefore, many of the details associated with but not limited to structural design, drainage and geotechnical consideration, construction methodology, access logistics, CN operation coordination, etc., will have to be addressed during detailed design adhering to the most current design guidelines and regulations at that time.

Construction of the Metrolinx GO Transit Barrie Line Overhead Crossing

10.9.K Metrolinx and York Region agreed with the approach to maintain the interim 4-lane widening as an at-grade crossing while implementing Metrolinx's latest Enhanced Grade Grossing Standards. This will be further reviewed and coordinated with Metrolinx during the detailed design of the 4-lane widening assignment (which is ongoing).

10.9.L The structure design of the overpass structure at the Metrolinx GO Transit Barrie Line crossing will be further refined during detailed design, in consultation with Metrolinx, once the location of the third track is confirmed in the future.

Technical Agencies Consultation

10.9.M All relevant technical agencies will be consulted during detailed design including permit application and approval.

Indigenous Community Engagement

10.9.N The Region remains committed to engagement of Indigenous Communities and will continue to provide information, invite feedback and extend the invitation to meet with Indigenous Communities during detailed design.

10.9.O The Region commits to outreach effort with the Indigenous Communities during detailed design where Stage 2 Archaeological Assessment is required. Indigenous Communities may wish to send field liaison representation during the Stage 2 field work. The Region will work with their archaeological consultant in the outreach and engagement at that time.

10.10 Permits and Approvals

10.10.A Following the successful completion of the Municipal Class EA process documented in this ESR, all EA requirements will have been met. Other approval requirements will be addressed for the project during detailed design which may include:

- *Ontario Heritage Act* requirements for Archaeological Clearance;
- Notifications/permissions from respective utilities with facilities in the area;
- Permits / Approvals from MTO as they relate to the limits of MTO's Controlled Access Highway (CAH) area;
- A permit from TRCA would be required prior to any development/site alteration within the TRCA regulated areas (Ontario Regulation 166/06);
- Some utilities and municipal services works will require separate permits under TRCA's Ontario Regulation 166/06.
- A Permit To Take Water (PTTW) application will be prepared, as required, to obtain PTTW from MECP if the amount of water taken exceeds 50,000 L/day as

per the Ontario's Water Taking Regulation (Ontario Regulation 387/04 made under the *Ontario Water Resources Act*). The permit application will be accompanied by all appropriate supporting hydrogeological assessment information. It should be noted that certain water taking activities have been prescribed by the Water Taking Environmental Activity and Sector Registry (EASR) Regulation Ontario Regulation 63/16. These prescribed water-taking activities will require registration in the EASR;

- Environmental Compliance Approval for the stormwater management works is released by MECP, while a permit to discharge to municipal stormwater or sewer needs to be approved by the municipality;
- Information Gathering From and Avoidance Alternative Forms required for Redside Dace and potentially for Species at Risk Bats;
- Meeting *Endangered Species Act* (2007) requirements for Rouge River - Subsection 17(2)(c) of Ontario Regulation 242/08 obtaining an overall benefit permit under the ESA (2007) for impacts to Redside Dace habitat.
- Completing the DFO Self-Assessment process to determine if DFO review under the *Fisheries Act* is required and obtain Fisheries Act Authorization, as applicable.
- Under the *Canadian Navigable Waters Act (CNWA)*, application for approval to the Navigation Protection Program (NPP) required for Bowes Bridge replacement.

The *Impact Assessment Act*, 2019 does not apply to this project.

10.11 Monitoring

10.11.A A general monitoring program will be developed during detailed design which shall be implemented during construction to measure and monitor any potential project impacts on water courses, including identifying contingency measures to mitigate or minimize the impact if any.

10.11.B During construction, the Contractor will ensure that implementation of mitigating measures and key design features are consistent with the contract and external commitments.

10.11.C Mitigation measures shall be implemented and maintained by the Contractor who will ensure that the natural, social, and economic environments are not

impacted by the construction activities and/or that impacts are minimized. The Contractor will also ensure that items such as sedimentation controls and appropriate signage are maintained throughout construction.

10.11.D Appropriate signage shall be implemented to identify detour routes at the time of temporary roadway/sidewalk closures. In addition, closure events and restricted access to local residents and/or businesses shall be planned to accommodate vehicle and pedestrian movement during construction.

10.11.E In addition, the effectiveness of the environmental mitigating measures will be assessed to ensure that:

- Individual mitigation measures are providing the expected control and / or protection;
- Additional mitigation measures are provided, as required, for any unanticipated environmental problems that may develop during construction.
- The Contractor will ensure that the environmental measures outlined in this report and further developed during detailed design are carried out. In an event that problems arise, appropriate agencies will be contacted to provide further input.
- If the impacts of construction are different than anticipated, or if the method of construction is such that there are greater than anticipated impacts, the Contractor's methods of operation will be changed or modified to reduce those impacts.