Highway 427 Expansion Project

Design and Construction Report

Project Number 16M-01172-11

Document Number	**H427-0-ENV-REP-057**

August 2, 2018

THE PUBLIC RECORD

This Design and Construction Report (DCR) is being carried out in accordance with the approved environmental planning process for projects under the Ontario Ministry of Transportation (MTO) *Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000).

A copy of this document has been submitted to the following office of the Ontario Ministry of the Environment and Climate Change (MOECC) to fulfill the requirements of the MTO Class EA.

Ministry of the Environment and Climate Change
Central Region Office
5775 Yonge Street, 8th Floor
North York, Ontario M2M 4J1

This report is available online for review at www.427expansion.ca, as well as the following review locations between **August 2, 2018** to **August 31, 2018** during regular business hours:

MOECC EA File #: TC-CE-02

Ministry of Environment & Climate Change Environmental Assessment and Permissions Branch 135 St. Clair Avenue West, 1st Floor, Toronto, ON M4V 1P5 Tel: (416) 314-8001	**Ministry of Transportation** Central Region Major Projects Office 159 Sir William Hearst Avenue, 7th Floor, Toronto, ON M3M 0B7 Tel: (416) 235-4299
City of Vaughan Clerk's Office 2141 Major Mackenzie Drive, Vaughan, ON L6A 1T1 Tel: (905) 832-2281	**Regional Municipality of York Clerk's Office** 17250 Yonge St., Newmarket, ON L3Y 6Z1 Tel: (905) 895-1231
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Etobicoke Clerk's Office 399 The West Mall, Main Floor, South Block Toronto, ON M9C 2Y2 Tel: (416) 394-2516	**LINK427 Project Office** 1 Royal Gate Boulevard, Woodbridge, ON L4L 8Z7
Regional Municipality of Peel Clerk's Office 10 Peel Centre Drive, Brampton ON L6T 4B9 Tel: (905-791-7800)	**LINK427 Project Website** www.427expansion.ca

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HOW TO COMMENT

Interested persons are encouraged to review this DCR and provide comments by August 31, 2018.

Comments and information are being collected to assist LINK427 in meeting the requirements of the Ontario Environmental Assessment Act. Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act.

With the exception of personal information, all comments will become part of the public record. Comments on this DCR can be provided by mail, e-mail, or online to:

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If you have any accessibility requirements to participate in this project, please contact one of the Project Team members listed above.

Des renseignements sont disponibles en français en composant 1-888-595-3152.

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ACRONYMS

AFP	Alternative Financing & Procurement
ANSI	Area of Natural and Scientific Interest
AODA	Accessibility for Ontarians with Disabilities Act
CEAA	Canadian Environmental Assessment Act

CISEC	Certified Inspector of Sediment and Erosion Control (CISEC)
CMP	Compliance Monitoring Program
CPR	Canadian Pacific Railway
COS	Contamination Overview Study
CSP	Corrugated Steel Pipe
DCR	Design and Construction Report
DSS	Designated Substance Survey
DSMP	Drainage and Sediment Management Plan
EA	Environmental Assessment
EASR	Environmental Activity and Sector Registry
ELC	Ecological Land Classification
EMP	Earth Management Plan
EMS	Environmental Management System
EQMP	Environmental Quality Management Plan
ESA	Endangered Species Act
ESAs	Environmentally Significant Areas
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
GHG	Green House Gas
GPL	General Purpose Lanes
HOV	High Occupancy Vehicle
HVA	Highly Vulnerable Aquifers
IO	Infrastructure Ontario
LPD	Litres Per Day
MAG	Municipal Advisory Group
MBR	Migratory Bird Regulations
MBCA	Migratory Birds Convention Act
MNRF	Ministry of Natural Resources and Forestry
MOECC	Ministry of Environment and Climate Change
MTO	Ministry of Transportation
NBL	Northbound Lanes
NOX	Oxides of Nitrogen
ORM	Oak Ridges Moraine
OEAA	Ontario Environmental Assessment Act
OPSS	Ontario Provincial Standard Specification
OHSA	Occupational Health and Safety Act
PIC	Public Information Centre
PSW	Provincially Significant Wetlands
PTTW	Permit to Take Water
PVMS	Portable Variable Message Signs
ROW	Right-Of-Way

SAR	Species at Risk
SBL	Southbound Lanes
SCS	Site Condition Standard
TESR	Transportation Environmental Study Report
TRCA	Toronto and Region Conservation Authority
TSP	Total Suspended Particulates
TMP	Traffic Management Plan
TSS	Total Suspended Solids
WCMP	Waste and Contamination Management Plan
ZOI	Zone of Influence

Executive Summary

The Ministry of Transportation (MTO) and Infrastructure Ontario (IO) has selected LINK427 to undertake the design, build, finance and maintenance of the Highway 427 Expansion project in the City of Vaughan and the City of Toronto. The scope of work includes the design and construction of the following:

- A new 6.6 km extension of Highway 427 from Highway 7 to Major Mackenzie Drive, including:
  - eight lanes from Highway 7 to Rutherford Road;
  - six lanes from Rutherford Road to Major Mackenzie Drive;
  - three new interchanges (Langstaff Road, Rutherford Road and Major Mackenzie Drive); and
  - new median managed lanes.
- The widening of the existing Highway 427 corridor from Finch Avenue to Highway 7 for a total length of 4.0 km, including:
  - from six to eight lanes between Finch Avenue to south of Steeles Avenue;
  - from four to eight lanes, from south of Steeles Avenue to Highway 7; and
  - new median managed lanes.

This project is being carried out in accordance with the approved environmental planning process for Group 'A' projects under the Ministry of Transportation (MTO) *Class Environmental Assessment for Provincial Transportation Facilities* (2000) (MTO Class EA) and builds upon the approved Environmental Assessment Report (EA) (January 2010) for the Highway 427 Extension. A separate TESR was completed in 2013 for the widening of existing Highway 427 between Albion Road to Highway 7. Subsequently a Transportation Environmental Study Report (TESR) was completed in 2016 to add additional lanes to the proposed Highway 427 extension.

This Design and Construction Report (DCR) (referred to as DCR #3, because it is the third in a series of DCRs to this assignment) includes an overview of the refinements to preliminary design, public and stakeholder consultation, an assessment of the potential effects of the proposed project and identification of measures required to mitigate any anticipated adverse impacts. Consultation has been undertaken with Government Agencies, pertinent municipalities and the Toronto and Region Conservation Authority (TRCA), which is documented in this DCR. This DCR has been posted for a 30-day review period from **August 2, 2018** to **August 31, 2018**. A notice has been issued to advise the public, project stakeholders and agencies of the start of the review period and locations where the DCR will be available for review. Subsequent DCRs for this project will be made available for public review for a period of 30 days when published.

During detail design, LINK427 undertook a design optimization process to refine the preliminary design presented in the Individual EA (2010), and subsequent TESRs (2013 and 2016) to reflect available opportunities for improvement. The most significant design changes, in terms of potential environmental impacts, made as part of this process were to the four major watercourse crossings, Highway 427 bridges over Rainbow Creek, Langstaff Road bridge over Rainbow Creek, Highway 427 bridges over West Robinson Creek and Major Mackenzie Drive bridge over West Robinson Creek.

This DCR #3 documents the design and associated construction works primarily relating to new structures, detours and lane diversions at both Langstaff Road and Major Mackenzie Drive. Traffic Control Plans will be prepared and implemented for the proposed staging works along, Langstaff Road and Major Mackenzie Drive.

Other major components of this DCR #3 include the construction of bridges for the 427 over Rainbow Creek, West Robinson Creek, CPR / McGillivray, and Major Mackenzie Drive. This DCR also covers the construction of the cross-road bridges/culverts on Langstaff and Major Mackenzie Drive, including two watercourses Rainbow Creek at Langstaff, and West Robinson Creek at Major Mackenzie Drive and the Langstaff Road Underpass at the 427.

Both public and stakeholder consultation have been carried out in accordance with the approved environmental planning process for Group 'A' projects under the MTO Class EA. This involved issuing a Notice of Commencement for detail design and construction, which included newspaper notifications, a project website and letters to project contacts/stakeholders carried forward from the preliminary design phase of the project. Consultation was also carried

out with Indigenous Communities, the Ministry of Natural Resources and Forestry (MNRF), the Ministry of Environment and Climate Change (MOECC), TRCA, municipalities, utility companies and property owners within a 2.0 km radius of the project. A second Public Information Centre (PIC) was also held to provide the public and stakeholders an opportunity to review and comment on the proposed works, including mitigation measures regarding DCR #3.

The Project Lands are composed largely of agricultural, residential, industrial, commercial and recreational land uses. There are no Provincially Significant Wetlands (PSWs), provincially or regionally Significant Areas of Natural or Scientific Interest (ANSIs) or Environmentally Significant Areas (ESAs) within the Lands. Rainbow Creek and West Robinson Creek are the two main vegetated valley crossings.

Appropriate mitigation measures will be implemented to minimize potential impacts to wildlife and wildlife habitat. The contractor will avoid works within the migratory bird nesting period and will follow best management practices related to encounters with wildlife during construction. Within the Lands, studies identified the presence of species protected under the Provincial *Endangered Species Act*, 2007 (ESA), as well as the presence of Species at Risk (SAR) habitat on the Lands adjacent to the Rainbow Creek valley. Mitigation measures have been incorporated into this DCR to minimize potential impacts to SAR bats, in accordance with the ESA 2007, and the Overall Benefit Permit for SAR bats from the MNRF. Components of the project specifically related to SAR mitigation include: timing window restrictions for structural removal and tree clearing to avoid sensitive periods, habitat compensation, revegetation and planting plans to mitigate impacts to habitat.

Rainbow Creek and West Robinson Creek including their associated valley systems are main tributaries of the Humber River. Mitigation measures will be implemented to minimize impacts to these watercourses during construction which include sediment and erosion control measures to prevent sediment laden runoff from entering the watercourses.

There are potential construction related impacts to groundwater, however environmental impacts to groundwater pumping are not anticipated as dewatering at the sites will be less than 50,000 Litres per day (LPD). The pumping rate of 50,000 LPD is the threshold volume limit above which rate an EASR or a Category 3 PTTW will be required. No registration or a PTTW is required if pumping volume is less than 50,000 LPD altogether from a site. The Transportation Environmental Study Report (TESR), dated January 2016 describes in detail the potential impacts from construction and the proposed mitigation measures that are to be followed when impacts are identified. The impacts identified were re-evaluated and updated based on LINK427's review and assessment of dewatering requirements and are outlined further in **Section 6.1**. There are no impacts to the existing or future land uses within the Lands as a result of the proposed DCR #3 works as these works are contained with the existing MTO Right-of-way (ROW) outlined in the previous EAs. No additional property is required for the construction works proposed in DCR #3.

A Noise By-law exemption has been obtained from the City of Vaughan for the construction activities associated with DCR #3. Some night work construction is anticipated in the City of Vaughan as the project construction schedule dictates. All works within the City of Vaughan that are included in this DCR will be completed adhering to the applicable Noise Control By-laws, LINK427's Construction Noise and Vibration Plan and the MOECC Conditions of Approval.

The construction activities for DCR #3 will not involve the production of any excess soils that require offsite management. However, should there be any excess soils, they will be managed in accordance with the projects Waste and Contamination Management Plan, the projects Earth Management Plan and with Ontario Provincial Standard Specification (OPSS) 180 (Management of Excess Materials).

Mitigation measures to minimize impacts to air quality are focused on managing equipment and vehicles. Non-chloride dust suppression methods will be applied during construction of the highway and concrete processing.

The results of previous archaeological assessments in the Lands indicated that the Lands are clear of archaeological potential and no further archaeological assessments are required. The construction activities covered in DCR #3 are within the vicinity of the Colerain Cemetery and McKinnon Site which are protected however, construction will not impact any built or cultural heritage landscapes within the Lands.

1 Project Overview

1.1 Project Team and Background

The Ministry of Transportation (MTO) and Infrastructure Ontario (IO) has selected LINK427 to undertake the design, build, finance and maintenance of the Highway 427 Expansion project in the City of Vaughan and the City of Toronto.

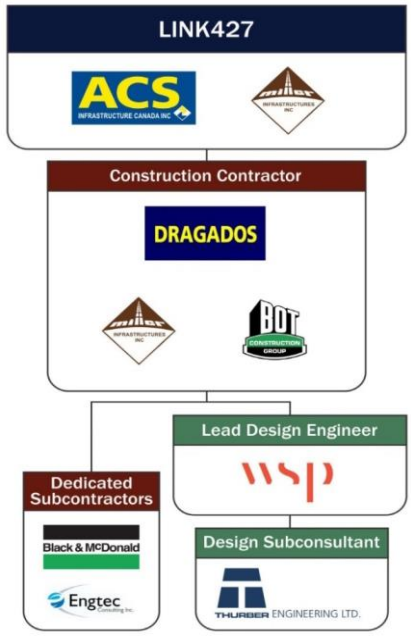
The project has been procured as an Alternative Financing & Procurement (AFP) project, which is an innovative way of financing and procuring large, complex infrastructure projects. Under the AFP model, provincial ministries and/or project owners establish the scope and purpose of a project while design and construction work is financed and carried out by the private sector. In the case of the Highway 427 Expansion, LINK427 will be responsible for the maintenance, construction, lifecycle repair and renewal of the highway for the next 30 years.

The organizational structure of LINK427 is shown in **Figure 1** and is composed of the following private sector companies:

Developer: ACS Infrastructure Canada Inc. and Brennan Infrastructures Inc. (a member of the Miller Group of Companies)

- Construction: Dragados Canada Inc., Brennan Infrastructures Inc. and BOT Infrastructure Ltd.
- Design: WSP Canada Group Ltd. and Thurber Engineering Ltd.
- Maintenance: ACS Infrastructure Canada Inc. and Brennan Infrastructures Inc.

Figure 1: Organization Structure



1.2 Previous Studies - Preliminary Design

1.2.1 Highway 427 Extension Transportation Corridor Environmental Assessment Report

In July 2006, the Province of Ontario released the *Growth Plan for the Greater Golden Horseshoe* which was referred to during preliminary design. An updated version of the Growth Plan was released in 2017 which was referred to during detail design. The Growth Plan outlines objectives and policies for the management of growth and development and planning decisions within the Greater Golden Horseshoe over the next 30 years.

The *Growth Plan* supports improving access to inter-modal facilities to enhance the movement of people and goods and to provide access to major employment areas. As per this direction, the MTO initiated an Individual Environmental Assessment (EA) under the Ontario *Environmental Assessment Act* (OEAA) in 2010 for the extension of Highway 427 to address transportation problems at the existing Highway 427 terminus (referred to as the Individual EA (2010) in this report). The Individual EA was conducted in accordance with the planning process documented in the *Highway 427 Transportation Corridor Environmental Assessment Terms of Reference* that was approved by the Minister of the Environment and Climate Change (MOECC) in November 2005.

The purpose of Individual EA was to develop the Recommended Plan for the extension of Highway 427 to meet the following objectives:

- Addressing the existing and short-term transportation problems related to the current Highway 427 terminus, truck traffic accessibility to and from the Canadian Pacific (CP) Vaughan Intermodal Facility, and the impact on inter-regional traffic in the Peel-York boundary area;
- Identifying and protecting required property for any proposed transportation corridor and allowing planned development to occur outside of the transportation corridor;

- Ensuring that the alternatives / preferred solution would not preclude or predetermine planning for the other future transportation corridors or a future extension of the transportation corridor northerly, if ever required.

In November 2010, the Ontario Minister of Environment and Climate Change, with the approval of Cabinet, decided to allow the Highway 427 Extension Transportation Corridor Environmental Assessment Report (Individual EA) (January 2010) to proceed, subject to conditions. The approved Recommended Plan was for a 6.6km transportation corridor from Highway 7 to Major Mackenzie Drive, including a highway and dedicated transitway, located in the City of Vaughan, York Region.

The key elements of the Recommended Plan included the construction of 6 lanes traffic lanes from Highway 7 to Rutherford Road, 4 lanes of traffic lanes from Rutherford Road to Major Mackenzie Drive, a 60 m wide transitway right-of-way (ROW) from Highway 7 to north of Major Mackenzie Drive in each direction, and commuter parking lot facilities. The highway expansion also included construction of new interchanges at Langstaff Road, Rutherford Road, and Major Mackenzie Drive.

1.2.2 Highway 427 from Albion Road to Highway 7, Preliminary Design and Class EA Study

In 2013, the MTO undertook a Class EA to develop a long-term strategy to address needs along the existing Highway 427 transportation corridor between Albion Road and Highway 7. The study followed the approved environmental planning process for Group 'B' undertakings under the MTO *Class Environmental Assessment for Provincial Transportation Facilities* (2000) and was documented in a Transportation Environmental Study Report (TESR, 2013).

The purpose of the Class EA was to develop the Recommended Plan for the existing Highway 427 between Albion Road and Highway 7, to meet the following objectives:

- Identifying interim and ultimate transportation needs of Highway 427 between Albion Road and Highway 7;
- Completing a preliminary design of the technically preferred plan; and
- Completing a Feasibility Study for the widening of the four Highway 427 Overpasses at Highway 407 and the 427N-407E ramp, and identifying ultimate bridge cross section requirements to allow for the ultimate widening of Highway 427 through the 407 Interchange.

The key elements of the Recommended Plan included widening the existing Highway 427 from 4 to 8 lanes from 1.5 km south of Albion Road to Highway 7 for a total length of 4 km. The Recommended Plan also included median managed lanes; widening and rehabilitation of existing bridges where required to accommodate the widening of Highway 427; modifications to the Highway 407 / Highway 427 interchange; and drainage and illumination improvements.

1.2.3 Highway 427 Extension Widening from Highway 7 to Major Mackenzie Drive, Preliminary Design and Class EA Study

Subsequent to the completion of the Individual EA (2010) for the Highway 427 extension and in response to future projected traffic demands, MTO reviewed the original approved EA and determined a potential need for one additional lane in each direction. For that reason, MTO undertook a Class EA in 2016 to amend the Recommended Plan for the proposed Highway 427 extension to allow for an additional lane in each direction. The study followed the approved environmental planning process for Group 'B' undertakings under the MTO *Class Environmental Assessment for Provincial Transportation Facilities* (2000) and was documented in a Transportation Environmental Study Report (TESR, 2016).

The purpose of the Class EA was to develop the Recommended Plan for the widening of the Highway 427 Extension within the median (one northbound lane and one southbound lane).

The key elements of the Recommended Plan include the widening of the Highway 427 Extension by one additional lane in each direction (to a total of 8 lanes from Highway 7 to Rutherford Road, and 6 lanes from Rutherford Road to Major Mackenzie Drive), median managed lanes, and drainage and illumination improvements.

1.3 Detail Design Project Description

The purpose of the current detail design study is to refine the approved Recommended Plan from the preliminary design for the Highway 427 Expansion, as documented in the Individual EA (2010) and subsequent TESRs (2013 & 2016). As the project is being undertaken using an AFP approach, it is LINK427's responsibility to carry forward commitments identified during preliminary design into the detail design for project implementation and construction.

The overall scope of work being undertaken as part of detail design includes the design and construction of the following components:

- The widening of the existing Highway 427 corridor from Finch Avenue to Highway 7 for a total length of 4.0 km, including:
  - from six to eight lanes between Finch Avenue to south of Steeles Avenue;
  - from four to eight lanes, from south of Steeles Avenue to Highway 7; and
  - new median managed lanes.
- A new 6.6 km extension of Highway 427 from Highway 7 to Major Mackenzie Drive, including:
  - eight lanes from Highway 7 to Rutherford Road;
  - six lanes from Rutherford Road to Major Mackenzie Drive;
  - three new interchanges (Langstaff Road, Rutherford Road and Major Mackenzie Drive); and
  - new median managed lanes.

The location of the proposed works are shown in **Figure 2**.

This project is being carried out in accordance with the approved environmental planning process for Group 'A' projects under the MTO *Class Environmental Assessment (*Class EA) *for Provincial Transportation Facilities* (2000).

A total of five Design and Construction Reports (DCRs) will be prepared to document the various components of the detail design for the Highway 427 Extension Project. The public consultation, which commenced with DCR #1, will continue throughout the project and will be documented as appropriate in each subsequent DCR. DCR #1 was completed and made available for a 30-day public review period from **December 5, 2017** to **January 8, 2018**. DCR #2 was completed and made available for a 30-day public review period from **April 10, 2018** to **May 11, 2018**.

Table 1 provides a summary of how the project components have been divided amongst all the previous two DCRs and the anticipated division of project components for the fourth and fifthDCRs. This is the third DCR completed for this project and will be referred to as DCR #3 throughout this report.

DCR #3 documents the detail design Recommended Plan for the construction of seven (7) Highway 427 Extension structures, including four (4) major watercourse crossings, and the staging of traffic to facilitate the construction of two new interchanges of the Highway 427 Expansion summarized in **Section 1.2**. The scope of work presented in this DCR includes the following components:

- The construction of new Highway 427 bridges (northbound lanes (NBL) & southbound lanes (SBL)) over Rainbow Creek;
- Replacement of the existing Langstaff Road culvert with a new precast concrete arch structure over Rainbow Creek;
- Construction of a new interchange bridge structure at Langstaff Road including detours/ staging for the construction of Langstaff Road using previously constructed components (as described in DCR #2);
- Construction of new Highway 427 bridges (NBL & SBL) over West Robinson Creek;
- Construction of new Highway 427 bridges (NBL & SBL) over the CP rail corridor & McGillivray Road;

- Replacement of the existing Major Mackenzie Drive culvert with a bridge over West Robinson Creek; and
- Construction of a new interchange bridge structure at Major Mackenzie including detour/staging for the construction of Major Mackenzie Drive using previously constructed components (as described in DCR #2).

Table 1: DCR Phasing

DCR #	Project Area	Construction Work to be Addressed
1	■ Finch Avenue to Major Mackenzie Dr.	■ Vegetation / brush clearing ■ Preloads (including grubbing) at the Major Mackenzie Drive and Rutherford Road Interchanges and CP Rail / McGillivray Road overpass. ■ Concrete stockpiling south of Langstaff Road within the lands ■ Advanced utility works
2	■ South of Finch Avenue to Major Mackenzie Drive	■ Construction Staging including detours on Highway 427, Finch Avenue, Albion Road, Steeles Avenue, Highway 7, Zenway Boulevard, Huntington Road, and McGillivray Road. ■ Rehabilitation and/or Widening of Highway 427 from South of Finch Avenue to Highway 7. ■ Electrical works along Highway 427 from South of Finch Avenue to Highway 7. ■ Fencing (security fencing throughout the limits) ■ Foundations – bridge/retaining wall footings and / or deep foundations (piles/caissons) at the CNR Overpass, Albion Road Overpass, 407ETR off-ramp over Albion Road, Steeles Avenue Overpass, Highway 7 retaining walls, and Zenway Boulevard Underpass. Grubbing, stripping of top soil, ditching, highway construction and final grading from south of the Finch Avenue to Highway 7 inclusive of the Finch Avenue Interchange, Albion Road, Steeles Avenue, the 407ETR Interchange, Highway 7, and the Highway 7 Interchange. Components of the new interchanges at Langstaff Road, Rutherford Road, and Major Mackenzie Drive will be constructed as well. New ramps will be constructed at Highway 7 in addition to the rehabilitation and reconstruction of the existing ramps. Zenway Boulevard will be detoured to the south to allow for the reconstruction of Zenway Boulevard over the proposed 427. ■ Highway Drainage and Water Resources (ditching, subdrains, sewers and culverts) throughout the Highway 427 corridor from south of Finch Avenue to north of Major Mackenzie Drive. ■ Removals of select portions of existing roads, existing drainage structures etc. along the existing Highway 427 from south of Finch Avenue to north of Major Mackenzie Drive. ■ Pavement (granulars, concrete paving, and asphalt) throughout the Highway 427 corridor from south of Finch Avenue to north of Major Mackenzie Drive.

DCR #	Project Area	Construction Work to be Addressed
		■ Structures (overpass and underpass) including the widening/rehabilitations on the Finch Avenue Underpass, three Humber River water crossings, CNR Overpass, Albion Road Overpass, 407ETR off-ramp over Albion Road Overpass, Steeles Avenue Overpass, 407ETR Overpass, Highway 7 Underpass, and construction of the new Zenway Boulevard Underpass. ■ Traffic (lane closures) consisting of short term off-peak hours traffic management on Highway 427 from south of Finch Avenue to Zenway Boulevard (including ramps at Finch Avenue, 407ETR, and Highway 7), Finch Avenue, Albion Road, Steeles Avenue, 407ETR, Highway 7, Zenway Boulevard, Rainbow Valley Boulevard, Vaughan Valley Boulevard, New Enterprise Way, Langstaff Road, Rutherford Road, McGillivray Road, Major Mackenzie Drive, Huntington Road, and Barons Street. ■ Utility relocation, including but not limited to Rogers, Bell, Enbridge, Alectra, Hydro One, Toronto Hydro and others throughout the limits of the Project. ■ Seeding and sodding throughout the limits of the Project. ■ Demolition of Farm Structures (once ESA permits for Species at Risk (SAR) Bat and Barn Swallow is received). ■ Closure of Huntington Road north of Major Mackenzie Drive and south of CP Rail line. ■ Closure of McGillivray Road at Rutherford Road. ■ Lane detours, diversions and traffic Management for Highway 427 (from south of Finch Avenue to Zenway Boulevard, ramps included), Finch Avenue, Albion Road, Steeles Avenue, Highway 7, and Zenway Boulevard.
3	■ Highway 7 to Major Mackenzie Drive	The works necessary to undertake the following: ■ The construction of new Highway 427 bridges (NBL & SBL) over Rainbow Creek; ■ Replacement of the existing Langstaff Road culvert with a new precast concrete arch structure over Rainbow Creek; ■ Construction of a new interchange bridge structure at Langstaff Road including detours/staging for the construction of Langstaff Road using previously constructed components (as described in DCR #2); ■ Construction of new Highway 427 bridges (NBL & SBL) over West Robinson Creek; ■ Construction of new Highway 427 bridges (NBL & SBL) over the CPR rail corridor & McGillivray Road;

DCR #	Project Area	Construction Work to be Addressed
		■ Replacement of the existing Major Mackenzie Drive culvert with a bridge over West Robinson Creek; and ■ Construction of a new interchange bridge structure at Major Mackenzie including detours/staging for the construction of Major Mackenzie Drive using previously constructed components (as described in DCR #2).
4	■ Highway 7 to Major Mackenzie Drive	The works necessary to undertake the following: ■ Construction of new Overpasses at Rutherford Road and Street A (Future John Lawrie Street). ■ Electrical (street lighting, traffic lights etc.) for the remainder of the Project. ■ Guiderail and barriers for the remainder of the Project. ■ Intelligent Transport Systems (ITS) for the remainder of the Project. ■ Pavement Markings for the remainder of the Project. ■ Traffic Signage for the remainder of the Project. ■ Water Resources / Stormwater Ponds for the remainder of the Project.
5	■ South of Finch Avenue to Major Mackenzie Drive	■ Landscaping (planting of trees and shrubs) from south of Finch Avenue to north of Major Mackenzie Drive, including the existing and new interchanges at Finch Avenue, Highway 407, Highway 7, Langstaff Road, Rutherford Road, and Major Mackenzie Drive, and all crossing roads. ■ Vegetation restoration from south of Finch Avenue to north of Major Mackenzie Drive, including the existing and new interchanges at Finch Avenue, Highway 407, Highway 7, Langstaff Road, Rutherford Road, and Major Mackenzie Drive, and all crossing roads. ■ Fisheries and Endangered Species Act mitigation.

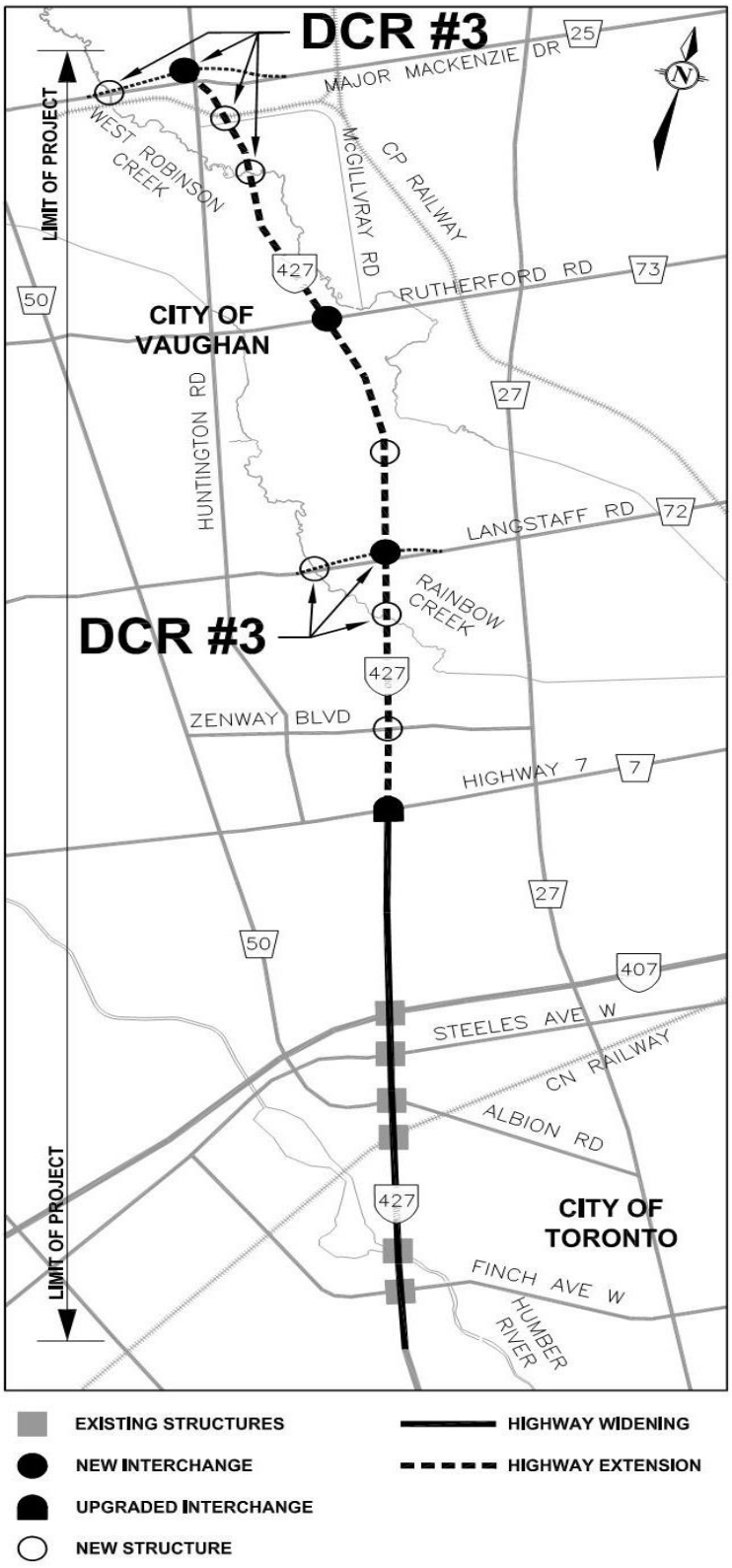


Figure 2: Project Limits Key Map

1.4 Purpose of the Design and Construction Report

This DCR #3 has been prepared in accordance with the requirements of the approved environmental planning process for Group 'A' undertakings under the MTO Class EA. DCR #3 is intended to document the following:

- The Class EA process followed;
- Description of the consultation program carried out during detail design;
- Changes in existing environmental conditions from those documented during preliminary design;
- Description of the Recommended Plan developed during detail design for the works outlined in DCR #3;
- Description of the rationale for any changes to the design as approved in preliminary design;
- An explanation of how commitments during preliminary design have been incorporated into the detail design; and
- Anticipated environmental impacts, proposed mitigation measures and commitments to future work.

As required under the Class EA, this DCR is being made available to the public, stakeholders, agencies and Indigenous communities for a 30-day review period between **August 2, 2018** to **August 31, 2018** online at www.427expansion.ca, as well as the following review locations:

- Ministry of Environment and Climate Change, Environmental Assessment and Permission Branch
- Ministry of Transportation, Major Projects Office, Central Region
- City of Vaughan (Clerk's Office)
- Regional Municipality of York (Clerk's Office)
- Kleinberg Library, Vaughan
- Toronto Public Library – Humberwood Library
- Regional Municipality of Peel (Clerk's Office)
- Etobicoke Civic Centre
- LINK427 Project Office

Any concerns during this review period should be discussed with LINK427 and all comments will be considered by LINK427. Significant concerns will be resolved through ongoing consultation with concerned / affected stakeholders and additional studies will be undertaken to address concerns, if required. If significant concerns are not identified during the review period, further documentation will not be prepared and LINK427 may commence construction of the elements as described in DCR #3 without further notice, subject to receiving required permits and approvals and the commitments in this DCR.

2 Environmental Assessment Process

2.1 Ontario Environmental Assessment Act

The MTO's *Class Environmental Assessment for Provincial Transportation Facilities* was approved under the *Ontario Environmental Assessment Act* (OEAA) in fall 1999, and was amended in 2000. This planning document defines groups of projects and activities and the environmental assessment process that MTO has committed to follow for these undertakings. Provided that this process is followed, projects and activities included under the MTO Class EA do not require formal review or approval under the OEAA. There is an opportunity at any time during the MTO Class EA process for interested persons to provide comments and review outstanding issues.

The MTO Class EA process is principle-based. Where appropriate, this DCR references the principles applied and how they were achieved during the environmental assessment process.

The following principles underlie the MTO Class EA process:

Transportation engineering principles

The transportation engineering principles ensure that the project provides an effective and safe transportation system.

Environmental protection principles

The environmental protection principles ensure that the project provides effective environmental protection. Existing environmental conditions, sensitivities and environmental protection requirements were assessed and are documented in this DCR. Mitigation measures have been developed to avoid, prevent, and/or reduce any residual adverse effects.

External consultation principles

The consultation principles ensure that there is effective consultation with stakeholders early and throughout the study process. Throughout this study, local elected representatives, Indigenous communities, provincial and federal agencies, local municipalities, interest groups, and members of the general public were encouraged to participate through a proactive consultation plan that included letters, newspaper notices, brochures and a Public Information Centre (PIC).

Evaluation principles

The evaluation principles ensure that an effective evaluation process is in place to provide a balance between transportation engineering and environmental protection principles and to fulfill the project goals. The evaluation process used to assess planning and design alternatives was traceable, replicable and understandable by those who may be affected by the decisions.

Documentation principles

The documentation principles ensure that there is effective environmental documentation and that the opportunity to challenge the project is provided. The environmental documentation required for this project is this DCR, which will be filed for a 30-day public review period.

Environmental clearance principles to proceed

As part of the preliminary design, an Individual EA for the Highway 427 Extension was approved, with conditions, by the MOECC in November 2010, as described in **Section 1.1.1**. Subsequent TESRs were completed in 2013 for the widening of existing Highway 427 between Albion Road to Highway 7 and again in 2016 to add additional lanes to the proposed Highway 427 extension.

Following the 30-day public review of this DCR, the project will have met the requirements of the MTO Class EA. Any comments and concerns received through the 30-day public and agency review process, will be incorporated into the final design. LINK427 will obtain permits and approvals to implement the works in accordance with the EA.

2.2 Canadian Environmental Assessment Act

On July 6, 2012 *Canadian Environmental Assessment Act* (CEAA) (2012) came into effect which focuses on assessment of "designated projects". Projects can be designated projects under CEAA (2012) if they meet the criteria for physical activities under the schedule, Sections 2 to 4.

The expansion of Highway 427 is not considered a "designated project". Therefore, an assessment under CEAA is not required.

3 Consultation Process

3.1 Previous Consultation Undertaken during Preliminary Design

Consultation during preliminary design was consistent with the requirements for the Individual EA under the OEAA, and Group 'A' projects under the MTO Class EA. Consultation activities included on-going consultation with federal, provincial, and municipal agencies, Indigenous communities, local elected representatives, interest groups and members of the public.

The following is a summary of preliminary design consultation activities:

External Agency Consultation

The Project Team consulted and held meetings with federal and provincial agencies, local elected officials, municipalities, utilities, interest groups and Municipal Advisory Groups (MAG). The MAG included representatives from the Region of Peel, City of Brampton, Town of Caledon, York Region and City of Vaughan.

Meetings with GO Transit / Metrolinx, the Toronto Transit Commission (TTC), and the 407 ETR were held as part of the 2013 EA study.

Meetings were held with the MOECC, the Ministry of Natural Resources and Forestry (MNRF), as well as the Toronto and Region Conservation Authority (TRCA), regarding various elements of the Highway 427 Extension and proposed widening as outlined in the TESR (2016).

Public Information Centres

Three rounds of PICs were held during the Individual EA and one PIC was held for each of the subsequent EAs (2013 and 2016). The PICs were organized as "drop-in" style sessions with representatives from MTO and the Project Team available to answer questions and discuss the project. An advanced session was offered for any interested local elected representatives, Indigenous community representatives and external agency representatives.

3.2 Consultation during Detail Design

Consistent with the requirements for Group 'A' projects under the MTO Class EA, consultation with federal, provincial, and municipal agencies, Indigenous communities, local elected representatives, interest groups and members of the public was on-going over the course of the Detail Design study.

The consultation program was carried out based on the following principles:

- All reasonable efforts are made to ensure that potentially affected or interested parties are given the opportunity to participate in the consultation process;
- Stakeholders may provide input at any time during the study; however, structured opportunities for input occur at key study stages;
- LINK427 shall constructively address input received during the consultation process;
- LINK427 shall make reasonable efforts to resolve concerns; and
- Consultation plans and processes are sufficiently flexible to permit responses to new issues that arise as the study proceeds.
- Stakeholders and the public were kept informed of the study and were asked for input through the use of conventional, effective consultation methods including:
- Notices published in local newspapers;
- Direct letter mailings to external agencies, local elected officials, and Indigenous communities;
- A PIC to provide stakeholders with an opportunity to review and comment on the overall study process, the Class EA process, the proposed design, and the proposed mitigation measures; and
- Notice to all study participants and the public announcing submission of the DCR for public review and comment.

3.2.1 Project Website

A project website (www.427expansion.ca) was created and provides project information, updates, and documents to interested stakeholders. The website includes information on the project background, LINK427, frequently asked questions, public involvement, and provides a comment submission tool.

3.2.2 Study Contact List

A contact list of local elected officials; Indigenous communities; local, provincial and federal agencies; local municipal government; utilities; school boards; and interest groups was developed, building on contact lists developed during preliminary design. Over the course of the study, any individuals or organizations expressing interest in the project were added to the contact list.

The contact list includes the following individuals and organizations:

Local Elected Officials	MPP – Etobicoke North MPP – Vaughan – King MPP – Vaughan - Woodbridge	MP – Etobicoke North MP – Vaughan-King MP – Vaughan - Woodbridge
Provincial and Federal Government Agencies	Environment Canada Transport Canada Fisheries and Oceans Canada Ministry of Natural Resources and Forestry Ministry of Health & Long-Term Care Ministry of Tourism, Culture and Sport Ministry of Agriculture, Food & Rural Affairs Ministry of the Environment and Climate Change	Ministry of Indigenous Relations and Reconciliation Ministries of Citizenship, Immigration & International Trade Ministry of Community Safety and Correctional Services Ministry of Municipal Affairs and Housing Ministry of Energy Metrolinx Infrastructure Ontario Toronto and Region Conservation Authority
Municipalities	City of Brampton City of Vaughan Regional Municipality of Peel Town of Caledon City of Toronto Regional Municipality of York Township of King	
Indigenous Communities	Mississaugas of Scugog Island Chippewas of Rama First Nation Hiawatha First Nation Alderville First Nation Huron-Wendat Nation Six Nations of the Grand River Territory	Chippewas of Georgina Island First Nation Beausoleil First Nation Curve Lake First Nation Mississaugas of the New Credit First Nation Huron-Wendat Nation

	Wahta Mohawks First Nation Oneida Nation of the Thames Association of Iroquois and Allied Indians	Kawartha Nishnawbe First Nation Mohawks of the Bay of Quinte Union of Ontario Indians
Utilities	TransCanada Pipeline Hydro One Networks CPR Rogers Enbridge Bell Alectra	
School Boards	York Catholic District School Board Conseil scolaire de district catholique Centre-Sud Credo Christian School Toronto District School Board Conseil scolaire Viamonde	
Emergency Services	York Region Emergency Medical Services York Region Paramedic Services York Regional Police Brampton Fire and Emergency Services Peel Ambulance Dispatch City of Toronto EMS City of Toronto Fire Services City of Toronto Fire Services North Command City of Toronto Fire Services West Command	Toronto Police Service No. 33 Division Toronto Emergency Medical Services Toronto Paramedic Services Toronto Police Service Ontario Provincial Police Ontario Provincial Police - Highway Safety Division Ontario Provincial Police Facilities Section Vaughan Fire & Rescue Service notification system Vaughan Fire Chief and Deputy Fire Chief
Interest Groups	407ETR Canadian Pacific Railway CN Rail Toronto Transit Commission (TTC)	York Federation of Agriculture Toronto Environmental Alliance Toronto Coalition for Active Transportation Greater Toronto Airports Authority

3.2.3 Notice of Commencement of Detail Design and Construction

3.2.3.1 Public Notification

English and French Notices were published in the following local newspapers and posted on the project website to inform the general public of the detail design study commencement and to solicit questions, concerns, and pertinent information:

- Toronto Star: August 23, 2017
- Etobicoke Guardian: August 23, 2017
- Vaughan Citizen: August 24, 2017
- Brampton Guardian: August 24, 2017
- L'Express: August 29, 2017

The notices were also distributed to the following municipal offices to be displayed on their websites and posted on community bulletin boards:

- Region of York
- City of Vaughan
- Region of Peel
- City of Brampton
- City of Toronto

In conjunction with the publication of the newspaper notice, a brochure was distributed via Canada Post Neighbourhood Mail to all residents and businesses within a 2-km radius of the project. The brochure provided details about the project, as well as provided an opportunity to submit information, comments, or questions. The brochure was distributed on August 23, 2017.

Copies of the newspaper notices and brochure are provided in **Appendix A**.

3.2.3.2 Stakeholder Notification

Individuals and organizations on the study contact list were sent a Notice of Commencement of Detail Design letter on August 23, 2017.

The purpose of the letter was to inform stakeholders of the project, as well as provide an opportunity to submit information, comments, or questions.

Copies of the notification letters are provided in **Appendix A**.

3.2.4 DCR #3 Stakeholder Consultation

Consultation with the stakeholders included on the Study Contact List have been on-going throughout the study. A number of comments were received from the stakeholders listed below relating to the scope of works addressed in DCR #3. Correspondence with Agencies such as the Ministry of Natural Resources & Forestry (MNRF) and Toronto and Region Conservation Authority (TRCA) has been ongoing regularly from February 2018 to May 2018. On May 15, 2018 members of the LINK427 Design, Environmental, Traffic and Communications Teams, along with MTO representatives, met with Municipal representatives for a DCR #3 Overview meeting. Correspondence with Municipalities including the City of Vaughan and York Region on the contents of DCR #3 has been ongoing from February 2018 to May 2018. Responses to comments on the 50% design packages were sent to Municipalities in May 2018. Correspondence with emergency services and CP Rail have also been ongoing throughout the study. A summary of all comments received and how they were addressed are provided in **Appendix B – Agency Correspondence Table**. Personal information has been redacted in accordance with the *Freedom of Information and Protection of Privacy Act*.

DCR #3 stakeholder correspondence:

- Curve Lake First Nations
- Chippewas of Rama First Nation
- Regional Municipality of York
- Regional Municipality of Peel
- City of Vaughan
- Ministry of Natural Resources & Forestry
- Toronto and Region Conservation Authority
- Vaughan Bicycle User Group (BUG)
- York Region Cycling Coalition

3.2.5 Indigenous Communities Consultation

In response to the Notice of Commencement of Detail Design letter, two comments were received from Huron-Wendat Nation requesting copies of the Archaeological Assessments related to the Highway 427 Expansion. The Archaeological Assessment Reports were provided.

In response to the PIC #1 Notice, a comment was received from the Chippewas of Rama First Nation advising that the letter was reviewed and shared with Council and the information was forwarded to the Williams Treaties First Nation Process Co-ordinator/Negotiator. In addition, a comment was received from Curve Lake First Nation requesting copies of any Environmental and Archaeological Assessments, as well as Design and Construction Report #1 and #2. All reports were provided. In response to the PIC #2 Notice, a comment was received from the Chippewas of Rama First Nation advising that the letter was reviewed and shared with Council and the information was forwarded to the Williams Treaties First Nation Process Co-ordinator/Negotiator.

No requests for meetings with Indigenous Communities have been received at this time.

3.2.6 Public Information Centres

A total of two PICs have been held as part of the detail design study. The first PIC was held to present the Recommended Plan for the scope of work presented in DCR #2 on **January 25, 2018**. The second PIC was held to present the Recommended Plan for the scope of work presented in DCR #3 on **May 22, 2018** at the Element Vaughan Hotel in Vaughan, Ontario**.** Both PICs were held from 4pm and 8pm with a one-hour advanced session from 3pm to 4pm for invited stakeholders, including municipal representatives, MPs/MPPs, and representatives from Indigenous Communities. The PICs were organized as informal 'drop-in' style sessions with representatives from LINK427 available to answer questions and discuss the project. Attendees were asked to sign a register and were encouraged to complete a comment sheet.

The purpose of the PICs was to provide an opportunity for stakeholders and members of the public to review and comment on the overall study process, the Environmental Assessment process, and the proposed detail design. Display panels included:

- A description of the project;
- An overview of the environmental assessment process;
- A summary of existing environmental conditions;
- A description of the study process;
- A description of the detail design;
- A summary of anticipated environmental impacts and associated mitigation measures; and
- Next steps.

Copies of the Notice of Public Information Centres as well as general comments received during the PICs are available in **Appendix A**.

PIC #2 addressed all works in DCR #3, including the construction of bridges, cross-road bridges/culverts, and detours and lane diversions. This also included changes made since the initial EA and Preliminary Design.

Eleven (11) attendees signed the PIC #2 register and three (3) comment sheets (all three comment sheets were from one individual, a Municipal representative from Peel Region) were submitted at the PIC. Two (2) comments were received by email or phone call in response to the Notice of PIC, one regarding a contact update, and the other seeking clarification on the information being conveyed at PIC #2. No comments were submitted by email or phone call following PIC #2. Comments and responses to comments received at PIC #2 are summarized in **Table 2**. Responses were provided to the individual that submitted a comment and provided contact information.

A copy of the PIC #2 display materials is included in **Appendix C**.

Table 2: Summary of Comments Received at PIC #2

Highway 427 Expansion Project Comments received from PIC #2 held May 22, 2018	Highway 427 Expansion Project Responses sent by LINK427 on June 11, 2018
Public Comment Form 1 ■ It is nice to see that all "structures" are coming and design well. ■ Hwy 427 Extension needs to connect to future "GTA West" or at least make the provisions to connect and extend. ■ There is not mention of "GTA West" on PIC boards! ■ Please provide transitway on "the highway extensions" ■ Pedestrian crossings on the "interchanges" will be nice where intersecting on Arterial Roads. ■ Major Mac please provide smooth passage at the same time protecting opportunities to extend in future. ■ I am very pleased that MTO and LINK427 team is proceeding with the project on schedule and providing us the opportunity to consult and input. ■ Please consider car-pool lot on Major Mackenzie Road. This will help people to carpool! ■ Glad to know that there is carpool lot on Langstaff Road. Please coordinate timelines with the Highway 427 extension. ■ Highway 427 should end on a "Highway" and not on "Arterial Road". ■ Please consider extensive "provisions" where the Highway 427 extension is ending so that there is no "traffic jams" at the terminus. ■ Please consider "truck only lane" or provisions to connect CP Vaughan. ■ All interchanges should have two left turn and two right turning lanes. ■ Glad to know that you are providing "BAT BOXES" and other measures for endangered species!	**Response** ■ The current EA and most recent TESR did not include for these facilities although the original EA did protect for a future Transitway Station/Carpool Lot at Major Mackenzie Drive. Although the current Highway 427 Expansion Project does not include any carpool lots, the ministry is proceeding with the design & construction of a carpool lot in the NW quadrant of Highway 427 & Langstaff Road under a separate contract. ■ As noted above the current Project does not include the construction of the Langstaff carpool lot. The ministry will be constructing the carpool lot at Langstaff Road. ■ The original EA did not include an extension of Highway 427 past Major Mackenzie Drive. In the future, if the province decides to move forward with the GTA West project an extension from the Highway 427 terminus at Major Mackenzie Drive will be provided north to the GTA West. ■ The designed configuration of the terminus has been developed in accordance with the EA and TESR. The geometry and provisions have been designed in accordance with current MTO standards. In addition, a queue warning system will be installed to provide additional information to motorists as required. ■ The current EA and TESR did not include provisions for a dedicated "truck only lane" or a connection to CP Vaughan. It is not anticipated that such provisions will be required. ■ The Interchange off-ramps have been designed based on projected traffic volumes and the required turning movements.

Highway 427 Expansion Project Comments received from PIC #2 held May 22, 2018	Highway 427 Expansion Project Responses sent by LINK427 on June 11, 2018
■ All new structures are coming well and optimally designed.	■ The original EA and the current EA and TESR do not include the construction of an extension beyond Major Mackenzie Drive. However, the current design will be able to accommodate (with some re-configuration) a future connection to the GTA West if it is re-activated. ■ The original EA and the current EA and TESR do not include an extension to GTA West. The province has put the GTA West project on hold. ■ This current Project does not include for the design and construction of the transitway but the 60m wide corridor will remain protected for future implementation of the transitway. ■ Pedestrian Crossings will be provided at all crossing roads as required. ■ The designed configuration of the terminus has been developed in accordance with the EA and TESR. The geometry and provisions have been designed in accordance with current MTO standards. The design allows for the future expansion northerly.

4 Refinements to the Preliminary Design

The MTO Class EA process recognizes that during detail design, as the project progresses and more information is made available, changes to the approved preliminary design may be required. During this advancement from preliminary design to detail design, the environmental impacts of specific elements of the design are revealed. Other factors or changes may also be identified during detail design that have the potential to affect the specific design criteria. Consequently, the EA process must be able to account for the impacts associated with design changes as more specific information is made available. It may be necessary to amend the EA because of such changes, so a process must be followed to consider the changes within the context of the approved EA to determine if an amendment is required based on the significance of the change.

The Individual EA (2010) developed a process to determine if an amendment to the approved EA is required for this project. This process is outlined in Section 9.2 Process for Amending the Undertaking Following EA Approval of the EA (2010). It involves reviewing any changes being carried out and determining the significance of the change in terms of its potential effect on the environment, a stakeholder and/or a commitment made in the EA (2010) and EA Conditions of Approval from the MOECC. If the change that is made during detail design is determined to be negligible or of a minor nature, then no amendment to the EA is required and the change can be documented in a DCR.

When developing the detail design, LINK427 undertook a design optimization process to refine the preliminary design presented in the Individual EA (2010), and subsequent TESRs (2013 and 2016) (discussed in **Section 1.2**) to reflect available opportunities for improvement. This process was based on current site conditions, available/updated information and engineering technologies, and industry experience.

The design optimization process involved four watercourse crossing structures and one interchange structure. The four watercourse crossing structures are:

- Highway 427 bridges over Rainbow Creek;
- Langstaff Road bridge over Rainbow Creek;
- Highway 427 bridges over West Robinson Creek; and
- Major Mackenzie Drive bridge over West Robinson Creek.

The preliminary designs for these watercourse crossing structures were optimized based on current site conditions and available information, including updated hydrological flow data from the TRCA. This resulted in the opportunity to optimize the overall span length of each structure (reduction in length).

The interchange structure at Highway 427 and Major Mackenzie Drive underwent design optimization changes typical of the detail design process based on updated constructability information. The two structures identified in the preliminary design (one northbound and one southbound) have been optimized into one structure in the LINK427 detail design by combining the Highway 427 northbound and southbound off-ramps to minimize construction impacts and to allow for future expansion of the highway. As this design optimization had no potential for environmental effects, analysis of environmental effects or comparative evaluation was not undertaken for this refinement.

LINK427 utilized the process outlined in Section 9.2 of the Individual EA (2010) and undertook a comparative evaluation of the preliminary designs and detail designs to characterize the net effects of the design changes to each of the four watercourse crossings. The results of the comparative evaluation determined that the difference in net effects are not significant and an amendment to the preliminary design is not required (see **Section 4.4**).

As discussed in **Section 3.2**, consultation with MNRF and TRCA has been on-going throughout the detail design study. Both agencies have reviewed and commented on LINK427's refinements to the preliminary design and associated environmental impact assessment (see **Section 6**). LINK427 has been incorporating these comments into the current design to arrive at the detail design presented in this DCR. Based on this iterative consultation process, all of the comments provided by the MNRF and TRCA (**Appendix B**) have resolved and there are no outstanding concerns with the LINK427 refinements to the preliminary design.

The following sections provide a description of the changes and optimization that occurred between preliminary design and detail design of the DCR #3 structures, the process used to optimize the design of the structures during detail design, and the results of the impact assessment of the four watercourse crossings.

4.1 Highway 427 Transportation Corridor EA Amendment Process

Section 9.2 of the Individual EA (2010) outlines the process to be used to determine if an amendment to the preliminary design is required due to changes during detail design. Section 9.2 states the following:

- Some aspects of the project may require a change as project details are further developed during the later stages of project design and construction.
- It may be necessary to amend the approved preliminary design because of changes in conditions, development of new technologies or mitigation measures, or the identification of previously unknown concerns.
- Changes to the project may occur due to:
    - Unforeseen site-specific problems encountered only during subsequent design phases and /or construction;
    - Improvements in the design to provide greater environmental benefits and/or less adverse effects;
    - Elements of the project that were not previously envisioned;
    - Circumstances that develop at time of construction;
    - Issues identified in other approval processes; and
    - Changes to the regulatory framework (i.e. new legislation or regulations).
- Where such changes may occur, a process must be followed to consider the changes within the context of the Minister-approved 427 Transportation Corridor EA (referred to as the Individual EA (2010) in this report) and determine if an amendment is required based on the significance of the change.
- MTO and/or its agent will determine the significance of the change in terms of its potential effects on the environment, a stakeholder (including the public), and/or a commitment made in the Minister approved 427 Transportation Corridor EA.
- If the significance of the change is determined to be negligible or of a minor nature, no amendment would be required and the change could be implemented by MTO and/or its agent.
- If the significance of the change is determined not to be negligible, but of a more substantial nature, an amendment would be required.

4.2 Summary of Changes to the Preliminary Design

The following provides a summary of the changes to the preliminary design Recommended Plans for the DCR #3 structures that were made during the detail design optimization process. The detail design optimization process for these structures is discussed further in **Section 4.3**, followed by a description of the comparative evaluation of the changes from the preliminary design to the detail design in **Section 4.4**.

4.2.1 Highway 427 Structures over Rainbow Creek

The preliminary design for the Highway 427 structures over Rainbow Creek included three-span bridge structures (NBL & SBL) with a total length of 109 m. During detail design, it was determined that the span length of the structures could be reduced to single-span structures with a total length of 49.4 m (NBL) and 47.7 m (SBL) and still meet the hydraulic performance and environmental criteria as outlined in the Individual EA (2010). The new span lengths comply with the design parameters outlined in preliminary design while improving constructability. The detail design optimization process for these structures is further described in **Section 4.3**.

4.2.2 Langstaff Road Structure over Rainbow Creek

The preliminary design for the Langstaff Road structure over Rainbow Creek included a two-span bridge with a total length of 72 m. During detail design, it was determined that the proposed structure type could be modified and the span length could be decreased to a 14.6 m single-span precast concrete arched structure while still meeting the hydraulic performance and environmental criteria as outlined in the Individual EA (2010). The design optimization process for this structure is further described in **Section 4.3**.

In addition, traffic staging at Langstaff Road during construction has been changed to maintain two lanes (one in each direction) and two bike lanes during construction, as opposed to maintaining the full four-lane configuration identified in preliminary design. The change in traffic staging will minimize impacts to adjacent environmentally sensitive areas and improve the constructability of the traffic staging areas.

4.2.3 Highway 427 Structures over West Robinson Creek

The preliminary design for the Highway 427 structures over West Robinson Creek included two-span bridge structures (NBL & SBL) with a total length of 120 m for each structure. During detail design, it was determined that the span length of the structures could be reduced to two-span structures with 93.1 m (NBL) and 93.5 m (SBL) in length and still meet the hydraulic performance and environmental criteria as outlined in the Individual EA (2010). The new span lengths comply with the design parameters outlined in preliminary design while improving constructability. The detail design optimization process for these structures is further described in **Section 4.3**.

4.2.4 Highway 427 Structure over Major Mackenzie Drive

The preliminary design for the Highway 427 structures at Major Mackenzie Drive included two separate bridge structures (NBL & SBL). During detail design, it was determined that the proposed structures could be combined into one single structure for both the NBL and SBL. The revised design provides a more efficient space utilization, and a simpler alternative for a potential future expansion of Highway 427 north of Major Mackenzie Drive. There are no significant adverse effects on the environment from this change.

4.2.5 Major Mackenzie Drive Structure over West Robinson Creek

The preliminary design for the Major Mackenzie Drive structure over West Robinson Creek included a two-span bridge with a total length of 68 m. During detail design, it was determined that the span lengths could be reduced to a single-span structure with a total span length of 41.2 m and still meet the hydraulic performance and environmental criteria as outlined in the Individual EA (2010). The new span lengths comply with the design parameters outlined in preliminary design while improving constructability. The detail design optimization process for this structure is further described in **Section 4.3**.

Table 3: Comparison of Changes from Preliminary Design to Detail Design

Structure	Preliminary Design	Detail Design
Highway 427 Structures over Rainbow Creek	Three-span bridge structures (NBL & SBL)	Single-span bridge structures (NBL & SBL)
	Total length: 109 m	Total length: 49.4 m (NBL); 47.7 m (SBL)
Langstaff Structure over Rainbow Creek	Two-span bridge structure	Single-span precast arched culvert structure
	Total length: 72 m	Total length: 14.6 m
	4 lane traffic staging, including bike lanes	2 lane traffic staging, including bike lanes

Highway 427 Structures over West Robinson Creek	Two-span bridge structures (NBL & SBL)	Two-span bridge structures (NBL & SBL)
	Total length (NBL & SBL): 120 m	Total length: 93.1 m (NBL); 93.5 m (SBL)
Highway 427 Structure at Major Mackenzie Drive	Two separate structures (NBL & SBL)	One structure for both NBL & SBL
Major Mackenzie Drive Over West Robinson Creek	Two-span bridge structure	Single span bridge structure
	Total length: 68 m	Total length: 41.2 m

4.3 LINK427 Detail Design Optimization Process

With regard to the watercourse crossings, LINK427 reviewed the relevant background information related to hydraulic performance criteria for the preliminary designs provided in the Individual EA, 2010, and the AECOM Stormwater Management Report, 2016. It was determined that the hydraulic criteria were the key drivers in developing the preliminary design, so it was noted that optimization opportunities would be largely tied to hydraulic performance. Therefore, LINK427 focused on the Humber River watershed hydraulics to develop the optimized span lengths for each of the four watercourse crossings that met the following hydraulic performance requirements:

- No increase in the regulatory water surface elevations outside of the MTO ROW (as measured at the nearest upstream cross-section from the TRCA hydraulic model);
- Any increase in water elevation upstream of the relevant crossing structure must be accommodated within the MTO ROW;
- No significant increase in the existing conditions floodlines resulting from installation, replacement or modification of a new or existing structure; and
- Maintain a minimum of a 1 m freeboard[1] between the regulatory flood elevation and the edge of pavement elevation on the new Highway 427 watercourse crossing structures at Rainbow Creek and West Robinson Creek.

To determine the current hydraulic conditions of Rainbow Creek and West Robinson Creek, LINK427 obtained the most recent hydrologic and hydraulic information of the Humber River watershed from the TRCA. It was determined that the flow rates had been updated in a study completed after the preliminary design.

The TRCA provided new flow information that updated the Humber River hydrologic model demonstrating that flow rates in the main Rainbow and West Robinson creek channels decreased, resulting in less overall channel utilization during a Regulatory Event and a consequent reduction in floodplain elevations compared to those contemplated with the original span structures from the EA. Therefore, the hydraulic design criteria generated from the model outputs were also substantially reduced, which had important implications for the span length. This created an opportunity for LINK427 to examine the Humber River hydraulics iteratively to determine the optimal span lengths[2]. These results were used to determine the optimized design of the four main watercourse crossings, which resulted in a decreased overall span length at each structure (**Table 3**).

[1] Distance from the surface of the watercourse to the underside of the structure.

[2] With the change in hydrology from the EA process, the optimization of the spans across both Robinson Creek and Rainbow Creek could not be directly compared to the results found in the original documents. Rather, the updated models were run with the original EA proposed spans and the subsequently optimized spans to ensure that all hydraulic criteria were met and that appropriate comparisons could be made.

The optimized, shortened span LINK427 design and updated hydraulic modeling results were presented to the TRCA in 2017. After reviewing the information provided by LINK427, the TRCA confirmed with LINK427 that the LINK427 hydraulic models used to develop the revised span lengths accurately present both the existing and proposed hydraulic conditions (written communication, October 2017). The revised span lengths therefore adhere to the hydraulic requirements as outlined above.

A review was also undertaken of the geomorphological considerations and associated design criteria, including a field assessment and analysis of the functions at each crossing and the potential impacts of the shortened spans. Other environmental criteria, including impacts to wildlife passage, wildlife and SAR habitat, fish and fish habitat and vegetation, were also reviewed to determine the potential impacts of the shortened spans.

Therefore, LINK427 advanced the preliminary design through a process of review, refinement and optimization to establish updated detail designs for the structures. Through this process, it was found that the key optimization opportunities of the watercourse structures resulted in a reduction in the span lengths compared to the preliminary design as a result of the updated TRCA flow information and refined hydraulic modelling results. LINK427 has been able to demonstrate through the detail design process that the shortened span lengths of the detail design are able to fulfill all of the same hydraulic performance criteria used in the preliminary design. Consequently, LINK427 has been able to shorten the span lengths through a process of design optimization without any compromise to the hydraulic and geomorphological performance, while maintaining or minimizing the potential adverse effects to the natural environment, identified in the preliminary design.

Regarding the reduction in available lanes and speed limit on Langstaff Road during construction, LINK427 explored several options to maintain the existing four lanes, however, the replacement of the watercourse crossings created some complications. Therefore, it was determined that maintaining the existing number of lanes through the work zone would not be feasible. Consultation with York Region and stakeholders are ongoing and approval is being sought. Originally, a reduction in speed limit (from 80 km/hr to 60 km/hr) was to be implemented once construction was complete, however, there is a requirement to reduce the speed limit during construction. LINK427 is currently discussing the speed reduction during construction with York Region and stakeholders. A temporary bylaw for the speed reduction will be sought. LINK427 has carried out a traffic analysis and determined that the reduction in lanes and speed limits will not decrease the operational performance of this section of the roadway.

4.4 Comparative Evaluation of Net Effects

As described above, Section 9.2 of the Individual EA (2010) states that a process must be followed to consider any changes to the approved preliminary design, within the context of the Individual EA (2010).

A comparative evaluation was carried out to determine whether the design changes to the six major watercourse crossing structures would result in a significant change to the net effects of the project. This method highlights the difference between preliminary design and detail design by comparing the net effects associated with each and presents the trade-offs using a clear rationale for the differences. The relative differences between preliminary design and detail design can be clearly understood and a determination of significance can therefore be made.

A comparative evaluation table was created for each watercourse crossing and are provided in full in **Appendix D**. The evaluation determined that there are no significant changes to the net effects of the project as a result of the detail design optimizations to the four watercourse crossing locations (six structures).

4.4.1 Methodology

To determine the criteria on which to base the comparative evaluation, a “Long List” to “Short List” EA methodology was used. The Long List of criteria was developed from the original environmental factors and criteria presented in the 2010 IEA and the 2016 TESR. The first step in the approach was to eliminate criteria from the Long List that do not have the potential to distinguish any significant differences between the designs. Only criteria with the potential to identify significant differences were carried forward to the Short List (see Table 1 in **Appendix D**). These Short List of environmental factors and criteria were then applied to the preliminary and detail designs in the comparative evaluation tables (see Tables 2 A-D

in **Appendix D**). Additional criteria beyond those included in the 2010 IEA and 2016 TESR were added to the comparative evaluation in order to create a comprehensive Short List that fully addresses all of the potential differences between the two designs (see footnoted included in the tables contained within **Appendix D**).

The comparative evaluation of net effects for each of the creek crossing designs was implemented in a manner to be consistent with the EA approach used in the 2010 IEA and the 2016 TESR. The assessment of significance was based on consideration of the net effects as they relate to the definitions provided in Section 9.2 of the 2010 IEA.

The following Long List of environmental factors and criteria were taken from the 2010 IEA and 2016 TESR:

- **Socio-Economic Environment**
  - Property and Access
  - Community Effects
  - Government Land Use Strategies
- **Cultural Environment**
  - Archaeology
  - Heritage Features
- **Natural Environment**
  - Groundwater and Surface Water
  - Fish and Fish Habitat
  - Wetlands
  - Wildlife Passage[3]
  - SAR and SAR Habitat[4]
  - Fluvial Geomorphology[5]
  - Designated Natural Features, Management Plans, Programs and Protection / Enhancement Programs
  - Air Quality
  - Vegetation
  - Agricultural Soils
  - Petroleum, Mineral, and Mineral Aggregate Resources
  - Property Waste and Contamination
- **Technical Environment**
  - Transportation
  - Engineering
  - Cost

[3] This environmental factor was not included in the original EA evaluation matrix as the EA was evaluating alignments not structures. LINK427 included it in this evaluation in relation to span reductions.

[4] This environmental factor was not included in the original EA evaluation matrix. LINK427 included this factor in in relation to the span reduction evaluation given the presence of SAR bat habitat at the Rainbow Creek Crossing. Bats were not considered SAR in 2010.

[5] This environmental factor was not uniquely identified in the original EA evaluation matrix as it was combined with Surface Water. LINK427 included it in this evaluation in relation to the span reductions.

Based on the potential net effects associated with each creek crossing, it was determined through a comparison of the preliminary and detail designs in Table 1 of **Appendix C** that there are no potentially significant differences on the Socio-Economic Environment and the Cultural Environment. As a result, no criteria were carried forward to the Short List from these environmental factors. Similarly, where the criteria contained under the Natural Environment and Technical Considerations did not present the potential for significant differences, they were not carried forward to the Short List. Where criteria were not carried forward, the net effect was determined by the engineering/technical/specialist experts to be the same regardless of which design is constructed because the requirements and approach to construction would result in the same net effect.

Therefore, the results of the Long List to Short List exercise documented in Table 1 of **Appendix D** identified the following factors, sub-factors and criteria to be carried forward as the Short List for the comparative evaluation of each of creek crossing:

- **Natural Environment**
  - Surface Water
  - Impacts to surface water[6]
  - Effect on watercourses that do not support direct fish habitat within the crossing location
  - Fish and Fish Habitat
  - Effect on watercourses that are confirmed to support direct fish habitat within the crossing location
  - Wildlife Passage
  - Impacts to wildlife movement
  - SAR Habitat[7]
  - Effect on SAR and SAR Habitats
  - Vegetation
  - Effect on vegetation
  - Fluvial Geomorphology
  - Impacts to channel geomorphology
- **Technical Considerations**
  - Transportation
  - Flexibility for future expansion / precluding or prejudging future expansion
  - Engineering
  - Constructability issues
  - Compliance with appropriate design criteria
  - Cost

[6] The Toronto and Region Conservation Authority (TRCA) updated the Humber River hydrology between the completion of the project EA and the commencement of the LINK427 detail design process. The preliminary and detailed design work associated with the hydraulic analysis of the optimized spans was completed with the updated Humber Hydrology data. In order to fairly compare the results of the preliminary design and the LINK427optimized detail design, the preliminary designs were evaluated with the updated Humber Hydrology flows as well. The tables (2A to 2D) in Appendix C reflect the results from this comparison.

[7] Where applicable.

Table 4 outlines the rating system that was used to determine the significance of a design change in the comparative evaluation.

Table 4: Comparative Evaluation Rating System

Rating	Result in Net Effect of Design Changes
Insignificant Change	■ Negligible / No difference ■ Minor difference (resulting in minor impacts easily mitigated / no changes to net effect)
Significant Change	■ Major difference (resulting in negative change to net effect)
Significant Benefit	■ Major difference (resulting in positive change to net effect)

4.4.2 Net Effects Comparative Evaluation Results

The following provides a summary of the net effects comparative evaluation results for each watercourse crossing structure. The detailed net effects and results of the comparative evaluation can be found in Tables 2A-2D in **Appendix D**).

4.4.2.1 Highway 427 Structures over Rainbow Creek

Surface Water

Both preliminary and detail designs meet the minimum freeboard criteria for the regulatory flood event and maintain the bankfull channel and existing channel platform. Both designs also maintain sediment transport and other channel functions. The changes to local channel hydraulics are minor.

The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the surface water criterion.

Fish and Fish Habitat

Both preliminary and detail designs avoid direct encroachment into the bankfull channel and maintain the fluvial geomorphic and hydrotechnical functioning of the channel, minimizing indirect effects to the watercourse and maintaining fish movement and instream habitat conditions.

The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the fish and fish habitat criterion.

Wildlife Passage

Both the preliminary and detail designs meet the Individual EA (2010) Design Criteria for a minimum bridge height of 3 m and exceed the minimum Openness Ratio[8] (OR) of 0.6. The LINK427 detail design OR is approximately 3.6 (for the ultimate 10-lane scenario), while the preliminary design OR is approximately 5.3 (for the ultimate 10-lane scenario), which is a reduction in the OR of approximately 1.7 for the detail design.

Despite the minor difference in OR between the preliminary and detail design, both exceed the minimum OR. The preliminary design exceeds the OR design criterion by approximately 4.7 and the detail design exceeds by approximately 3.0. Therefore, there is no difference in the functionality of the designs because both facilitate the full movement of all animals through the valley, including large mammals (e.g. White-tailed Deer). Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the preliminary design and the detail design. These structures will not impede the passage of wildlife in this landscape. Additionally, there is no significant

[8] Openness Ratio is the cross-sectional area of a structure (square metres) divided by the distance wildlife must travel through (or under).

difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage. The results of the comparative evaluation indicate that the net effect of the structures on wildlife passage as measured by bridge height and OR result in an *insignificant change*.

The effect of adding fill into the valley was also assessed for its potential net effect on wildlife passage. While the detail design requires an additional 14,000 m^3 of fill in the valley, the implementation of retaining walls and strategically placed wildlife fence will effectively funnel wildlife to and through the crossing in the same manner as the preliminary design. Therefore, the detail design will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor due to additional fill in the valley.

SAR and SAR Habitat

Approximately 0.83 ha of SAR bat woodland habitat will be impacted as a result of both preliminary and detail designs; however, the detail design may result in a small reduction of habitat loss, thereby resulting in a minor potential benefit. In addition, the detail design provides retaining walls on the structure to provide an opportunity to enhance SAR bat habitat.

As a result, there is a negligible difference in permanently impacted area and no net change to SAR bat habitat impacts. Additionally, habitat restoration can be achieved as described in the SAR Permit from the Ministry of Natural Resources and Forestry (MNRF). The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary and detail design. A rating of *insignificant change* was assigned for the SAR and SAR habitat criterion.

Vegetation

Vegetation along Rainbow Creek at the location of the crossing is a low quality, young forest with ground flora dominated by invasive Dog-Strangling Vine. The detail design does not require vegetation clearing within the entire ROW and will retain vegetation at the structure wherever possible.

Preliminary design mitigation measures included vegetation restoration which can be completed as part of detail design. LINK427 will replace and enhance riparian vegetation removed or disturbed by the construction of the structure by planting clusters of native tree and shrub species as well as native grasses and herbaceous species. Woodland restoration and edge management are included in the Landscape Plan and Vegetation Restoration Plan (VRP) developed as part of detail design.

Construction approaches have been modified from preliminary design to avoid entering valley lands where possible, and to minimize impacts to environmentally sensitive areas.

Overall, the total temporary and permanent impacts to vegetation are reduced through the detail design structure and construction access points. The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the vegetation criteria.

Fluvial Geomorphology

Erosion mitigation is required for both the preliminary and detail designs. The extent of the erosion mitigation is similar. The preliminary design includes proposed rock protection around the crossing piers that extends along both sides of the channel of Rainbow Creek. The detail design includes proposed channel offset protection to be incorporated into the crossing rock protection along the crossing walls of the structure. The channel offset protection is comprised of riverstone and woody debris and offers a more natural bank treatment option over angular rock protection as proposed in preliminary design.

The results of the comparative evaluation indicate that the difference between the net effects of preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the fluvial geomorphology criterion.

Transportation, Engineering and Cost

Consideration was given to the flexibility for future expansion, constructability, compliance with engineering design criteria and cost. After assessing these criteria, it was found that the detail design results in a *significant benefit* compared to the

preliminary design. Most notably, the detail design allows for all bridge construction to be conducted from behind the abutments and retaining walls, including the cranes to erect the girders, requiring minimal to no access into the valley, whereas the preliminary design would have required works within the valley. The results of the comparative evaluation indicate that these factors result in a significant cost reduction for the detail design over the preliminary design.

4.4.2.2 Langstaff Road Structure over Rainbow Creek

Surface Water

Both preliminary and detail designs meet the minimum freeboard criteria for a regulatory flood event and maintain the bankfull channel and existing channel platform. Both designs also maintain sediment transport and other channel functions. The changes to local channel hydraulics are minor.

The results of the comparative evaluation indicate that the difference between the net effects of the preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the surface water criterion.

Fish and Fish Habitat

The preliminary design bridge structure and the detail design precast concrete modular bridge structure both avoid direct encroachment into the bankfull channel, and maintain the fluvial geomorphic and hydrotechnical functioning of the channel, minimizing indirect effects to the watercourse and maintaining fish movement while protecting the underlying physical habitat features. The reinstated reach incorporated in the detail design will provide natural channel form and contain natural substrates to provide adequate fish passage.

The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the fish and fish habitat criterion.

Wildlife Passage

Both the preliminary and detail designs include the replacement of the existing culvert at Langstaff Road with a bridge structure, resulting in improved wildlife passage. Both designs exceed to the minimum EA (2010) Design Criteria for a bridge height of 3 m and exceed the minimum OR of 0.6.

While the detail design reduces the OR relative to the preliminary design by approximately 11.6, the detail design OR still exceeds the required minimum design criteria provided in the 2010 EA by 0.8 (133% greater than the minimum). This means that there is no difference in the functionality of the two designs because both designs facilitate the full movement of all animals through the valley, including large mammals (e.g. White-tailed Deer). Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the preliminary design and the detail design. These structures will not impede the passage of wildlife in this landscape. Additionally, there is no significant difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage. The results of the comparative evaluation indicate that the net effect of the structures on wildlife passage as measured by bridge height and OR result in an *insignificant change.*

In addition, removal of the existing 3 m x 3 m culvert and replacement with a 14.6 m precast concrete modular bridge structure at this location will reinstate the valley linkage and will provide a substantial improvement to wildlife movement opportunities through the Rainbow Creek Valley system as a whole. This is because the detail design structure will result in an increase in span width of 11.6 m (387% increase) versus the existing condition, it will have an open footing vs. the existing closed bottom culvert, it will result in a 0.5 m increase in height, and will have an increase in OR of 1.14.

The effect of adding fill into the valley was also assessed for its potential net effect on wildlife passage. While the detail design requires an additional 5,000 m^3 of fill in the valley, the implementation of retaining walls and strategically placed wildlife fence will effectively funnel wildlife to and through the crossing in the same manner as the preliminary design. Therefore, the detail design will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor due to additional fill in the valley.

SAR and SAR Habitat

There is no SAR habitat present at the Langstaff Road structure over Rainbow Creek.

Vegetation

Vegetation at the location of the crossing consists of primarily cultural meadow. The preliminary design noted that there may be a possibility of vegetation survival beneath the proposed span, though survival of vegetation under the bridge itself would be limited to a small strip on either side due to the shadowing effect of the structure on light and moisture. The detail design does not accommodate vegetation restoration directly beneath the structure, though the value of the vegetation at this location is low. This area of restoration can be accommodated through other restoration measures.

All other preliminary design mitigation measures at this structure can be met through the detail design. In addition, the detail design results in a reduction of approximately 100 square metres in overall vegetation impact compared to preliminary design due to the reduction of construction access requirements. The results of the comparative evaluation indicate that the difference between the net effects between the preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the vegetation criteria.

Fluvial Geomorphology

Both the preliminary and detail designs require the development of a new a channel design for the reinstated channel of Rainbow Creek in the location of the existing culvert after it's removal. The preliminary design includes proposed rock protection along the existing channel banks and overbank, but a channel realignment was not shown. The detail design includes a proposed sinuous, morphologically-diverse channel realignment in place of the culvert. In place of the rock protection proposed by the preliminary design, the detail design proposes the overbank within the culvert be re-constructed using a Riverstone mix topped with a soil veneer. Additionally, a vegetated rock buttress is proposed to be integrated along the existing channel banks in lieu of the rock protection proposed in preliminary design. The construction of the vegetated rock buttress would require isolation and unwatering along the channel bank. However, the buttress would offer added long-term ecological benefit over rock protection, which would likely be dumped along the bank and into the channel.

The results of the comparative evaluation indicate that the difference between the net effects of preliminary design and detail design are minor. A rating of *insignificant change* was assigned to the fluvial geomorphology criterion.

Transportation, Engineering and Cost

Consideration was given to the flexibility for future expansion, constructability, compliance with engineering design criteria and cost. After assessing these criteria, it was found that the detail designs results in a *significant benefit* compared to the preliminary design. The preliminary design includes works that result in increased construction complexity and would require entrance into the valley. The detail design includes all bridge construction to be conducted from behind the abutments and retaining walls, resulting in improved constructability, and cranes will be placed at the back of the abutments to erect the girders, requiring minimal to no access into the valley. The results of the comparative evaluation indicate that these factors result in a significant cost reduction for the detail design over the preliminary design.

4.4.2.3 Highway 427 Structures over West Robinson Creek

Surface Water

Both preliminary and detail designs meet the minimum freeboard criteria for a regulatory flood event and maintain the bankfull channel and existing channel platform. Both designs also maintain sediment transport and other channel functions and the changes to local channel hydraulics are limited.

The detail design results in a projected surface water depth increase of 0.05 m in comparison to the preliminary design. This localized effect (within 55 m upstream of the structure) was assessed to be minor. A rating of *insignificant change* was assigned to the surface water criterion.

Fish and Fish Habitat

Both preliminary and detail designs avoid direct encroachment into the bankfull channel and maintain the fluvial geomorphic and hydrotechnical functioning of the channel, minimizing indirect effects to the watercourse and maintaining fish movement and instream habitat conditions.

The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the fish and fish habitat criteria.

Wildlife Passage

Both the preliminary and detail designs exceed to the minimum Individual EA (2010) Design Criteria for a bridge height of 3 m and exceed the minimum OR of 0.6.

The detail design results in a change to the bridge height relative to the preliminary design that ranges from a 0.5 m decrease to a 3.5 m increase. However, the height of the detail design exceeds the 2010 EA design criteria by 1 m – 5 m. The OR of the detail design is approximately 6.2 (for the ultimate 10-lane scenario), while the preliminary design OR is approximately 10, resulting in a reduction to the OR by approximately 3.8. However, while the detail design reduces the OR by approximately 38% relative to the preliminary design, it exceeds the required minimum design criteria provided in the 2010 EA by 933% (for the ultimate 10-lane scenario).

Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the preliminary design and the detail design. These structures will not impede the passage of wildlife in this landscape. Additionally, there is no significant difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage.

The results of the comparative evaluation indicate that the net effect of the structures on wildlife passage as measured by bridge height and OR result in an *insignificant change*.

The effect of adding fill into the valley was also assessed for its potential net effect on wildlife passage. While the detail design requires an additional 14,000 m3 of fill in the valley, this increase in fill is a result of raising the height of the bridge which results in benefits to wildlife passage by implementing a higher structure. The use of retaining walls and strategically placed wildlife fence will effectively funnel wildlife to and through the crossing in the same manner as the preliminary design. Therefore, the detail design will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor due to additional fill in the valley.

SAR and SAR Habitat

There is no SAR habitat present at the Highway 427 structures over West Robinson Creek.

Vegetation

Vegetation at the location of the crossing consists of primarily cultural meadow / mineral cultural thicket. The detail design does not require vegetation clearing within the entire ROW and will retain vegetation at the structure wherever possible.

The preliminary design anticipated that large trees growing underneath or within the vicinity of the structures would be removed and that the majority of vegetation would not survive under the structures due to reduced sunlight and precipitation penetration. Four (4) mature bur oak trees exist in the valley and were recommended for retention, where feasible. Three (3) of the four (4) mature bur oak trees can be retained as part of detail design. Preliminary design mitigation measures include replacement and enhancement of riparian vegetation, planting clusters of native tree and shrub species along the banks of West Robinson Creek within the ROW and restoration of banks and riparian areas. Riparian and slope vegetation can be replaced and enhanced within the ROW as part of detail design, with the exception of the area directly below the structure. Because the area below the structure would experience shading and moisture deprivation, restoration outside the structure is more likely to be successful.

The detail design results in a reduction of approximately 100 square metres in overall vegetation impact compared to preliminary design due to the reduction of construction access requirements. The results of the comparative evaluation

indicate that the difference between the net effects between the preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the vegetation criteria.

Fluvial Geomorphology

There is a difference in the proposed erosion mitigation measures between the preliminary design and the detail design. The preliminary design used rock protection in the vicinity of the crossing piers, outside of the channel footprint. Under the detail design, the rock protection is maintained, but additionally, channel offset protection is proposed along a segment of retaining wall, and along the south extent of the rock protection. Similarly, the offset protection is proposed outside of the channel footprint. The offset protection is proposed to be integrated with the rock protection so as to not increase the area of disturbance in the floodplain versus the preliminary design. The construction impact may be considered temporary as the offset protection will re-vegetate over time. In-channel bank protection (e.g., vegetated rock buttress) is required in the vicinity of the east crossing pier, which is designed to match the existing bank grade in order to limit the construction footprint in the channel. The in-channel works would require temporary isolation and unwatering along the channel bank during low flow conditions. From a geomorphological standpoint, the difference between the preliminary and detail designs is considered minor as the proposed in-channel works maintain the bankfull channel and do not impact creek function.

The results of the comparative evaluation indicate that the difference between the net effects of preliminary design and detail design are minor. A rating of *insignificant change* was assigned to the fluvial geomorphology criterion.

Transportation, Engineering and Cost

Consideration was given to the flexibility for future expansion, constructability, compliance with engineering design criteria and cost. After assessing these criteria, it was found that the detail designs results in a *significant benefit* compared to the preliminary design. While both the preliminary and detail design include works within the valley, the detail design improves constructability of the structures and minimizes construction impacts through decreased girders lengths and overall size of the structure. The results of the comparative evaluation indicate that these factors result in a significant cost reduction for the detail design over the preliminary design.

4.4.2.4 Major Mackenzie Drive Structure over West Robinson Creek

Surface Water

Both preliminary and detail designs meet the minimum freeboard criteria for a regulatory flood event and maintain the bankfull channel and existing channel platform. Both designs also maintain sediment transport and other channel functions. The changes to local channel hydraulics are limited.

The results of the comparative evaluation indicate that the difference between the net effects of the preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the surface water criterion. ***Fish and Fish Habitat***

Both preliminary and detail designs avoid direct encroachment into the bankfull channel and maintain the fluvial geomorphic and hydrotechnical functioning of the channel, minimizing indirect effects to the watercourse and maintaining fish movement. The reinstated reach incorporated into the detail design will provide natural channel form and contain natural substrates to provide adequate fish passage.

The results of the comparative evaluation indicate that there is a negligible / no difference in the net effects between the preliminary design and the detail design. A rating of *insignificant change* was assigned to the fish and fish habitat criteria.

SAR and SAR Habitat

There is no SAR habitat present at the Major Mackenzie Drive structures over West Robinson Creek.

Fluvial Geomorphology

Both the preliminary and detail designs require a channel design for the reinstated channel of Rainbow Creek in the location of the existing culvert after it's removal. The preliminary design includes rock protection along both sides of the West

Robinson Creek channel and a channel realignment is not shown. The detail design maintains the rock protection and a riverstone-lined channel is proposed in-place of the culvert. As such, the extents of the impacted areas are very similar.

The results of the comparative evaluation indicate that the difference between the net effects of preliminary design and detail design are minor. A rating of *insignificant change* was assigned to the fluvial geomorphology criterion.

Wildlife Passage

Both the preliminary design and the detail design include the replacement of the existing culvert at Major Mackenzie Drive with a bridge structure, resulting in improved wildlife passage. Both designs meet or exceed the minimum Individual EA (2010) Design Criteria for a bridge height of 3 m and exceed the minimum OR of 0.6.

The detail design provides the same bridge height as the preliminary design and exceeds the 2010 EA design criteria of 3 m height for wildlife passage by 0 – 1 m (0% - 33%).The LINK427 detail design OR is approximately 3.6, while the preliminary design OR is approximately 6, resulting in an overall reduction to the OR by approximately 2.4 (40%). However, the OR for the detail design still exceeds the required minimum design criteria provided in the 2010 EA by 3 (500%). Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the preliminary design and the detail design. These structures will not impede the passage of wildlife in this landscape. Additionally, there is no significant difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage. The results of the comparative evaluation indicate that the net effect of the structures on wildlife passage as measured by bridge height and OR result in an *insignificant change*.

In addition, removal of the existing 5 m x 3 m culvert and replacement with a bridge structure at this location will reinstate the valley linkage and will provide a substantial improvement to wildlife movement opportunities through the West Robinson Creek valley system as a whole. This is because the detail design structure will result in an increase in span length of 35 m (700% increase), will have an open footing vs. the closed bottom culvert, will result in a 1 m increase in height, and will have an increase in OR of 2.6.

The effect of adding fill into the valley was also assessed for its potential net effect on wildlife passage. While the detail design requires an additional 3,000 m^3 of fill in the valley, the implementation of retaining walls and strategically placed wildlife fence will effectively funnel wildlife to and through the crossing in the same manner as the preliminary design. Therefore, the detail design will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor due to additional fill in the valley.

Vegetation

Vegetation at the location of the crossing consists of deciduous forest. The detail design does not require vegetation clearing within the entire ROW and will retain vegetation at the structure wherever possible.

The preliminary design anticipated that existing woody and riparian vegetation will be removed to construct the new structure. Preliminary design mitigation measures include replacement and enhancement of riparian vegetation, planting clusters of native tree and shrub species along the banks of West Robinson Creek within the ROW and restoration of the natural channel. Riparian and slope vegetation can be replaced and enhanced within the ROW as part of detail design, with the exception of the area directly below the structure. Because the area below the structure would experience shading and moisture deprivation, restoration outside the structure is more likely to be successful.

The detail design results in a reduction of approximately 300 m^2 in overall vegetation impact compared to preliminary design due to the reduction of construction access requirements. The results of the comparative evaluation indicate that the difference between the net effects between the preliminary design and the detail design are minor. A rating of *insignificant change* was assigned to the vegetation criteria.

Transportation, Engineering and Cost

Consideration was given to the flexibility for future expansion, constructability, compliance with engineering design criteria and cost. After assessing these criteria, it was found that the detail designs results in a *significant benefit* compared to the preliminary design.

The preliminary design includes access roads in the valley while the detail design allows for all bridge construction to be conducted from behind the abutments, resulting in improved constructability and minimal to no access into the valley. The results of the comparative evaluation indicate that these factors result in a significant cost reduction for the detail design over the preliminary design.

4.4.3 Summary of Results

The results of the comparative evaluation indicate that the significance of the adverse environmental effects resulting from the changes between the preliminary design and the detail design of the four watercourse crossings are negligible or minor in nature.

Based on the process outlined in Section 9.2 of the Individual EA (2010), an amendment to the EA is therefore not required. The changes in design can be documented in a DCR and implemented as part of the detail design and construction.

In terms of transportation, engineering and cost criteria, the results of the comparative evaluation identified a potential for significant benefits over the preliminary design for all four watercourse crossings.

5 Detailed Description of the Undertaking

5.1 Major Features of the Proposed Works

The Recommended Plan for the DCR #3 works includes the following components:

- The construction of new Highway 427 bridges (NBL & SBL) over Rainbow Creek;
- Replacement of the existing Langstaff Road culvert with a new precast concrete arch structure over Rainbow Creek;
- Construction of a new interchange bridge structure at Langstaff Road including detours/staging, for the construction of Langstaff Road using the previously constructed components (as described in DCR #2);
- Construction of new Highway 427 bridges (NBL & SBL) over West Robinson Creek;
- Construction of new Highway 427 bridges (NBL & SBL) over the CPR rail corridor & McGillivray Road;
- Replacement of the existing Major Mackenzie Drive culvert with a bridge over West Robinson Creek; and
- Construction of a new interchange bridge structure at Major Mackenzie including detours/staging for the construction of Major Mackenzie Drive using the previously constructed components (as described in DCR #2).

The following sections detail the major features of the proposed works to be undertaken as part of DCR #3.

5.1.1 Structures

The following provides a detailed description of each of the structures to be constructed as part of DCR #3. General Arrangement drawings for the following structures are provided in **Appendix E.1**.

5.1.1.1 Highway 427 Structure over Rainbow Creek (NBL)

The proposed Highway 427 structure over Rainbow Creek (NBL) includes a single-span structure with a total length of 49.4 m and a total width of 34.6 m. The structure will carry five General Purpose Lanes (GPL) northbound and one High Occupancy Vehicle (HOV) lane northbound towards Major Mackenzie Drive. The superstructure will consist of NU 2400 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments. The structure will provide a minimum freeboard (bottom of girder to 100-year storm event) of approximately 5.6 m. Retaining walls in addition to the ones required for the structure have been added to the East side to provide the additional Bat Habitat restoration areas.

5.1.1.2 Highway 427 Structure over Rainbow Creek (SBL)

The proposed Highway 427 structure over West Robinson Creek (SBL) includes a single-span structure with a total length of 47.7 m and a total width of 32.1 m. The structure will carry four GPLs and one HOV lane southbound towards Toronto. The superstructure will consist of NU 2400 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments. The structure will provide a minimum freeboard (bottom of girder to 100-year storm event) of approximately 5.5 m. Retaining walls in addition to the ones required for the structure have been added to the West side to provide the additional Bat Habitat restoration areas.

5.1.1.3 Langstaff Road Structure over Highway 427

The proposed Highway 427 structure at Langstaff Road is a two-span bridge with a total length of 79.2 m and a total width of 27.28 m. The structure will carry four lanes (two lanes in each eastbound and westbound directions) of Langstaff Road over the new Highway 427 extension. The superstructure will consist of NU 1600 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments, as well as a concrete centre-pier founded on H-Piles. The structure will provide a minimum vertical clearance of 5.09 m. Retaining walls are located on each of the four corners of the structure.

The existing cyclist infrastructure on Langstaff Road will be maintained with a 1.5 m-wide bike lane on either side. A 1.55 m-wide raised sidewalk will be installed in both directions of travel.

5.1.1.4 Langstaff Road Structure over Rainbow Creek

The existing Langstaff Road structure over Rainbow Creek is a 3-m diameter Corrugated Steel Pipe (CSP) culvert. The proposed replacement culvert is a precast concrete span arch structure with a total length of 14.63 m and a total width of 37.0 m. The structure will carry four lanes (two lanes in each eastbound and westbound directions) of Langstaff Road over Rainbow Creek. The structure is complete with wingwalls and headwalls, and is supported on a substructure with H-Piles. Head walls are provided on the four corners of the structure to provide the required soil retention.

The existing cyclist access on Langstaff Road will be maintained with a 1.5 m-wide bike lane on both sides. The structure will provide a minimum vertical clearance of 3.0 m under the archway.

5.1.1.5 Highway 427 Structure over West Robinson Creek (NBL)

The proposed Highway 427 structure over West Robinson Creek (NBL) includes a two-span bridge structure with a total length of 93.1 m and a total width of 17.8 m. The structure will carry three GPLs northbound towards Major Mackenzie Drive. The superstructure will consist of NU 2400 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments as well as a concrete centre-pier. Retaining walls are provided on the four corners to retain the backfill. The structure will provide a minimum freeboard of 4.82 m.

5.1.1.6 Highway 427 Structure over West Robinson Creek (SBL)

The proposed Highway 427 structure over West Robinson Creek (SBL) includes a two-span bridge structure with a total length of 93.5 m and width of 14.1 m. The structure will carry two GPLs southbound towards Rutherford Road. The superstructure will consist of NU 2400 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments as well as a concrete centre-pier. Retaining walls are provided on the four corners to retain the backfill. The structure will provide a minimum freeboard of 3.37 m.

5.1.1.7 Highway 427 Structure at CPR / McGillivray Road (NBL)

The proposed Highway 427 structure at CPR / McGillivray Road (NBL) is a three-span bridge with a total length of 95.8 m and a total width of 29.7 m. The structure will carry two GPLs and two S-E ramp lanes in the northbound direction towards Major Mackenzie Drive. The superstructure will consist of NU 1600 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure will be supported on a substructure with H-Piles and false abutments (with RSS walls) with two concrete centre-piers founded on H-Piles. Crash walls are also provided on piers adjacent to the CPR tracks. Retaining walls are provided to retain the backfill.

5.1.1.8 Highway 427 Structure at CPR / McGillivray Road (SBL)

The proposed Highway 427 structure at CPR / McGillivray Road (SBL) is a three-span bridge with a total length of 100.8 m and a total width of 22.0 m. The structure will carry two lanes in the southbound direction towards Rutherford Road. The superstructure will consist of NU 1600 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure is supported on a substructure with H-Piles and false abutments (with RSS walls) with two concrete centre-pier founded on H-Piles. Crash walls are also provided on piers adjacent to the CPR tracks. The structure will provide a minimum vertical clearance of 7.3 m. Retaining walls are provided to retain the backfill.

5.1.1.9 Highway 427 Structure at Major Mackenzie Drive

The proposed Highway 427 structure at Major Mackenzie Drive is a single-span bridge with a total length of 39.0 m and a width of 19.1 m. The overpass will carry one lane each from the E-S and S-W ramp. The superstructure consists of NU 2000 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure is supported on a substructure with H-Piles and false abutments as well. The structure will provide a minimum vertical clearance of 5.3 m. Retaining walls are provided to retain the backfill.

5.1.1.10 Major Mackenzie Drive Structure at West Robinson Creek

The existing Major Mackenzie Drive structure over West Robinson Creek is a cast in place concrete culvert with headwalls. The proposed replacement structure is a single-span bridge with a total length of 41.2 m and a total width of

35.1 m. The structure carries three lanes on Major Mackenzie Drive in each of the eastbound and westbound directions, as well as one speed change lane from the S-W ramp. The superstructure consists of NU 2000 prestressed concrete girders, precast deck panels and a concrete topping. The superstructure is supported on a substructure with H-Piles and false abutments as well as a concrete centre-pier founded on H-Piles. Retaining walls will be provided on the four corners to retain the backfill.

The structure will provide pedestrian and cyclist access on Major Mackenzie Drive with a 1.55 m-wide raised sidewalk on the north side and a 3.55 m-wide raised multi-use path on the south side of the structure. The structure will provide a minimum vertical clearance of 3.00 m.

5.1.2 Construction Methods

Due to the similarity in scope, construction methods for the Highway 427 Extension structures are generally consistent and will consist of the following:

- Valley Access Management Plans are being developed to construct within the valleys in an Environmentally responsible manner using Best Management Practices.
- Erosion and Sediment controls will be installed to protect all of the environmental features prior to starting any clearing/grubbing and excavation works
- Access roads into the valleys will be constructed to access the various areas. Areas which prohibit construction activities will have been previously delineated and will remain off limits during construction.
- Construction will commence by excavating an area for the construction of the bridge abutments and piers using excavators and trucks to haul the material for reuse on the site. In the event seepage or water infiltration occurs, water will be pumped out from the excavation, contained / treated in filter bags, and dispersed over a vegetated area prior to infiltration to the ground or re-entry to an existing waterway. No large-scale or long-term pumping requirements are anticipated.
- Once the appropriate elevations have been reached, the pier footings will be formed and poured with reinforced concrete, followed by the pier columns and the pier caps (beams).
- Once the required elevation is achieved, deep foundations and H-Piles will be installed using cranes with either hydraulic or pneumatic hammers to support the weight of the structure.
- After the H-Piles have been installed, the base of the abutments will be constructed using reinforced granular walls with precast panels. These walls will provide the support for the abutments to be formed and poured with reinforced concrete.
- Following construction of the abutments, the precast girders and deck panels will be installed using cranes and transport trailers. The decks will then be cast which will tie the girders, deck panes, and abutments together into one continuous element.
- The pre-cast arch structure at Langstaff Road over Rainbow Creek will be brought to site on trailers. The location will be excavated using excavators and trucks hauling the excess materials to other parts of the site. Next, a clear stone bedding will be placed to serve as a foundation along the length of the proposed structural culvert. Cranes will be employed to lift the culvert pieces into place and assemble the pieces into a continuous unit. Once complete, the culvert will be backfilled using excavators and bulldozers.
- Construction of barrier walls, approach slabs, and sleeper slabs will follow soon after.
- The impacted areas, including the access roads will be reinstated at the end of the construction period.

The existing culvert structures at Langstaff Road over Rainbow Creek and Major Mackenzie Drive over West Robinson Creek will remain functional and in-place until the new replacement structures are built in their entirety, at which point the old culverts will be removed. The removal sequence is detailed in **Section 5.1.5**.

5.1.3 Construction and Traffic Staging

The majority of the Highway 427 extension structures are new build and do not require traffic staging on adjacent roads. The construction of the replacement structures at Langstaff Road over Rainbow Creek and Major Mackenzie Drive over West Robinson Creek will involve shifting the current roadway configurations to allow for travel to be maintained throughout construction. The completion of the interchange construction at Langstaff Road and Major Mackenzie Drive, including the permanent realignment of the roadways, will be completed using a staged construction methodology, as described below. The construction of the CPR/McGillivray Road Structure will not require any additional staging but will require both flagging from CPR and off-peak hour lane reductions on McGillivray Road.

5.1.3.1 Langstaff Road Construction Staging

Table 5 describes the Langstaff Road construction staging for the construction of the interchange and permanent road realignment. Construction traffic staging along Langstaff Road is shown in **Figure 3**. Temporary localized lane closures will be required while implementing the various staging configurations and for works which cannot be accommodated within the protected work areas. All changes to traffic conditions will be based on a safety-first approach and in accordance with the project Traffic Management Plan (TMP). A Temporary Long Term lane reduction from four to two lanes during construction is being discussed with the Road Authorities, both MTO and York Region, including a speed reduction from 80 km/hr to 60 km/hr. A Temporary bylaw from York Region will be required to reduce the speed limit. Discussions are ongoing with both York Region and the MTO.

Table 5: Summary of Langstaff Road Construction Staging

Langstaff Road Construction Staging				
Staging	**Timing**	**Work Span**	**Lane Reductions**	**Impacts to Pedestrians/Cyclists**
Langstaff – 1	2018-2020	■ Langstaff Road lane widths temporarily reduced and shifted to the south to facilitate permanent infrastructure works (road realignment and structure construction) along new alignment and construction of northern ramps	1 Lane reduction in both directions	■ There are no existing pedestrian facilities to be maintained during construction. ■ The existing bicycle lanes will be maintained during construction.
Langstaff – 2	2020	■ Langstaff Road lanes shifted along new alignment to facilitate removal of old alignment and construction of southern ramps	1 Lane reduction in both directions	■ There are no existing pedestrian facilities to be maintained during construction. ■ The existing bicycle lanes will be maintained during construction.
		■ Final configuration	None	■ Cyclists will have access to bike lanes on both the north and south sides

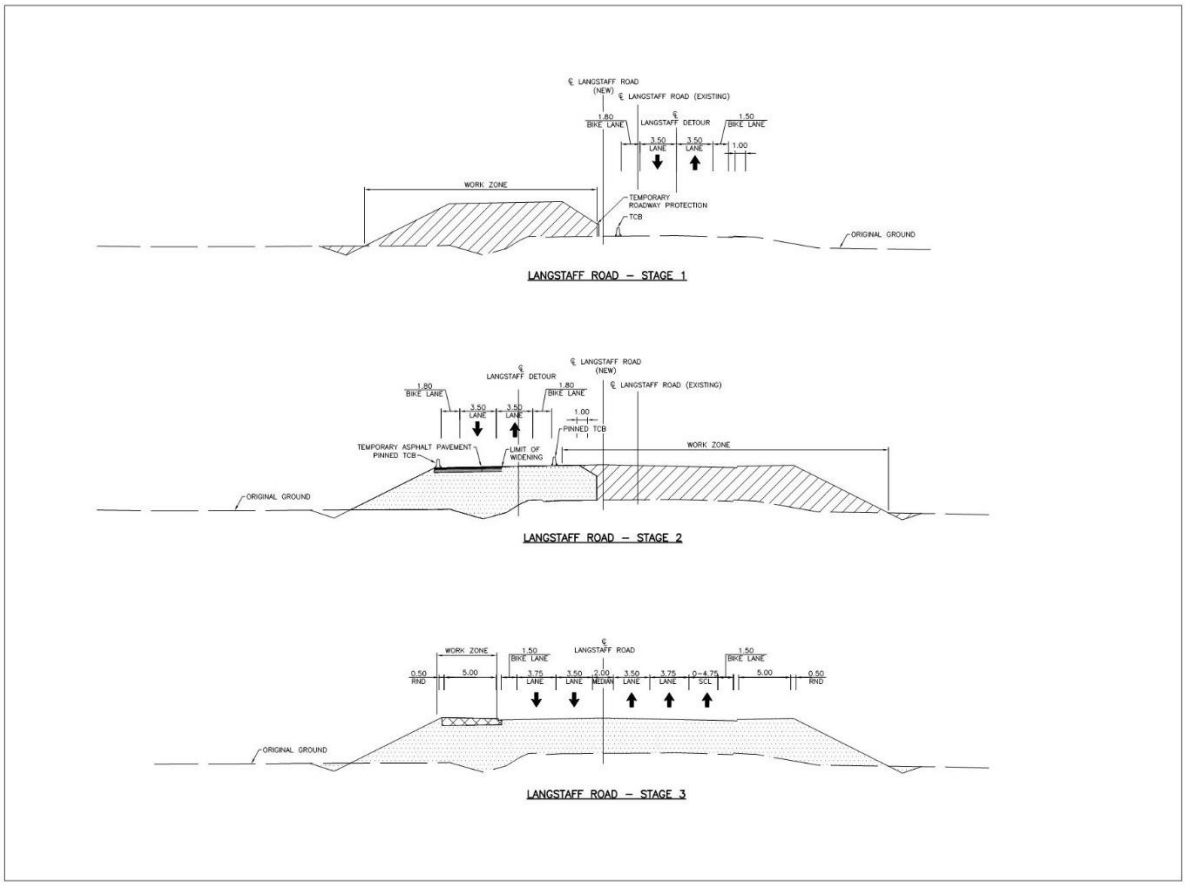


Figure 3: Langstaff Road Traffic Staging

5.1.3.2 Major Mackenzie Drive Construction Staging

Table 6 describes the Major Mackenzie Drive construction staging for the construction of the interchange and permanent road realignment. Construction traffic staging along Major Mackenzie Drive is shown in **Figure 4**. Temporary localized lane closures will be required while implementing the various staging configurations and for works which cannot be accommodated within the protected work areas. All changes to traffic conditions will be based on a safety-first approach and in accordance with the project TMP.

Table 6: Summary of Major Mackenzie Drive Construction Staging

Major Mackenzie Drive Construction Staging				
Staging	**Timing**	**Work Span**	**Lane Reductions**	**Impacts to Pedestrians/Cyclists**
Major Mackenzie Drive – 1	2018-2019	■ Major Mackenzie Drive lanes widths temporarily reduced and diverted to South, non-peak lane reductions to facilitate temporary widening construction	None	■ There are no existing pedestrian and cyclist facilities to be maintained during construction.
Major Mackenzie Drive – 2	2019-2020	■ Major Mackenzie Drive lane widths temporarily reduced and realigned northerly onto new alignment.	None	■ There are no existing pedestrian and cyclist facilities to be maintained during construction.

Major Mackenzie Drive Construction Staging				
Staging	**Timing**	**Work Span**	**Lane Reductions**	**Impacts to Pedestrians/Cyclists**
Major Mackenzie Drive – 3	2020	■ Final configuration	None	■ Pedestrians and cyclists will have access to sidewalks /Multi-use paths on the North and South sides.

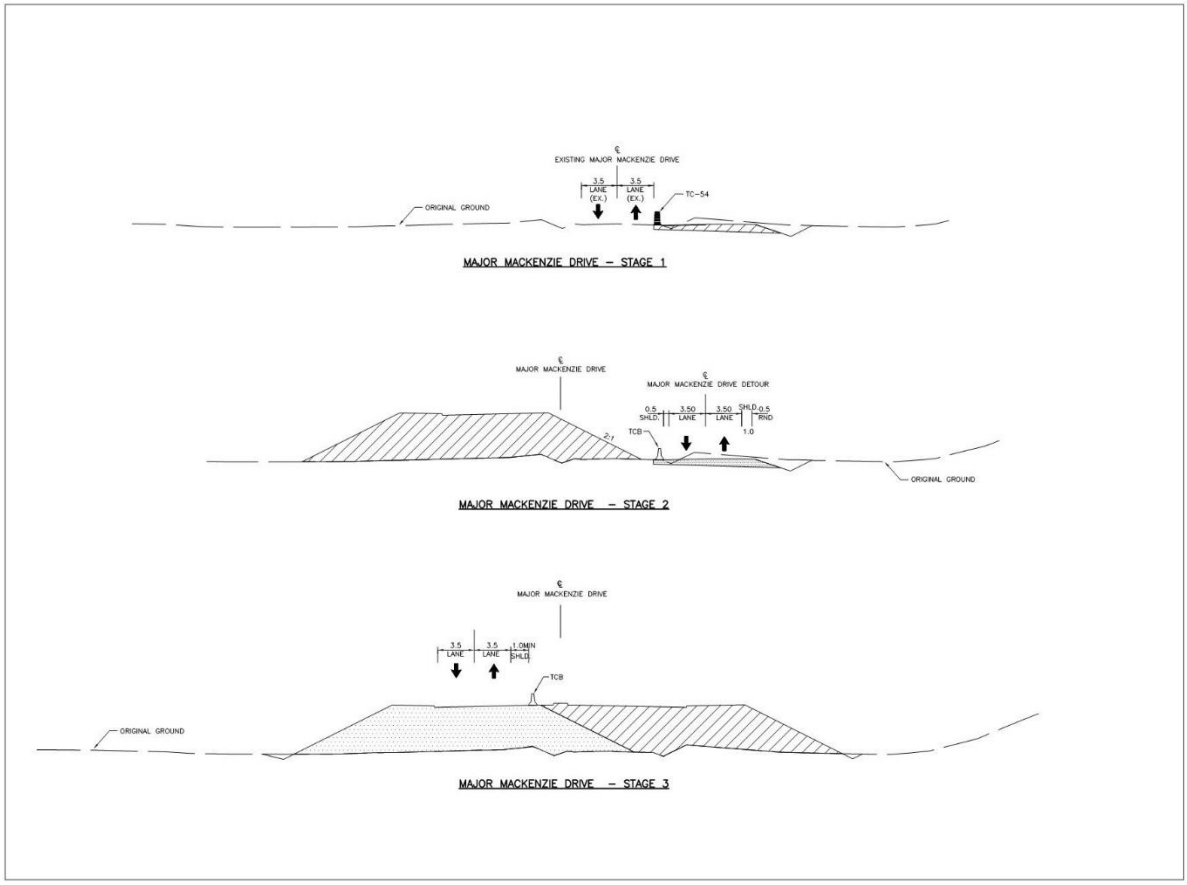


Figure 4: Major Mackenzie Drive Traffic Staging

A summary of the construction staging and lane reductions with respect to the timeline of the Project is shown below in **Figure 5.**

Crossroad Staging Summary (Extension Section from Highway 7 to Major Mackenzie Drive)												
	No lane reduction											
	One lane reduction per direction											
	2018			2019				2020				
Road	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
Langstaff			**Stage 1**			**Stage 2**					**Final Configuration**
Major Mackenzie			**Stage 1**			**Stage 2**			**Stage 3/ Final configuration**		

Figure 5: Summary of Langstaff Road and Major Mackenzie Drive Construction Staging and Lane Reductions

5.1.4 Active Transportation

All existing active transportation facilities will be maintained during construction.

- The Langstaff Road 1.5 m (min) bike lanes will be maintained during construction on both sides of the road. A graded boulevard will be maintained throughout construction so as to allow for pedestrian traffic to continue on one side or the other. Signage will be in place to direct pedestrians safely through the work zone.
- The Major Mackenzie Drive Shoulders will be retained throughout construction so as to allow for pedestrians and cyclists to safely traverse the work zone. Signage will be in place to direct pedestrians safely through the work zone.

The following facilities will be constructed as part of the works outlined in DCR #3:

- The Langstaff Road Bridge over Highway 427 will have 1.5 m wide bike lanes and raised 1.5 m sidewalks.
- The Langstaff Precast concrete Arch over Rainbow Creek will have 1.5 m bike lanes and 5.25 m boulevards on either side
- The Major Mackenzie Drive Structure over West Robinson Creek will have a 3.55 m MUP on the South side and a 1.55 m Sidewalk on the north side.

During Construction

During construction, clear signage will be provided on how to safely traverse the site due to temporary closures or detours along Langstaff Road and Major Mackenzie Drive.

5.1.5 Stormwater Management and Drainage

The drainage within the extension is provided by two watercourses located within the Humber Watershed, including the Rainbow Creek Watershed and the Robinson Creek Watershed, both within the TRCA jurisdiction.

Drainage Features

There are four (4) major watercourse crossings for the works proposed in this DCR, the remaining culverts, sewers, and watercourses have been covered in DCR #2.

A Fluvial Geomorphology Assessment Report was completed to evaluate these four watercourse crossings and delineate the watercourse reaches. This analysis provided recommendations related to sizing and placement of watercourse crossing structures and these recommendations have been incorporated into the sizing crossing treatments listed below.

Summary of Watercourse Crossing Treatment

Crossing Name	Watercourse	Station	Type
Rain 3	Rainbow Creek	11+600 Highway 427	Single span bridges (SBL and NBL)
Rain 5	Rainbow Creek	9+500 Langstaff Road	Precast concrete span arch structure
Rob 5	West Robinson Creek	15+525 Highway 427	Two new two-span bridges (SBL and NBL)
Rob 6	West Robinson Creek	9+420 Major Mackenzie Drive	New single-span bridge

The proposed stormwater management strategy consists of utilizing flat-bottomed grassed swales in all locations and implementation of temporary sedimentation basins/swales to provide quality and quantity control to runoff.

Specifically, existing drainage patterns are to be maintained as much as possible within the layout of the highway profile. Runoff from areas external to the ROW will be intercepted and conveyed to the temporary sedimentation basins and swales prior to entering the watercourses. Selection of proposed stormwater management practices was determined

based on the drainage area contributing flows to local watercourses. The drainage area considered for stormwater management consisted of the complete ROW.

Further details and locations of the permanent stormwater management and their outlets to the downstream watercourses will be addressed in a future DCR.

Fish Habitat Enhancement and Restoration

Any instream or near stream works will be conducted during the appropriate in-warmwater construction timing (from July 1 to March 31) to protect the resident warmwater fish communities present at watercourse crossings. A warmwater construction timing window (from July 1 to March 31) shall also be applied for installation of the culverts and associated works at the minor watercourses supporting seasonal fish use or draining to a downstream fishery.

There are two culvert removals, within the existing Fish Habitat proposed under this DCR.

Summary of Watercourse Crossing – Fish Habitat Enhancement and Restoration

Crossing Name	Watercourse	Fishery	Station	Facility	Watercourse /Fish Habitat modifications
Rain 3	Rainbow Creek	Yes	11+600 Highway 427	Single span bridges (SBL and NBL)	-
Rain 5	Rainbow Creek	Yes	9+500 Langstaff Road	Precast concrete span arch structure	Replacement of the existing culvert with a spanning arch structure with the channel reinstated through the crossing. Vegetative rock buttress to be installed at two meander bends to address bank erosion.
Rob 5	West Robinson Creek	Yes	15+525 Highway 427	Two new two-span bridges (SBL and NBL)	Vegetative rock buttress to be installed at a meander bend to address bank erosion.
Rob 6	West Robinson Creek	Yes	9+420 Major Mackenzie Drive	New single-span bridge	Replacement of the existing culvert with a new single-span bridge with the channel reinstated through the crossing.

At the locations identified above the natural channel design principles were used for all realignment and/or reinstatements:

- Vegetation feature removals were minimized; and
- Morphological diversifications such as plunge pools were implemented
- Substrates were sized such that “anchor” stones will remain during large storm events, and mixed with smaller gravel, cobble, and sand.
- Smooth transitions between the upstream and downstream reaches
- Reinstated channels designed to maintain fish passage during low flow conditions

Future DCR's will detail further enhancements such as:

- The replacement and/or enhancement of riparian and instream vegetation, which might include planting clusters of native trees, shrubs, and herbaceous species along the banks within the lands;
- The stabilization of banks that have eroded and slumped using up-to-date bioengineering techniques, which might include live staking, fascines, live cribwalls and native material revetments;
- The installation of fish habitat structures, which might include cross logs, cabled log jams and boulder placement; etc.

Detailed plans for the installation of the watercourse crossing structures and channel reinstatements/restorations have been developed and will include the best management practices.

Location of Sedimentation Detention Basins, Swales, and Check Dams

The location of drainage management facilities such as sediment detention basins, swales, and check dams, has been determined prior to commencing the works within each drainage catchment area. A detailed assessment was completed within each drainage catchment area along the Highway 427 Expansion to assess the adequacy of the land in terms of available area, soil characteristics, receiving water characteristics, etc.

Erosion and Sediment control

LINK427 has developed an Erosion and Sediment Control Plan (ESCP) for the project in accordance with the Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects ('Environmental Guide': MTO 2015a). The purpose of the ESCP is to document the environmental protection measures for preventing and controlling erosion and sedimentation during construction.

The ESCP was structured in accordance with the Environmental Guide (2015) and includes the following components:

- Statement of Objectives;
- Project Description;
- Pre-development Site Conditions;
- Critical Areas of Concern;
- Responsibilities and Accountability;
- BMP Selection and Design;
- Monitoring and Maintenance;
- Contingency Plan; and,
- Detailed Site Drawings.

A multiple barrier solution will be used to provide an adequate level of protection for all receiving watercourses. Components of the multiple barrier solution shall include (but are not limited to):

- Dewatering via pumping and isolating the construction zone from outside flows to keep the work in the dry;
- Screening of water prior to dewatering pump intake;
- Heavy duty silt fence at or above the regulatory flood line;
- Temporary sedimentation pond for dewatering prior to discharge to watercourses;
- Temporary diversion swale necessary to convey runoff;
- Straw bale and / or rock check dams in temporary diversion swale as required;
- Stabilization of all disturbed areas where work will not take place for a period of 15 days or more in accordance with OPSS 572;
- Dewatering effluent discharge to be directed to sedimentation basins;

- Energy diffusers to be employed for dewatering effluent lines;
- Use of check dams, sediment barriers, and/or filters prior to discharge to the creek; and,
- In-Stream Control Practices:
  - Auguring and Directional Drilling;
  - Sediment/Turbidity Curtains;
  - Temporary Stream Crossings Via Culvert(s);
  - Dry Flume/By-Pass Pumping;
  - Cofferdam; and,
  - Site Dewatering.

A Certified Inspector of Sediment and Erosion Control (CISEC) will inspect temporary erosion and sedimentation controls in accordance with Task ENV 7 of the Construction Administration and Inspection Task Manual (MTO 2010) and with the Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects (MTO, 2015a). Inspections shall occur once per day during installation, prior to forecasted major storm events, during snowmelt and following significant storm events (MTO 2015a). Environmental inspections for routine maintenance of erosion and sedimentation controls shall occur once per week, unless maintenance/ repairs are required upon inspection and after significant storm events (MTO 2015a). The Design builder will also be expected to abide by the protocols outlined in the Erosion and Sediment Control Inspection Guide (TRCA 2008) and Silt Smart, Version 1.2 (CVC et al., 2012).

Construction Period Drainage and Sediment Control Plans

Construction Period Drainage and Sediment Management Plans (DSMPs) have been developed for the Project. The purpose of DSMPs is to provide a procedure for water quality treatment of the runoff generated within all drainage catchment areas within the Lands before water is discharged to any watercourse. In addition to the water quality treatment, DSMPs also address attenuation of frequent runoff events, and sediment control. Each DSMP is site-specific and based on managing stormwater within each drainage catchment area located within the Project limits throughout each and every phase of construction.

Construction Methods

Prior to disturbing the ground and any of the existing drainage all of the existing watercourses (wet and dry) will be protected with the required erosion and sediment control measures outlined in the detailed drawings and the above mentioned ESCP and DSMP's, including but not limited to protections along all watercourses within the Project Limits and all outlets to downstream watercourses. As each catchment area is protected the construction of the ditching, temporary swales, temporary sedimentation basins, and check dams will begin using excavators, bulldozers, and trucks to relocate the fill to other parts of the site. Temporary rock check dams will be installed in the ditch lines at the same time. A topsoiling operation will begin as soon as the final surfaces of the ditches, temporary swales, and sedimentation basins are constructed. A minimum of 50 mm of topsoil will be placed and further protected with either hydro seeding or hydro seeding with erosion control blankets. The drainage will be constructed from the outlets so as to always maintain positive drainage throughout the limits of the Project.

For the structures that do not affect the watercourses, where no in-water work is required, all bridge work will be completed from within the designated areas. Cranes will be utilized to erect the girders over the water. All formwork and access platforms will be installed/removed from above with no impact to the underlying protected areas.

For the in water work including the culvert removals and channel restorations at the fishery locations identified above, within the specified timing window of July 1 to March 31, the Best Management Practices will be used to develop and implement specific plans to:

- install the necessary erosion and sediment control measures;
- install the flow by pass systems (including but not limited to diversion pipes, screened pumps, coffer dams, etc.);

- conduct de-fishing operations;
- excavate the existing stream bed;
- installation of the culvert, substrate, plunge pools, and backfill;
- restoration of the channel; and,
- removal of the flow bypass and any temporary devices in the water course.
- Monitoring of water quality upstream and downstream will be ongoing and continuous.

6 Environmental Impacts, Mitigation Measures and Commitments

This section identifies the impacts to the natural, socio-economic and cultural environments associated with the construction activities covered in this DCR #3, and the proposed measures to mitigate the potential adverse effects. Mitigation includes planning decisions, design features, construction requirements, construction constraints and the potential for follow-up monitoring requirements. The assessment of impacts is based on the structural designs and related works described in detail in **Section 5**, which have been refined by LINK427 through the detail design process.

This section also describes and documents how the commitments outlined in the Individual EA (2010), the associated MOECC Notice of Approval (November 2010), and TESR (2016) have been addressed with respect to the works proposed within DCR #3.

Construction works associated with this DCR #3 will not commence until the applicable permits, approvals and authorizations for those works are in place.

A number of commitments for additional work or environmental impact mitigation measures related to this project have been identified and are summarized below.

The key to ensuring effective environmental quality control and risk management during the project is the development and proactive implementation of an approach that:

- Identifies the environmental sensitivities;
- Presents the environmental protection measures in a way that can be translated into requirements and for which compliance can be verified; and,
- Includes a monitoring program that verifies that the environmental protection measures are being implemented and are effective.

LINK427 is committed to ensuring that this approach is applied proactively, and consistently throughout the project. LINK427 has developed an Environmental Management System (EMS) and an Environmental Quality Management Plan (EQMP) to oversee implementation of this commitment throughout design and construction of the project.

6.1 Natural Environment

6.1.1 Terrestrial Ecosystems

6.1.1.1 Existing Conditions

Terrestrial field investigations were undertaken for the Individual EA (2010), TESR (2016), and in 2017 by LINK427 in accordance with the MTO Environmental Reference for Highway Design (2013). Background information was reviewed to determine the locations where detailed mitigation / restoration plans are required, including compliance with the Individual EA commitments, were summarized to document the activities performed by MTO since the approval of the EA studies, and identified the scope and responsibilities for future work to be performed by LINK427. Vegetation communities were classified based on the *Ecological Land Classification* (ELC) *System for Ontario* and are shown in **Figure 6** and **Figure 7.**

Background information documented in the Individual EA (2010) and TESR (2016) identified the predominant natural environmental features as those areas associated with the West Robinson Creek and Rainbow Creek watercourses and their respective valley systems.

The Highway 427 structure over Langstaff Road, Highway 427 structure over CPR / McGillivray Road and Highway 427 structures over Major Mackenzie Drive are located outside of these valley systems and within disturbed lands / agricultural fields with no defining terrestrial features or sensitivities.

Vegetation communities in the Lands within the scope of DCR #3 works are common vegetation communities that are well-represented on the landscape. Vascular plant species in these communities are represented by a high proportion

of non-native species, which is likely due to the high level of disturbance in the surrounding area as a result of changes from agricultural and urban development.

Existing terrestrial conditions at each of the four main valley crossings and the potential presence of SAR and rare flora within the Lands are described below.

Highway 427 Structures over Rainbow Creek

The vegetation community at the Highway 427 Rainbow Creek crossing is described as a young to mid-aged wooded stream corridor with scattered mature trees along the stream. It is classified as a Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3) with surrounding areas of Mineral Cultural Thicket (CUT1) and Dry-Moist Old Field Meadow (CUM1-1). A high proportion of invasive species have been recorded in this forested valley system, notably Hybrid Willow (*Salix sp*.), Manitoba Maple (*Acer negundo*), Common Buckthorn (*Rhamnus*) and Dog-strangling Vine (*Vincetoxicum rossicum*).

Highway 427 Structures over West Robinson Creek

The vegetation community at the Highway 427 West Robinson Creek Crossing is classified as a Cultural Meadow (CUM1) with Cultural Woodland (CUW1) elements within the floodplain of West Robinson Creek. At the time of the Individual EA (2010), portions of the crossing area were active pastureland. However, it is currently dominated by common, tolerant old field species, typical of lands with historical agricultural use. Very large mature Bur Oak (*Quercus macrocarpa*) trees are present in this area and have been recommended for protection during construction. Invasive species have not been identified as a concern at this location.

Langstaff Road Structure over Rainbow Creek

The vegetation community at the Langstaff Road structure over Rainbow Creek is classified as a Cultural Meadow (CUM1-1) with a Mineral Cultural Thicket (CUT1) inclusion adjacent to the riparian area bordering Rainbow Creek. These communities are very common and are comprised of common native and non-native species that are typical of disturbed areas. Invasive species have not been identified as a concern at this location.

Major Mackenzie Drive Structure over West Robinson Creek

The vegetation community at the Major Mackenzie Drive structure over West Robinson Creek is described as a lowland deciduous riparian forest with an inclusion of mineral meadow marsh along the creek. There is also a Cultural Meadow (CUM1) west of the creek. The riparian forest is classified as a Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3), dominated by non-native willow trees, Black Walnut and Basswood, with abundant Buckthorn in the understory and an inclusion of Reed Canary Grass in the riparian zone of the creek. Invasive species have not been identified as a concern at this location.

Species at Risk and Rare Flora

Previous correspondence with the MNRF indicated the potential for Butternut (*Juglans cinerea*) to occur within the Lands. Butternut is a SAR listed as Endangered under the ESA; however, no Butternut trees were observed during field investigations conducted as part of the Individual EA (2010), TESR (2016) or LINK427 in 2017. No other SAR plant species have been documented or observed within the Lands.

The Individual EA (2010) notes that a number of L-ranked (local ranking system developed by the TRCA) and regionally rare plant species have been documented within the Lands. LINK427 conducted targeted searches for L-ranked and regionally rare plants in September 2017. No L-ranked or regionally rare species were documented within the vicinity of the four main valley crossings, or Highway 427 structures over Langstaff Road, Highway 427 structure over CPR / McGillivray Road, and Highway 427 structure over Major Mackenzie Drive.

The Individual EA (2010) also recommended reviewing the locations of mature Bur Oak trees at West Robinson Creek in order to determine if they could be retained. LINK427 has surveyed these locations and the location of these trees. With these locations in mind, LINK427 has made every effort during the detail design process to revise the grading limits, resulting in the potential to retain three (3) of the four (4) trees identified.

6.1.1.2 Potential Impacts

Works included as part of DCR#3 include any remaining clearing and grubbing required at the four main creek crossings that have not already been completed as part of the works addressed in DCR #1 and DCR #2. The construction approach at each of the four main creek crossings has been further refined as part of detail design to minimize the potential vegetation removals wherever possible, as discussed in **Section 4**.

Although the design and approaches to construction have made every effort to minimize impacts on vegetation in the valleys, construction activities will still have the potential to result in the following effects to adjacent vegetation that is not being lost (as previously documented in the Individual EA [2010] and TESR [2016]) and updated herein:

- Release of construction-generated sediment to adjacent vegetation areas;
- Vegetation clearing / damage beyond the working area;
- Spills of contaminants, fuels and other materials that may reach natural areas;
- Changes in drainage patterns (groundwater and/or surface runoff) that can affect dependent vegetation / wetland areas located either upgradient or downgradient of the ROW. Blocking of existing surface / subsurface drainage patterns can result in vegetation dieback or condition changes through impoundment within or diversion of water away from a wetland. An increase or focused concentration of runoff can also result in erosion and associated sedimentation impacts on receiving vegetation.
- Spread of invasive plant species through improper disposal of grubbed materials, stockpiled topsoil containing invasive plant seed and root materials and/or improperly cleaned equipment moving around the Lands.
- Die-off of remaining vegetation under the new structures due to a lack of sunlight and precipitation due to the size of the structures.

6.1.1.3 Mitigation Measures

In order to prevent unintended impacts to adjacent vegetation, all vegetation not requiring removal will be protected with fencing prior to the initiation of the clearing works that were documented in DCR #1 and will remain fenced throughout construction, including during construction of the works identified in this DCR #3. These protected vegetation areas were identified in the preliminary design as locations outside of the anticipated construction impact areas and they have been respected through the detail design. Fencing and other mitigation measures designed to protect and limit the impacts to vegetation are outlined below.

Mitigation measures from the Individual EA (2010) and TESR (2016) have been carried forward and integrated herein as applicable to the construction works and potential impacts identified in DCR #3. The following measures will be implemented during construction works associated with DCR #3.

General Vegetation Protection Mitigation Measures

- Clearing, grubbing and follow-up construction activities will be carefully planned prior to the start of construction in order to foresee and mitigate any environmental issues before they occur.
- Vegetation removal (i.e., clearing and grubbing) completed as part of DCR #3 will be restricted to within the Lands, as identified in the design drawings.
- LINK427 has carefully reviewed construction impacts and made extensive efforts to minimize vegetation removals, including altering construction approaches to avoid entering valleys where possible, and to minimize impact where equipment is required to enter sensitive areas.
- Grading limits have also been refined to retain as much vegetation as possible, including a number of mature trees at West Robinson Creek.
- LINK 427 will protect and retain existing vegetation and trees, within identified protected vegetation areas.

- Prior to heavy machinery working adjacent to identified natural areas and vegetation communities, tree protection barriers shall be installed outside the drip-line of the significant features to protect any vegetation that is to be retained and is in the vicinity of exposure to damage by machinery or other sources. This includes, but is not limited to, where vegetation removals will occur within forested communities. LINK427 shall ensure that all protection fencing conforms to the OPSS for the Protection of Trees (OPSS 801.07.02) and that the fencing is installed outside of the drip-line of the identified vegetation communities or natural heritage features. The boundaries of the Lands and protected vegetation will be clearly delineated on construction specifications and will be fenced prior to the start of works associated with DCR #1. The fencing will be retained in place throughout the duration of works associated with DCR #3.
- Erosion and sediment control (ESC) measures will be installed according to the ESC Plan and as located on the design drawings, and will be maintained throughout construction.
- LINK427 will ensure the use of appropriate vegetation clearing techniques (e.g. trees to be felled away from the retained natural areas).
- Tree grubbing will be restricted to the required activity zone. Where possible, tree stumps will be cut flush to the ground and grubbing will be avoided to minimize soil disturbance, particularly in erosion prone areas.
- In the event that adjacent vegetation communities or planted trees are accidently damaged during construction activities, LINK427 will implement appropriate contingency measures such as pruning tree limbs or roots that are accidently damaged using proper arboricultural techniques. Removals shall only occur within 'simple habitat'[9] during the breeding bird season.
- Tree/shrub debris will be stored outside identified protected vegetation.
- Any trees/shrubs that are felled will be removed or mulched as soon as possible. During the breeding bird season (April 15th to August 15th) if trees or shrubs need to be removed, a clearance by a qualified biologist will be undertaken prior to any removals.
- Vegetation removals (including non-woody vegetation) shall take place outside of the appropriate timing windows for breeding birds and bats (see **Section 6.1.2** for further details).
- Exposed surfaces shall be stabilized and seeded with a temporary seed mix in areas where woody vegetation planting is not to occur within 45 days from completion of the works. Other exposed surfaces will be seeded as per the Landscape Plan discussed in a future DCR.
- Temporary stockpiles will be seeded with a temporary seed mix consisting of Oats (*Avena sativa*) in spring/summer and winter wheat (*Triticum aestivum*) in fall as recommended by MNRF to quickly stabilize these areas.
- Areas within the Lands with a high proportion of invasive species (i.e., Buckthorn and Common Reed) will be delineated in the field by LINK427 Plant Ecologist/Botanist(s) prior to the start of clearing activities (DCR #1). Grubbing and topsoil stripping from these identified areas will require separate disposal in accordance with the Invasive Species Management Program (ISMP) to avoid the spread of these species within the Lands.

[9] Simple habitats include:
-Urban parks, consisting mostly of lawns with a few isolated trees;
-Vacant lots with few possible nest sites;
-Previously cleared areas where there is a lag between clearing and construction activities (and where ground nesters may have been attracted to nest in cleared areas or in stockpiles of soil, for instance); or
-A structure such as a bridge, a beacon, a tower or a building (often chosen as a nesting sot by robins, swallows, phoebes, Common Nighthawks, gulls and others) (CWS 2014)

- LINK427 will restrict earth movement immediately adjacent to woodlands during periods of high dust generation. Non-chloride dust suppressants will be applied during dry periods to those areas which generate large amounts of dust.
- Construction vehicle access will be limited to the existing roadways and construction paths, away from the protected vegetation.
- Vehicle re-fueling stations will be located within a centralized location on-site away from the protected vegetation.
- For areas immediately adjacent to the protected vegetation, supervision of the construction will occur.
- LINK427 shall undertake environmental inspection during construction to ensure that protection measures are implemented, maintained and repaired and remedial measures are initiated where warranted.
- There shall be no storage of materials within adjacent natural areas.
- LINK427 will ensure appropriate clearing and disposal of all construction-related debris following construction.
- A Vegetation Restoration Plan (VRP) has been developed in consultation with the MNRF and the TRCA. Once completed, the VRP will be used as the guiding document for future vegetation restoration activities. A final copy of the VRP will be provided to the MOECC. The VRP will be integrated with the erosion control plan, the invasive species management plan and requirements of the ESA permit for SAR Bats. The VRP and Landscape Plan, which is to be implemented as part a future DCR, include the following elements:
    - Planting at stormwater ponds will be designed to stabilize inlet and outflow areas and provide shading and bank stabilization. Additional planting around each pond will contribute to vegetative cover.
    - Native species will be utilized where possible, particularly adjacent to sensitive areas and valleys.
    - Vegetation enhancement will be performed in areas where it is likely to be successful and will contribute ecological benefit.
    - Areas of meadow marsh habitat will be created and integrated with the stormwater management system.
    - Site-specific mitigation will be performed at key locations such as woodlands and valleys, to enhance existing vegetation and habitat.
    - Other locations along the highway such as interchanges and embankments will be vegetated with a combination of aesthetic and naturalized plantings.

Per the MOECC Notice of Approval for the Individual EA (2010), the proponent shall make reasonable efforts during the detail design phase of the undertaking to minimize the removal of existing vegetation features, such as woodlands, and shall consider using any lands surplus to the highway and transitway construction for vegetative restoration. The following measures address this commitment:

- LINK427 has carefully reviewed construction impacts and made extensive efforts to minimize vegetation removals, including altering construction approaches to avoid entering valleys where possible, and to minimize impacts where equipment is required to enter sensitive areas.
- Vegetation within valleys and in sensitive areas will be fenced outside the construction impact zones. Existing trees that can be retained will be protected during construction.
- Exposed surfaces will be stabilized and revegetated as quickly as possible (maximum 45 days from completion of the works).
- Clearing will be minimized and grubbing will be restricted to areas where it cannot be avoided. Trees will be felled away from natural areas.

- Significant trees have been identified for protection as described in the EA.
- Forest restoration and edge management will be implemented adjacent to wooded areas.
- Hedgerows will be protected where possible.
- Temporary seed mixes such as oats and winter wheat will be used to stabilize those areas that have been graded and must remain open over the late fall/winter months. Once final grading is completed seeding and planting will be installed in accordance with the appropriate section of the VRP.
- Site-specific mitigation will be performed at key locations such as woodlands and valleys, to enhance existing vegetation and habitat. These measures are documented in a future DCR.

Site-specific Mitigation Measures

Site-specific mitigation measures are recommended for the protection and enhancement of vegetation at the four main creek crossings as outlined below. Restoration and planting plans at each crossing will be documented in detail in the VRP, and will be addressed in detail a future DCR.

Highway 427 Structures over Rainbow Creek

- LINK427 will retain the vegetation that is not directly impacted by construction of the new structure.
- LINK427 will replace and enhance riparian vegetation removed or disturbed by the bridge construction by planting clusters of native tree and shrub species, as well as native grasses and herbaceous species, to provide overhead cover to the ROW reach. In order to restore and enhance this valley, the area disturbed during construction will be restored to resemble the existing species assemblage of the community (Deciduous Forest) while also improving its ecological function and integrity by planting native and non-invasive species.
- Edge management treatments will be implemented along the edges of the retained forest community.
- Invasive species management measures will be implemented according to the ISMP, to be provided in the VRP.
- The deciduous forest at the Rainbow Creek crossing is identified as SAR Bat Habitat and specific mitigation requirements will be applied to this restoration area under the ESA Overall Benefit Permit. This includes limitation of vegetation removal, woodland restoration and edge management.

Highway 427 Structures over West Robinson Creek

- LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure.
- LINK 427 will replace and enhance riparian vegetation removed by the bridge construction by planting clusters of native tree and shrub species along the banks within the ROW. Riparian vegetation will be planted on the outer channel banks where possible to help stabilize the eroding banks. Floodplain planting will include woody vegetation.
- Banks will be stabilized where required using bioengineering techniques within the ROW.
- Impacts to the existing pond will be minimized.
- A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. Specifically, this area will be restored to a Dry-Fresh Graminoid Meadow, which is expected to provide foraging habitat for Barn Swallows. This shall include restoration of vegetation in areas disturbed during construction with native plant species in order to replace and enhance the existing vegetation cover within valley.
- Mature Bur Oak trees have been flagged by LINK427 and those that can be retained (i.e. 3 of the 4 trees) have been fenced with tree protection fencing.

Langstaff Road Structure over Rainbow Creek

- LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure.
- LINK427 will replace and enhance riparian vegetation removed on the valley slope by the culvert construction by planting clusters of native tree and shrub species along slopes and within the ROW.
- A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. The area disturbed during construction will be restored through riparian plantings of native and non-invasive species.

Major Mackenzie Drive Structure over West Robinson Creek

- LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure.
- LINK 427 will replace and enhance riparian vegetation removed by the bridge construction by planting clusters of native tree and shrub species along the banks within the ROW, and in other areas to improve vegetation cover.
- To restore and enhance this valley, the area disturbed during construction will be restored using Edge Management treatments adjacent to the existing vegetation.
- Native and non-invasive species will be used for planting.
- A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. This valley will be restored as Deciduous Forest (FOD) with native species and re-seeded with native seed varieties.

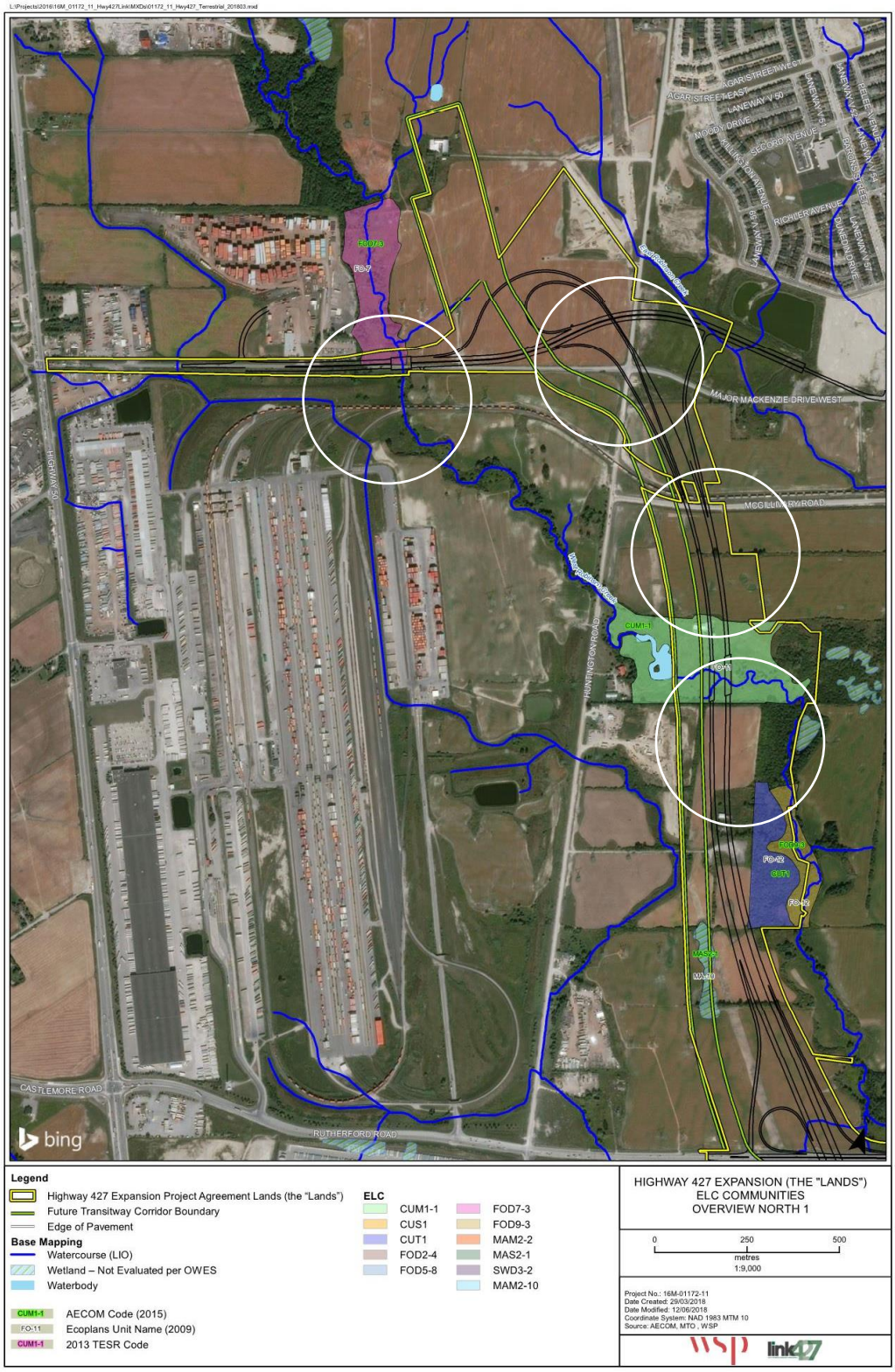


Figure 6: Vegetation Communities within the Lands

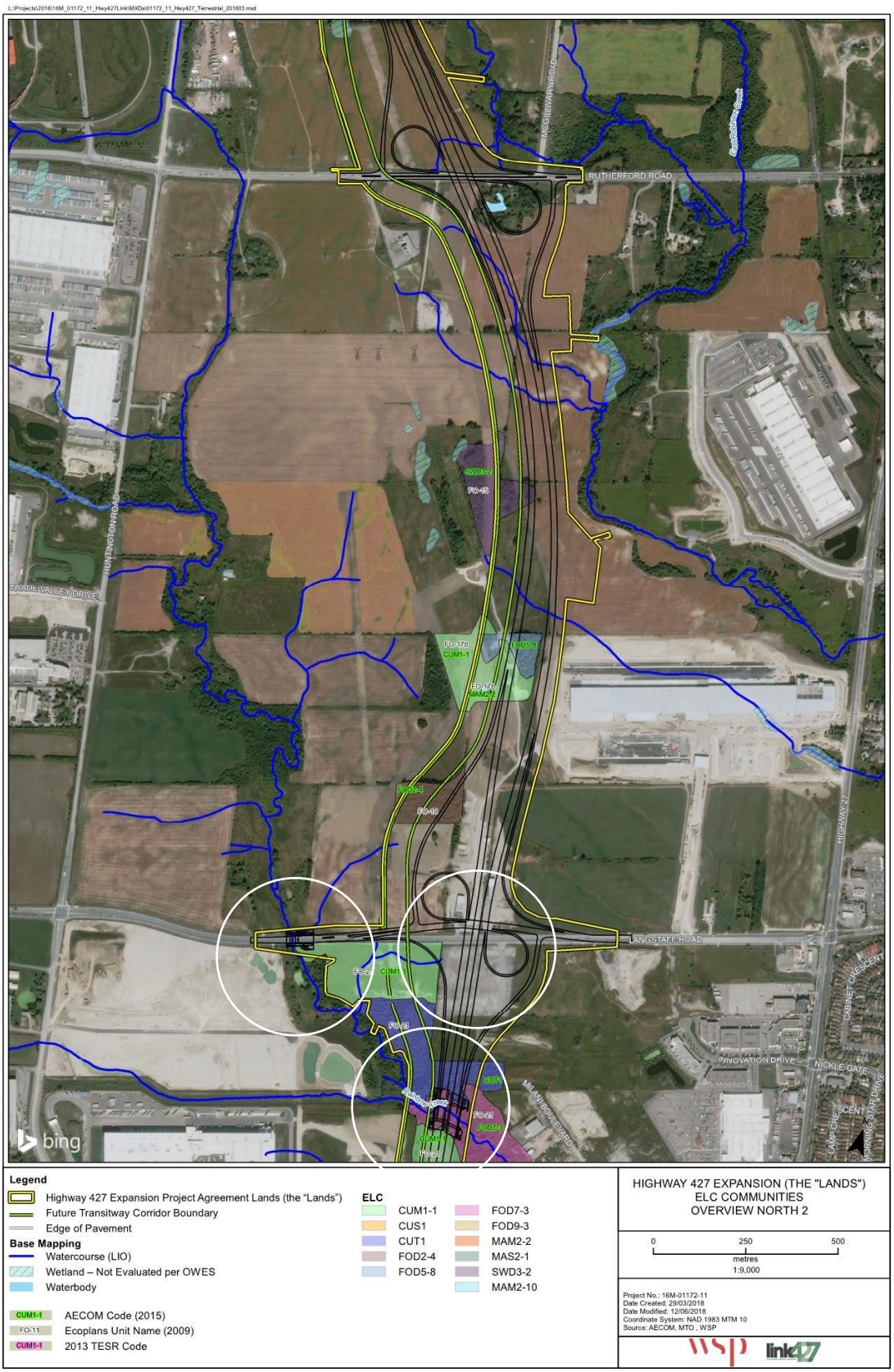


Figure 7: Vegetation Communities within the Lands

6.1.2 Wildlife, Wildlife Habitat and Species at Risk

6.1.2.1 General Wildlife and Wildlife Habitat

6.1.2.1.1 Existing Conditions

As per the Individual EA (2010), no significant wildlife habitat[10] was identified by MNRF within the Lands. In general, the wildlife recorded within the Lands are common, generalist species tolerant of urban or semi-urban conditions. The 2016 TESR confirmed this finding through the statement that: "it has been confirmed that no significant wildlife habitat exists within the Lands and the removal of non-specialized and non-significant marginal habitat can be mitigated as to avoid adverse effect on the non-specialized wildlife observed within the Lands" (p.33). As noted in the Individual EA (2010), the two valley systems within the Lands (i.e. Rainbow Creek and West Robinson Creek) provide "some opportunities for wildlife usage and movement however, these systems are limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements. They would not generally fall into the category of significant 'animal movement corridor', but would function more on a local linkage scale" (p.5-19).

Additional field investigations for wildlife conditions were undertaken in 2015 and 2016 and included targeted SAR Surveys for SAR bats and Barn Swallow. Amphibian Surveys were completed in 2016. No calling amphibians (i.e. Western Chorus Frog) were recorded. Breeding bird surveys were completed according to the Ontario Breeding Bird Atlas Field Program.

The observed species assemblage was consistent with the cultural habitat mosaic, proximity to development and moderate to high levels of disturbance within the Lands.

6.1.2.1.2 Potential Impacts

The wildlife and wildlife habitat community types are common on the landscape, generally, and impacts are considered minor and can be mitigated. Much of the loss of habitat has been addressed in DCR #1 through the loss of vegetation communities that will be cleared. Nevertheless, there remains potential for the following impacts to wildlife and wildlife habitat resulting from the works associated with DCR #3.

The following are potential impacts to wildlife and wildlife habitat:

- Localized impacts due to removal of and edge encroachment into common vegetation / habitat.
- Localized potential impact to migratory birds and their nests.
- Potential incidental encounters with wildlife during construction.
- Localized changes to wildlife movement opportunities.

6.1.2.1.3 Mitigation Measures

The mitigation measures outlined earlier to minimize the potential adverse effects to vegetation and to protect adjacent vegetation areas will in turn protect the associated wildlife habitat functions. However, it is also necessary to ensure the protection of breeding birds, as well as wildlife generally that may nest or otherwise use areas where construction is proposed, as outlined below.

Migratory Birds

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), the wounding or killing of birds, of species protected under the MBCA, 1994 and / or Regulations under that Act.

Mitigation measures to address potential impacts to Migratory Birds include:

[10]Significant Wildlife Habitat (SWH) is identified by the MNRF in the Significant Wildlife Habitat Technical Guide (MNR, 2000) as the following broad categories: 1) seasonal concentration areas (e.g., conifer forests for deer wintering); 2) rare vegetation communities or specialized habitats for wildlife; 3) habitats of species of conservation concern, excluding the habitats of endangered and threatened species; or 4) animal movement corridors.

- Vegetation clearing, grubbing and other construction activities which may be disruptive to migratory birds will comply with the MBCA, 1994 and Migratory Bird Regulations (MBR 2012). Timing restrictions will be complied with during construction activities, particularly vegetation clearing. Specifically, clearing of vegetation will occur outside of the breeding bird season (April 15th to August 15th).
- Where vegetation clearing and grubbing cannot be conducted outside of the breeding bird season (April 15th to August 15th), a qualified Avian Biologist will be retained and shall conduct a nest survey, according to MBCA guidance (i.e., within 'simple habitats' only).
- Clearing shall only be undertaken if no active nests or active breeding pairs are identified within the clearing area by the qualified Avian Biologist.
- The two culverts (Langstaff Road and Major Mackenzie Drive) that are proposed for removal will be inspected for nesting activity prior to removal. If there is any evidence of or potential for their use for nesting of migratory birds, their removal shall be scheduled outside of the migratory bird nesting period.
- If the structures cannot be removed outside the identified nesting season, bird nesting preventative measures (such as wire screens or tarps) shall be implemented to prevent new nesting prior to April 1 and maintained until August 30 of the calendar year in which they were installed. At a minimum, the preventative measures shall be installed at structures where evidence of past nesting was observed. These measures shall be periodically checked, and maintained as required so as not to entrap birds, and shall be removed following construction.

General Wildlife Protection

The landscape mosaic within the Lands provides habitat for tolerant, urban-adapted and open-country species (e.g. open-country / generalist birds and mammals, amphibians and reptiles).

Mitigation measures to address potential impacts to general wildlife include:

- All construction workers will be trained in advance of starting work regarding potential to encounter wildlife while undertaking their activities, and the appropriate response if an encounter occurs.
- Any wildlife incidentally encountered during construction will not be knowingly harmed.
- Under no circumstances will any animal (e.g., bird, reptiles, mammals etc.) be knowingly harmed, harassed or otherwise disturbed. If an animal is encountered, it will be allowed to move away on its own.
- If small wildlife (e.g. turtles, amphibians) are stranded within the construction zone, the MTO will be contacted and the animals will be captured and released by a qualified individual (e.g., LINK427 SAR Biologist).
- In the event that small wildlife encountered does not move away from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities will stop and the MTO will be notified immediately.

Wildlife Movement Opportunities

Wildlife movement was a specific consideration in the structure design at the main valley crossings. Specifically, design criteria for the four main valley crossings included:

- Maintenance of a minimum height of 3 m and a minimum OR of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). OR is the cross-sectional area of a structure (square metres) divided by the distance wildlife must travel through (or under). It is a measure of the tunnel effect of a structure that may influence use by various wildlife species. The ultimate design heights and ORs based on the four General Arrangements (**Appendix E.1**) meet or exceed these minimum criteria (all four structures meet the 3-m minimum height and provide ORs > 3 for the ultimate 10-lane scenario).

- Specific design aspects have been integrated into the detail design of the structures to enhance their function as eco-passages and make them more 'wildlife-friendly' including:
    - Selecting suitable substrate materials conducive to animal movement and footing of ungulates.
    - Selecting cover elements (e.g., woody cover / masses, brush piles, boulders, vegetation) to provide a natural transition with habitat features on either side of the structures and provide cover under the structure.
    - Restoring adjacent vegetation areas disturbed for construction access using native species, replacing and enhancing the existing vegetation cover along the valleys.
- A Wildlife Fence Plan has been developed for the project with the sole purpose of keeping wildlife off the highway ROW and funneling wildlife to the main valley crossings structures. The type of wildlife fence (e.g., height and size of openings) has been chosen based on the wildlife found in various areas along the length of the highway. The Wildlife Fence Plan will be incorporated into a future DCR.

6.1.2.2 Species at Risk

Since the completion of the Individual EA (2010), field investigations completed in 2015 and 2016, confirmed five (5) Species at Risk (SAR) within the Lands. The 2015 field investigations identified Barn Swallow and the spring 2016 field investigations confirmed the presence of four (4) SAR bat species (Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis and Tricoloured Bat).

ESA Overall Benefit Permit

The ESA prohibits the harm and harassment of protected species and damage or destruction of their habitat.

An Overall Benefit Permit is required to perform an activity that is not otherwise allowed under the ESA. The permit authorizes a person, company or organization to perform the activity, as long as an overall benefit to the species is provided in Ontario.

MTO obtained an Overall Benefit Permit for the project, including works to be completed at the Highway 427 structures over Rainbow Creek as part of DCR #3. LINK427 will comply with all of the conditions as outlined in the permit approval.

Barn Swallow

Barn Swallow was observed foraging over the Lands and nesting in two barn structures, as noted in the TESR (2016). The barn structures will be removed to accommodate the Highway 427 Expansion. Registration under the ESA (2007) was completed by MTO for the removal of breeding habitat for Barn Swallow (i.e., the two barns). The requirement is to "moth-ball" the Kellam Barn by boarding it up to help preserve it until later in the project. However, it is also possible that the barn's heritage features will be salvaged and the remnants removed. Whether the barn is boarded up or removed, this work will be done outside of the Barn Swallow active season (i.e., May 1 to August 31 of any given year) and LINK427 will provide alternative housing structures (i.e., nesting kiosks) prior to the next active Barn Swallow season (i.e., before May 1). Locations of the kiosks generally correspond to the four locations specified in the Barn Swallow Mitigation Plan. Locations have been adjusted slightly based on field conditions and recommendations by LINK427's wildlife and SAR specialists regarding the most suitable locations.

Mitigation measures to address potential impacts to Barn Swallow include:

- Moth-balling or removal of the two barn structures with confirmed Barn Swallow nesting habitat will occur outside of the Barn Swallow active season (i.e., May 1 to August 31).
- LINK427 will provide alternative housing structures (i.e., nesting kiosks) prior to the next Active Barn Swallow Season (i.e., May 1). LINK427 have installed alternative nesting structures prior to May 1, 2018.

LINK427 will implement all mitigation measures outlined in the Barn Swallow Mitigation and Restoration Record prepared in support of the Barn Swallow registration under the ESA, 2007, including 3 years of monitoring identified therein.

SAR Bats

As discussed above, an Overall Benefit permit under the ESA (2007) has been obtained for SAR bat habitat removal within the Lands, including for some of the works included in this DCR. Vegetation clearing activities that are proceeding under this DCR will remove identified SAR bat habitat at Rainbow Creek. Vegetation at Rainbow Creek can be cleared in accordance with the conditions of the permit.

Mitigation measures to address potential impacts to SAR Bats include:

- LINK427 will adhere to all of the conditions in the 17(2)(c) Permit issued by the MNRF for SAR Bats, including but not limited to:
    - Works within the Bat Species habitat shall be conducted between October 1 and March 31, of any year that the permit is in effect, unless otherwise directed by the MNRF
    - Overall Benefit Activities will be implemented according to the permit and habitat structures will be installed between October 1 and March 31 and will be in place prior to December 31, 2018. Overall benefit measures include habitat enhancement (i.e., restoration of woodland habitat), installation of habitat structures (i.e., bat boxes and BrandenBark™ structures) and all associated monitoring / reporting.
    - Design of the habitat enhancement / restoration of woodland habitat related to the permit obligations is still ongoing and will be included in a future DCR.

SAR Encounters

There is some limited potential for SAR encounters during construction. A SAR Awareness Training Manual has been prepared and is provided as an Appendix to the VRP and a protocol to follow in the event of an encounter is provided in that manual. Specifically, the following measures will be followed in the event of an encounter with a SAR:

- A SAR sighting is defined as an observation of a SAR where no action is required.
- A SAR occurrence is defined as an observation of a SAR where capture and relocation is required.
- In the event that SAR wildlife is encountered in the immediate work area, the protocol outlined below shall be followed:
    - Work in the immediate vicinity of the observation must come to a stop.
    - Should an Ecologist/Biologist not be on-site, one will be contacted immediately.
    - Ecologist/Biologist will notify the District MNRF Biologist within 48 hours of any observation of Endangered and Threatened species and/or immediately for any species going to a wildlife custodian.
    - It is not necessary to notify the District MNRF Biologist with observations of Special Concern species or general wildlife sightings (deer, raccoon etc.).
    - A 30-m setback from the area of the species location will be applied to allow the species to vacate the area naturally within a 24-hour period and then exclusionary fence is to be installed if appropriate.
    - Should a SAR be encountered during construction activities completed during the winter months (e.g. dislodged from hibernation), the species will immediately be placed in appropriate containers and stored in a dark, warm, quiet place and be transported to an appropriate wildlife sanctuary/rehabilitation facility as soon as possible. Onsite Ecologists/Biologist will advise of the transportation arrangements and consult with MNRF to notify them of the transportation.

- Work is to not commence again in the immediate area of the observation until further instructed by onsite Ecologist/Biologist.
- Any required SAR relocation must be conducted by a qualified Biologist or Ecologist.

6.1.3 Fish and Fish Habitat

6.1.3.1 Existing Conditions

Surface water features within the Lands originate as first order headwater drainages, which contribute ephemeral flow, sediments and nutrients to downstream habitat. Second-order drainages, including Rainbow Creek and West Robinson Creek, contain intermittent and permanent flow and provide spawning, rearing, feeding and migratory habitat for fish and generally support a wider variety of ecological features and functions. Rainbow Creek and West Robinson Creek are the two major watercourses within the Lands and are located within the Humber River watershed.

MNRF originally identified Rainbow Creek as 'contributing' Redside Dace habitat in 2015; however, in 2016 MNRF confirmed that detection surveys for Redside Dace in Rainbow Creek (including environmental DNA testing) have been unsuccessful. MNRF confirmed on April 22, 2016 that Redside Dace ESA habitat regulation for this species no longer applies to the Highway 427 Extension. There are no aquatic SAR within the Lands.

The existing conditions of each watercourse at the structure crossing locations (**Figure 8** and **Figure 9**) are presented below.

Highway 427 Structures over Rainbow Creek

The Rainbow Creek (Rain-3) channel is permanent and is considered to support a warmwater fish community with potential specialized fish habitat functions such as feeding, rearing, and spawning habitat for cyprinids and gamefish. Species noted to be present based on TRCA (2001) sampling data included Blacknosed Dace and Creek Chub. The reaches of Rainbow Creek within the vicinity of the crossing flow along a well-defined wooded valley, which is surrounded primarily by an agricultural landscape. The watercourse flows through an alluvial floodplain with well-defined, moderately unstable banks. The watercourse meanders naturally through flat (80%) and riffle (20%) habitat with a mixture of substrates from silt-sand to cobble / boulders. Aquatic vegetation is present to provide in-water cover. Nutrient loading and nearby roadway / commercial / industrial uses are point sources for pollution entering the creek. Overall, Rainbow Creek is described as having a low habitat sensitivity.

Highway 427 Structures over West Robinson Creek

The West Robinson Creek (Rob-5) channel is permanent and is considered to support a warmwater fish community with potential specialized fish habitat functions such as feeding, rearing, and spawning habitat for cyprinids and gamefish. Species noted to be present based on AECOM (2015) sampling data included Blacknosed Dace, Bluntnose Minnow, Central Stoneroller, Common Shiner, Creek Chub, Johnny Darter, Pumpkinseed, Largemouth Bass and White Sucker. Flowing southeast through a meadow and adjacent residential property, this reach of West Robinson Creek has been degraded as a result of anthropogenic activities. Nutrient and sediment loading from upstream agricultural activities and roadways have impacted West Robinson Creek's water quality. Upstream, the watercourse has been historically dredged and widened to create an online pond, significantly altering both the morphology and the flow regime of the system. The on-line pond outfall structure consists of collapsed concrete box culvert with a CSP culvert placed through it that is perched. Downstream of the on-line pond, the watercourse consists mostly of runs with minimal pools and riffles over substrates ranging from silty-clay to cobble. In-water cover is minimal with some woody debris, aquatic vegetation, abd undercut banks. Erosion and slumping is evident on both banks. Overall, West Robinson Creek is described as having a low habitat sensitivity.

Langstaff Road Structure over Rainbow Creek

The Rainbow Creek (Rain-5) channel is permanent and is considered to support a warmwater fish community with potential specialized fish habitat functions such as feeding, rearing, and spawning habitat for cyprinids and gamefish. Species noted to be present based on TRCA (2010) sampling data included Blacknosed Dace, Blackside Darter, Bluntnose Minnow, Common Shiner, Creek Chub, Fathead Minnow, Johnny Darter, Pumpkinseed, Rock bass and White Sucker. Upstream of the existing Langstaff Road culvert crossing, the channel flows through cultural meadow habitat.

Sections of the reach have been straightened in the past to accommodate agricultural practices and the existing Langstaff Road culvert crossing. The existing culvert is 18 m in length. Downstream of the existing Langstaff Road culvert crossing, the channel naturally meanders through meadow and mixed deciduous forest. There are notable signs of erosion along the banks in this reach. The watercourse has a variety of habitat features including riffle, runs, pools and flats with a substrates ranging from silt to boulders. In-water cover is abundant with aquatic vegetation, boulder and undercut banks. Overall, Rainbow Creek is described as having a low habitat sensitivity.

Major Mackenzie Drive over West Robinson Creek

The West Robinson Creek (Rob-6) channel is permanent and is considered to support a warmwater fish community with potential specialized fish habitat functions such as feeding, rearing, and spawning habitat for cyprinids and gamefish. Species noted to be present based on AECOM (2015) sampling data included Bluntnose Minnow, Common Shiner, Creek Chub, Johnny Darter, Largemouth Bass and White Sucker. West Robinson Creek has been somewhat degraded as a result of human activity. The naturally meandering system flows underneath Major Mackenzie Drive, and also under a CN Rail crossing further downstream. Upstream agriculture, high-traffic roadways and the downstream CN Rail corridor have each contributed to the moderate degradation of this watercourse. Upstream, the watercourse flows through a wooded area, while downstream the riparian zone transitions to meadow with sporadic small riparian trees. The Aquatic habitat consists entirely of run habitat with a silty-clay substrate. Direct fish habitat is provided with in-water cover provided by woody debris and aquatic vegetation. Some evidence of erosion is present throughout the system. Overall, West Robinson Creek is described as having a low habitat sensitivity.

6.1.3.2 Potential Impacts

As all four watercourse crossings support direct fish habitat, the proposed works have the potential to impact to fish and fish habitat if the appropriate mitigation measures are not implemented. The following are potential impacts associated with the construction of new structures and removals of the existing culverts without the implementation of mitigation.

Highway 427 Structures over Rainbow Creek (New Bridges)

- There are no direct impacts to instream habitat as a result of the construction of the new Highway 427 bridges over Rainbow Creek. The bridges fully span the bankfull width of the watercourses and are designed to maintain natural fluvial geomorphic processes.
- General potential indirect construction-related impacts (e.g. erosion and sediment influx or disturbance and downstream transfer, other water quality impacts) can be managed using appropriate mitigation and restoration measures.

Highway 427 Structures over West Robinson Creek (New Bridges)

- There will be nominal direct impacts to instream habitat as a result of the construction of the new Highway 427 bridges over West Robinson Creek due to the close proximity of the north pier to the channel. As such, based on a review of natural fluvial geomorphic processes, bank protection along the north pier in the form of a vegetative rock buttress will be installed. This measure will be sculpted into the bank to maintain the existing bank and channel profile.
- General potential indirect construction-related impacts (e.g. erosion and sediment influx or disturbance and downstream transfer, other water quality impacts) can be managed using appropriate mitigation and restoration measures.

Langstaff Road Structure over Rainbow Creek and Major Mackenzie Drive Structure over West Robinson Creek (Replacement of Existing Culverts)

- Although a longer length of channel will be covered by the new structures at the proposed Rainbow Creek and West Robinson Creek crossings, the much wider and higher replacement structures will enable re-creation of an open channel section that will accommodate natural fluvial geomorphic processes and will allow some sun and light

penetration at the inlet and outlet given the east-west orientation. Both structures will fully span the bankfull width of the watercourses.

- Localized direct impacts of the culvert removals and structure installation include temporary disturbance of the channel and localized removal of riparian vegetation required to remove the existing culverts, as well as temporary disturbance to re-create the open channel section.
- General potential construction-related impacts (e.g. erosion and sediment influx or disturbance and downstream transfer, other water quality impacts) can be managed using appropriate mitigation and restoration measures.

6.1.3.3 Mitigation Measures

The potential adverse effects are limited to nominal direct impacts associated with channel shading and potential indirect impacts, which can be addressed through standard mitigation measures. The proposed mitigation measures include:

- All instream or near stream works will be conducted during the appropriate in-water timing window. A warmwater construction timing window (in-water work is permitted from July 1 to March 31) will be applied to protect the resident warmwater fish communities present in watercourses further downstream.
- Sediment and erosion control measures will be implemented during all phases of construction, clean-up and restoration to prevent sediment laden runoff from entering any of the watercourses directly from the construction zone. At a minimum, the project ESCP will address the following aspects:
    - Perimeter silt fence will be installed between the work areas and all reaches of those watercourses where works are required, including ditch and drainage works that drain to watercourses that support fish habitat.
    - 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 stabilized.
    - All exposed and newly constructed 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 15 days) following completion of the works.
- All near-water construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty/reinforced fencing for all disturbed areas of the embankments that drain to the streams. Silt fencing will be regularly inspected and maintained as required.
- If required at the Langstaff Road and Major Mackenzie structures, only clean materials free of fine particulate matter will be placed in the water for temporary construction measures (e.g., temporary flow management dams will be constructed of 'pea gravel' bags, geotextile fabric or other clean material), or permanent works (e.g., culvert and channel substrates, cobble/boulder material).
- Temporary dewatering of the construction zones will be required for the culvert removals at Langstaff Road and Major Mackenzie Drive and for the new structure installation at Langstaff Road. All temporary dewatering will be done using appropriate energy dissipation and settling / filtration measures for discharge to ensure no erosion or sediment release occurs in the watercourses. No dewatering discharge will be released directly to the watercourses. If temporary dewatering of the near stream construction zone is required, dewatering will be discharged through a filter bag / splash pad located at least 30 m from the watercourses.
- All structure installations and channel restoration works will be completed 'in the dry'. For the Langstaff Road and Major Mackenzie structures, an appropriate temporary flow bypass system will be required to maintain existing watercourse flow around the construction zone to downstream fish habitat. To minimize the potential for impacts, works near watercourses will be conducted during low-flow periods.

- All dredged, salvaged or stockpiled materials will be located a safe distance from the watercourses edges, stabilized and a physical barrier placed between the stockpile and the watercourse to prevent the migration of any sediment or other material to the watercourse.
- All work areas or other disturbed surfaces draining to the watercourses and/or in the floodplain will either be temporarily or permanently stabilized and re-vegetated with appropriate native, non-invasive species a maximum of 15 days following construction.
- The erosion and sediment control measures will be left in place, monitored and maintained in proper working order until all disturbed areas draining to the watercourses are fully stabilized, including establishment of vegetative cover.
- No equipment shall cross or otherwise enter the watercourses except as outlined above (if necessary).
- All activity 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. Storage, maintenance or refueling or maintenance of equipment will be conducted at least 30 m away from the watercourses. LINK427 will implement the project Spills Prevention and Emergency Response Plan throughout construction.
- All on-site crew members operating construction vehicles will be appropriately trained in handling a potential spill and have WHMIS Training.
- Every effort will be made to retain as much of the natural vegetation as reasonably possible to help ensure bank stability and control erosion, and to expedite the recolonization of native plant species.
- All riparian vegetation removed to construct the highway works will be replaced with a mix of appropriate native species. Additional riparian plantings may be incorporated to enhance existing conditions along the ROW. Only native shrub and tree species, compatible with the site conditions will be used.
- A CISEC certified inspector will be on-site regularly throughout construction, responsible for ensuring the sediment and erosion control measures are functioning and all mitigation measures are being implemented.
- A Scientific Collectors Permit will be obtained in order to conduct a fish salvage prior to any works being conducted for the culvert removals and structure installation works at Langstaff Road and Major Mackenzie Drive using appropriate techniques to capture and transfer unharmed any stranded fish as specified in the permit.

Site-specific Mitigation Measures

Highway 427 Structures over Rainbow Creek

- Additional erosion protection along the crossing walls will be included in the design to protect against future channel meandering.

Highway 427 Structures over West Robinson Creek

- Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks.
- Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage.
- The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight.

Langstaff Road Structure over Rainbow Creek

- Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks.

- Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage.
- The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight.
- The upstream and downstream connection of the reinstated channel to the existing channel will transition smoothly to avoid development of scour and erosion.
- The channel reinstatements be properly designed to incorporate form and function of the existing fish habitats.

Major Mackenzie Drive Structure over West Robinson Creek

- Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks.
- Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage.
- The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight.
- The upstream and downstream connection of the reinstated channel to the existing channel will transition smoothly to avoid development of scour and erosion.
- The channel reinstatements be properly designed to incorporate form and function of the existing fish habitats.

6.1.3.4 Net Effects

There are no long-term residual effects to fish habitat associated with the installation of the new structures and removal of the existing structures because these culverts and realignments have been designed and will be constructed with adherence to the MTO Best Management Practices Manual for Fisheries (Version 2.2, 2016). A summary of net effects is provided below:

- Clear span structures avoid encroachment / infill into bankfull channel and maintain natural fluvial geomorphic processes.
- The structure designs accommodate the existing floodplains, and will pose no negative residual effects to fish and fish habitat.
- Permanent loss of vegetation is anticipated within the majority of the structure footprints at all four crossings; however, the channel reaches currently enclosed by the existing culverts at Langstaff Road over Rainbow Creek and Major Mackenzie Drive over West Robinson Creek will be restored.
- Properly designed and constructed structures will enhance natural fluvial geomorphic processes.

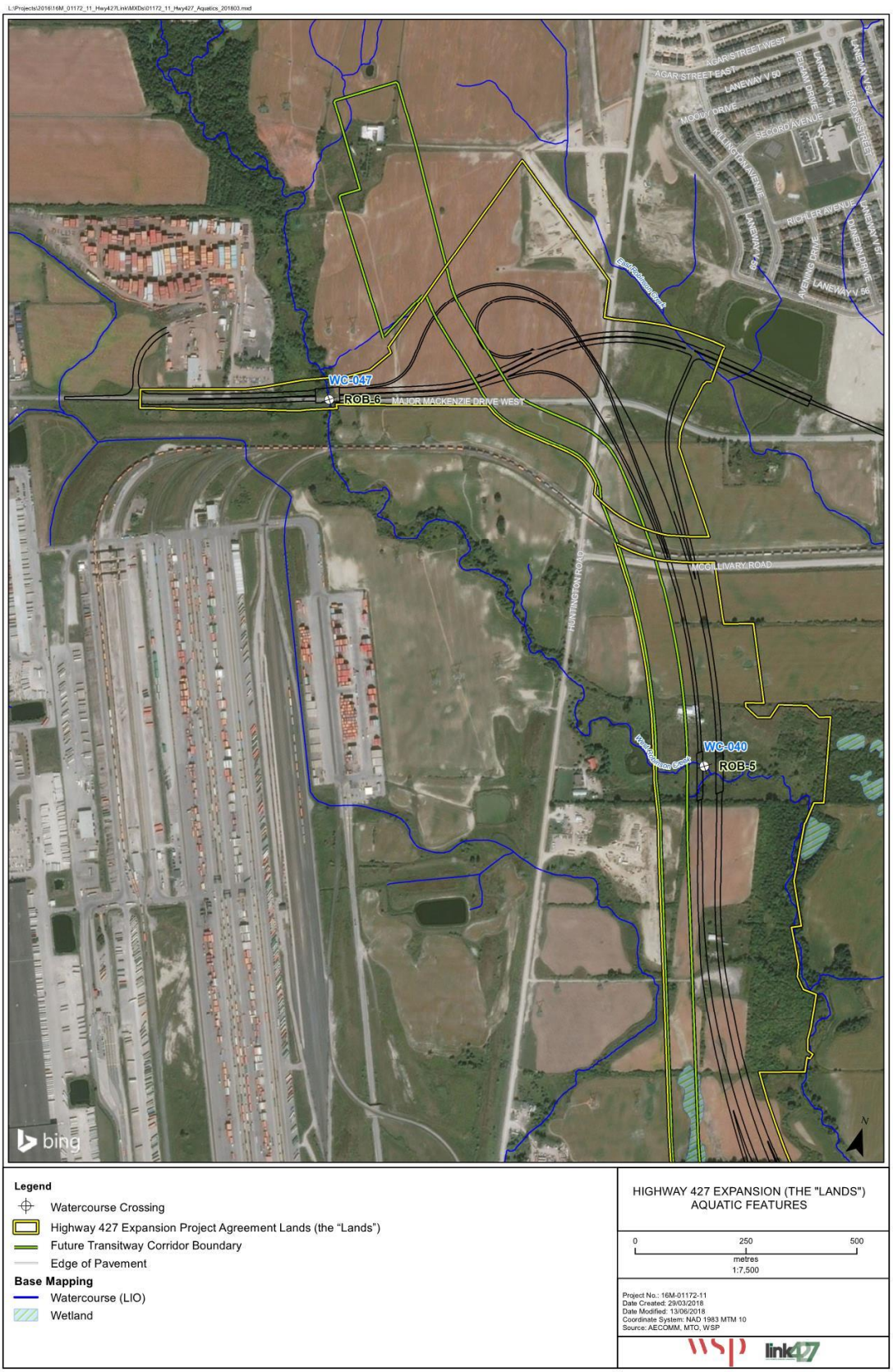


Figure 8: DCR #3 Highway 427 Expansion Watercourse Crossings near Major Mackenzie Drive

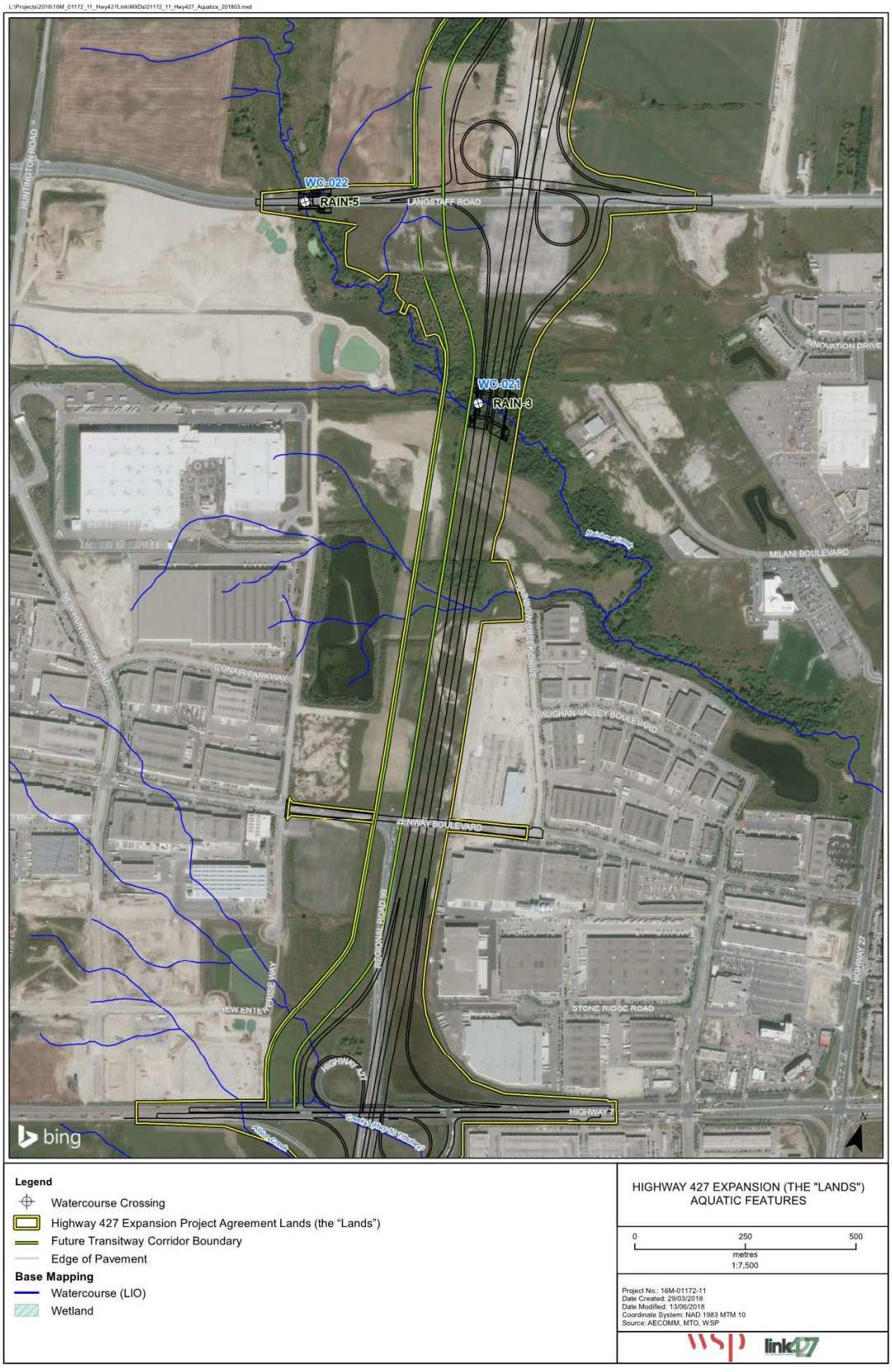


Figure 9: DCR #3 Highway 427 Expansion Watercourse Crossings near Langstaff Road

6.1.4 Groundwater and Hydrogeology

A number of previous studies have been carried out in order to fulfill groundwater and hydrogeological assessment requirements. These studies include:

- A Hydrogeological Assessment completed for the Individual EA (2010);
- A Groundwater Assessment Study Report for the TESR (2013); and,
- A summary of Existing Conditions, Potential Impacts, and Mitigation Measures for the TESR (2016).

Review of the previous studies, published documents and the soil characteristics identified during recently completed geotechnical investigations indicates that the Lands are principally located within the South Slope physiographic region in Southern Ontario. A small part of the Lands at the northwest between Rutherford Road and Major Mackenzie Drive are classified as lying within the Peel Plain physiographic region. The South Slope physiographic region is mapped from the Oak Ridges Moraine (ORM) to the north and slopes downwards towards Lake Ontario. It is typified by smooth, faintly drumlinized clay till plains. The Peel Plain physiographic region is associated with a former glacial lake (Lake Peel) and is characterized by thin glacio-lacustrine deposits principally comprised of clays and silts, overlying till deposits. The Peel Plain is mapped within the South Slope region (which is found to the north and south of the Peel Plain) and is characterized with a gradual and fairly uniform slope towards Lake Ontario.

The topography within the Highway 427 Expansion Lands is generally flat, gently sloping southward from the northwest to the southeast. According to topographic mapping (Brampton, 30M/12, 1994), ground surface elevations range from approximately 200 m above sea level (masl) at the northern end of the Lands to approximately 180 masl at the southern end of the Lands.

Based on the MOECC water well records and previous hydrogeological studies, the quaternary deposits in the vicinity of the Lands have been logged to depths ranging between about 15 mbgs (metres below ground surface) to greater than 47 mbgs (encountered at elevations between 164 and 185 masl). Lenses or discontinuous layers of silt, sand and gravel were logged in the well records within these clayey silt/silty clay deposits.

The Lands are located within the Humber River Watershed. Rainbow Creek and West Robinson Creek are two major tributaries to the Humber River. The regional groundwater flow direction within the Lands are to the southwest, south and southeast. On a local scale, the shallow groundwater flow will mimic the surface topography. The shallow groundwater levels are furthermore influenced by seasonal variation, and can be affected by the presence of underground utilities.

A groundwater monitoring program (consisting of the collection of water levels from existing monitoring wells, water samples from select locations for discharge quality, and an update of private water well survey) has been completed, in accordance with the Individual EA (2010) commitments to establish baseline conditions, to identify potential adverse impacts to groundwater, and to identify environmentally sensitive features or water sources (such as private water wells) related to DCR #3 construction activities. LINK427 staff completed a knock-on-the-door program and made reasonable efforts to contact the residents for the well survey on three events (once during normal work day time, once during the evening time and the third time on a weekend); however, so far none of the residents responded to the request with their contact information.

A dewatering assessment was completed by LINK427 in 2017 for the Highway 427 Expansion and includes seven (7) structures addressed in DCR #3 (**Table 7**). The results of the assessment indicate that the anticipated dewatering volume at each of the structure locations will be very minor (less than 50,000 litres per day (LPD)). The pumping discharge will be discharged as per the requirements of O. Reg. 63/16 and 64/16.

Table 7: Dewatering Assessment Summary

Site ID and Reference Drawing (DWG) Number	Station (STA) IDs	Anticipated Dewatering Volumes (LPD)
Highway 427 structures over Rainbow Creek (NBL & SBL) [DWG: 133, 134]	STA 11+600	Less than 50,000 LPD
Highway 427 structure at Langstaff Road [DWG: 136, 137]	STA 12+100	Less than 50,000 LPD
Highway 427 structures over West Robinson Creek (NBL & SBL) [DWG:142, 143]	STA 15+525	Less than 50,000 LPD
Highway 427 Overpass at CPR / McGillivray Road [DWG-145, 146, 147, 148]	STA 15+990	Dewatering not anticipated.
Highway 427 structure at Major Mackenzie Drive [DWG: 149, 150]	STA 16+550	Dewatering not anticipated.
Major Mackenzie Drive structure over West Robinson Creek [DWG: 151, 152]	STA 17+300	Less than 50,000 LPD
Langstaff Road structure over Rainbow Creek [DWG 35]	STA 9+507	Less than 50,000 LPD

6.1.4.1 Potential Impacts

An update of the 2010 hydrogeological assessment was completed in September 2016 by AECOM, and the key findings related to potential impacts are summarized below. The updates were reviewed by LINK427 to complete the dewatering assessment and updated based on recent hydrogeological information derived from a geotechnical site investigation by LINK427 (2017) and groundwater monitoring works by LINK427 (2017).

Groundwater Susceptibility and Potential Groundwater Impacts

The TESR (2016) indicated groundwater susceptibility to contamination as follows:

- There are coarse textured sand/silt layers present in the glacial till deposits, which serve as the primary aquifers for the private water well supply;
- The hydraulic connectivity between the overburden quaternary aquifer and the deeper bedrock aquifer systems is low due to the fine textured overburden soil. Therefore, the aquifer vulnerability within the Lands are considered low to moderate to the overburden aquifers and deeper bedrock aquifer; and
- The shallow overburden aquifer is considered to have higher vulnerability, especially in the areas where coarse textured soils are found at the ground surface, where the groundwater table is shallow, and/or the aquifer is in close vicinity of the surface water bodies and road infrastructure.

According to the Highly Vulnerable Aquifers (HVAs) mapping from the Assessment Report for the Toronto and the Region Source Protection Area (TRSPA, July 2015), limited areas of HVAs are present along Rainbow Creek, Robinson Creek and their tributaries in the proposed extension portion of Highway 427 north of Zenway Boulevard and Major Mackenzie Drive.

The potential impacts from the Highway 427 Expansion to the local groundwater system as identified in the TESR (2016) was reviewed. The impacts identified were re-evaluated and updated based on LINK427's review and assessment of dewatering requirements. The results of the assessment are summarized below:

- Changes to recharge / discharge regimes resulting from the disturbance of the ground surface, ground clearing, compaction, road cuttings, placement of fill, and the presence of the completed impervious layers of road surface;

- Potential dewatering impacts including a reduction in groundwater levels and reduction in flows to nearby private wells and groundwater-dependent water bodies are not anticipated since the assessment indicates that dewatering pumping to remove groundwater will be less than 50,000 LPD;
- Potential impacts associated with the application of commercial fertilizers during seeding activities to re-establish vegetative cover;
- Potential spills of hydrocarbons and other chemicals used during construction activities, which could impact the groundwater aquifer and groundwater-dependent water bodies specially in the areas of high aquifer vulnerabilities; and,
- The future use of salt for road de-icing in winter seasons has the potential to impact the groundwater and surface water resources in the immediate vicinity of the proposed road alignment. Careful thought should be given to use of salt alternative for deicing of the highway.

Due to the presence of low permeability overburden soil of considerable thickness, the potential impacts to the deeper aquifers within the Lands are generally considered to be low to moderate. Higher potential for groundwater impacts are present in the following areas:

- Along the creeks and their tributaries;
- Areas of Highly Vulnerable Aquifers (HVAs);
- Areas where groundwater dewatering is required and private water wells are located within the zone of influence.

Although dewatering pumping above 50,000 LPD at each site listed in **Table 7** is not anticipated, if the collective pumping at the sites totals more than 50,000 LPD on any given day, an Environmental Activity and Sector Registry (EASR) will be required for this phase of construction. A detailed Groundwater Dewatering summary table is provided in **Appendix F**.

Potential Water Supply Well Impacts

The TESR (2016), well survey (AECOM 2016) and the MOECC water well database search identified 22 private water supply wells for the extension portion from north of Zenway Boulevard to Major Mackenzie Drive (**Figure 10** and **Figure 11**). The majority of adjacent areas are used as agricultural farm lands. There are private wells within 500 m of the proposed Highway 427 extension alignment that are used by residents for their water supply in this area. With the exception of two (2) recorded wells, none of the water supply wells as shown in the MOECC database are located within 100 m of any the six (6) potential dewatering locations as part of DCR #3. One of the two wells that are within 100 m of a construction feature is abandoned (a dug well) and the other one is a deep well (Well ID: 6917556) used as a livestock well.

Five (5) of the seven (7) structures (as shown in **Table 7**) included in the DCR #3 works will require excavations for foundations. Dewatering at rates more than 50,000 LPD is not anticipated for construction work at any of these sites.

The Highway 427 structures over the Rainbow Creek (NBL and SBL) will be founded on H-piles with pile cap above groundwater level.

The foundation for the Highway 427 structure at Langstaff Road will be constructed in till which is not conducive to transmission of groundwater.

The Langstaff Road structure over Rainbow Creek is an open foot type founded on H-piles with underside of pile cap at 176.7 masl in till with groundwater in the area between 179.7 and 180.4 masl (February 2018). Till is not very conducive to transmission of groundwater. This location may require some form of pumping of groundwater accumulated from gravity drainage (of till) however is anticipated to be less than 50,000 LPD.

The piers for the Highway 427 structures over West Robinson Creek (NBL and SBL) will be founded on piles. The pile caps will be in till however the deepest pile cap (for the centre pier) will be slightly (approximately 0.7 m) below groundwater level (192.7 masl) as measured in adjacent monitoring well. This location may require some form of pumping of groundwater accumulated from gravity drainage (of till) however is anticipated to be less than 50,000 LPD.

The Major Mackenzie Drive structure over West Robinson Creek will be constructed on H-piles with pile cap constructed in shallow depths limited within till. The groundwater level (199 to 200 masl) is slightly higher than the foundation elevation of the underside (198.3 masl) of the deepest pile cap. This location may require some form of pumping of groundwater accumulated from gravity drainage (of till) however is anticipated to be less than 50,000 LPD.

Based on the dewatering analysis, the zones of influence (ZOI) from sump pumping is not estimated to extend further then 100 m from the dewatering pumping locations. This form of limited low-volume dewatering is not anticipated to impact water wells in the vicinity, since the private wells as the locations of the wells based on MOECC water well database are not located within the ZOI of any potential dewatering pumping locations. However as best management practice approach, a private water well monitoring program is recommended for the total length of the of the proposed construction works. A well survey program was initiated in March 2018 to identify the wells and their location in the field; however, residents did not respond to the request for the well survey. Any wells to be removed during the highway improvement activities will have to be decommissioned properly as per the Ontario Wells Regulation (R.R.O. 1990, Reg. 903).

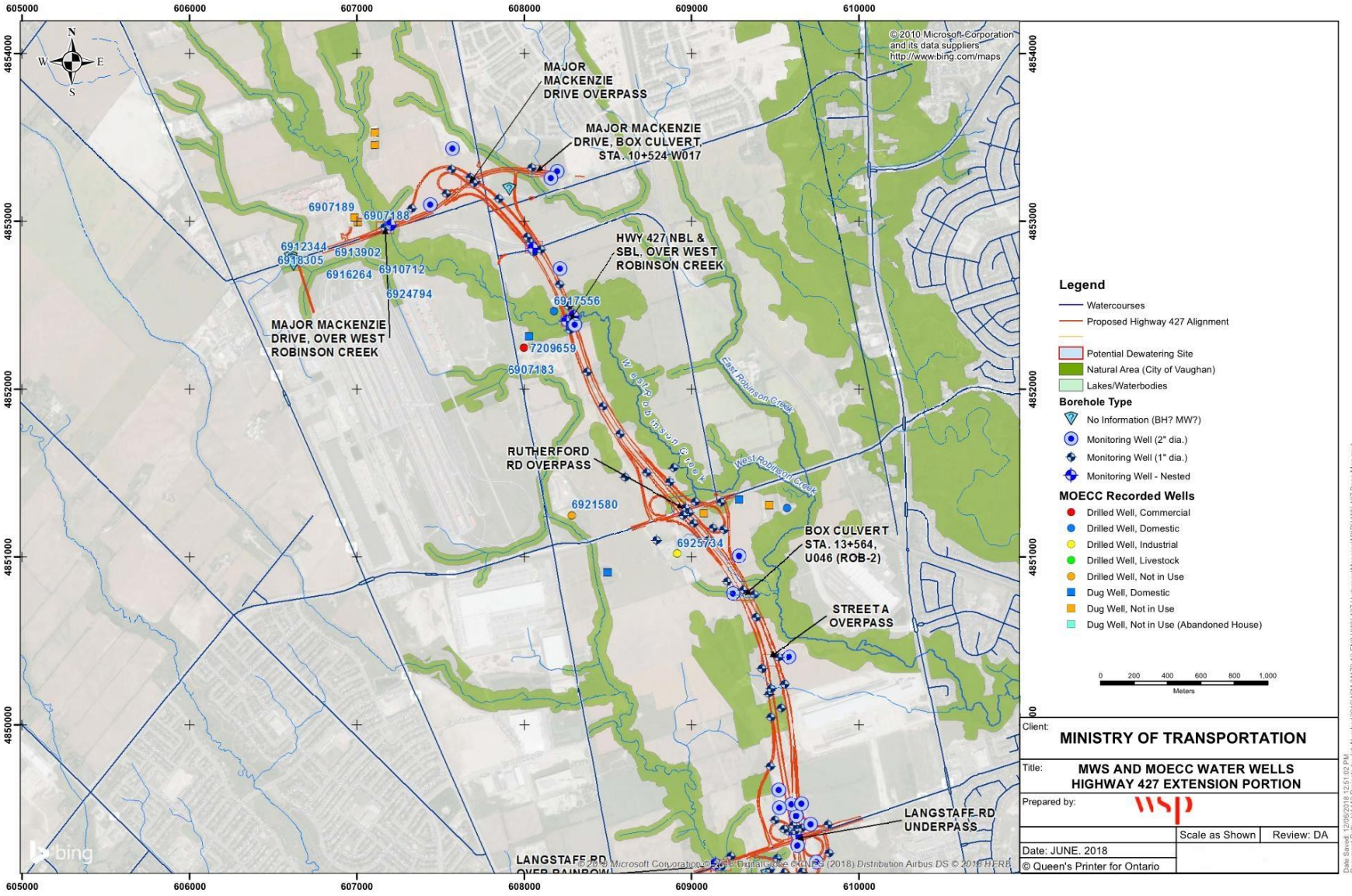


Figure 10: Existing Water Supply Well near Major Mackenzie Drive

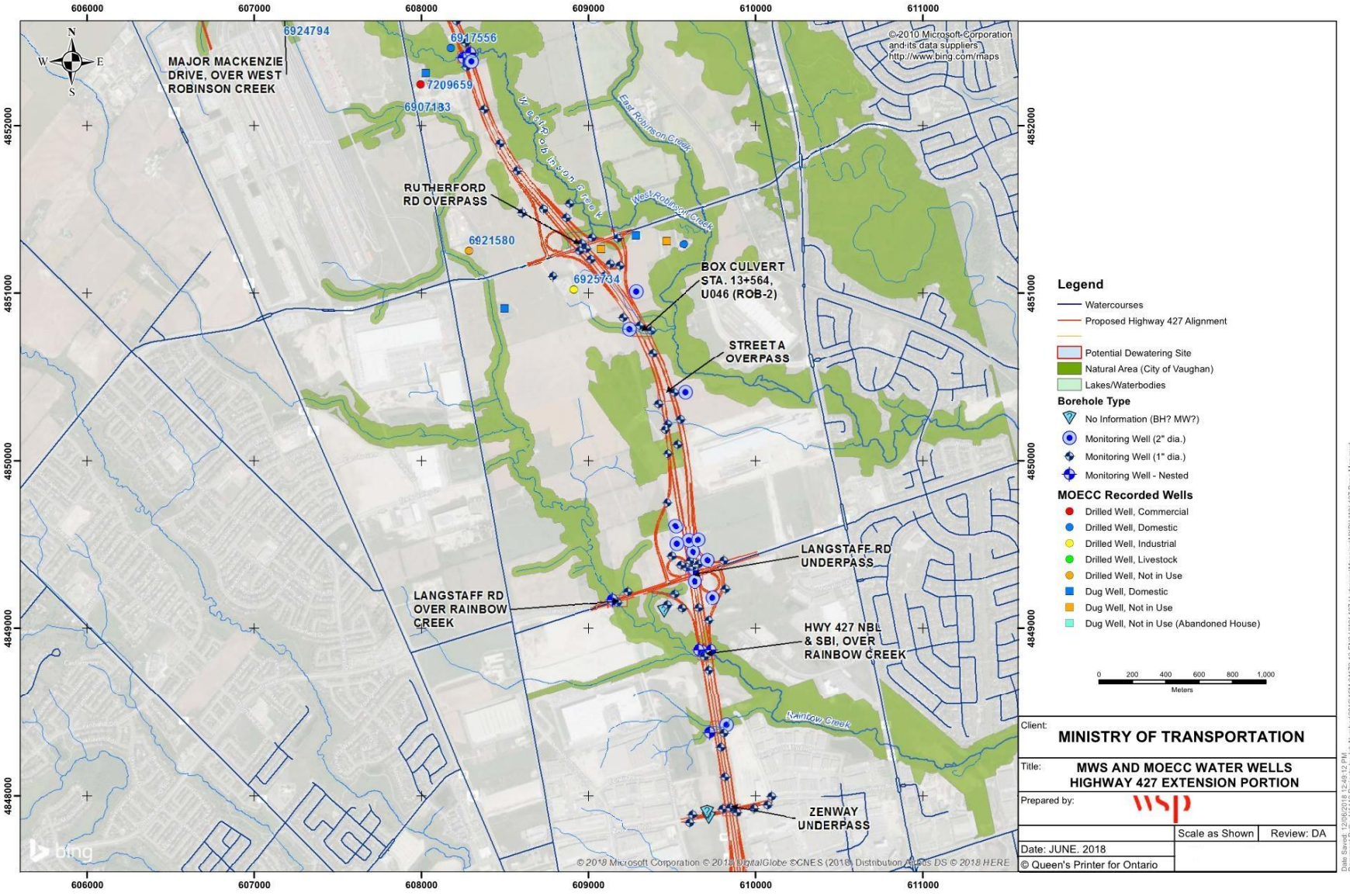


Figure 11: Existing Water Supply Well near Langstaff Road

The LINK427 groundwater monitoring program and hydrogeological assessment has been completed as per the EA (2016) commitments. Potential adverse impacts are not likely since dewatering at rates more than 50,000 LPD is not anticipated as part of DCR #3 works.

6.1.4.2 Mitigation Measures

Mitigation measures to address dewatering impacts are likely not required as the potential groundwater pumping for dewatering at the sites are anticipated to be less than 50,000 Litres per day. However, LINK427 recognizes that there is potential for impacts not related to groundwater pumping but due to construction related activities and **Section 6.0** of the Transportation Environmental Study Report (TESR), dated January 2016 describes in detail the potential impacts including from construction and the proposed mitigation measures that are to be followed when impacts are identified. The discharge shall be treated for particulates so that at the outlet location the concentration of total suspended solids (TSS) not to exceed 25 mg/L for protection of natural environment. If pumping is required to remove minor groundwater and surface water accumulated from storm events from the excavated areas, then best management practices for mitigation are to be followed:

- Dewatering activities shall be conducted in accordance with control procedures as specified in OPSS 517 Control of Water from Dewatering Operations. Appropriate dewatering measures shall be implemented to manage any groundwater encountered during grading activities, and dewatering discharge water will be filtered as necessary to prevent transport of sediment to natural surface water receptors;
- A Spill Prevention and Control Management Plan shall be prepared;
- Surface runoff will be directed to roadside ditches and ditch conditions shall be improved to minimize groundwater recharge impacts;
- Groundwater monitoring wells (screened in the shallow overburden) will be installed, if not already present, near the groundwater dewatering locations to closely monitor groundwater quantity and quality during the dewatering activities;
- The environmental quality of pumped water discharged to the natural environment must meet the requirements provided in O. Reg. 387/04 and O. Reg. 63/16; and
- Salt usage and runoff will be minimized during road de-icing applications by following best practices consistent with those used across North America and employ the latest winter maintenance technologies (alternative to and environmentally friendlier than using road salt).

The following preliminary design commitments shall be implemented by LINK427:

- Monitoring of private wells will be completed prior to construction to establish background conditions, subject to obtaining permission to access the property and the well(s) by the land owner. Monitoring of private wells located outside of the ZOI of the potential dewatering areas for the Highway 427 extension between Zenway Boulevard and Major Mackenzie Drive are not required. Deep wells located within the ZOI will not need monitoring because the depth of the wells are more than 15 m, significantly deeper than any level of groundwater lowering in a potential dewatering area. Shallow wells, if present within the ZOI, may require monitoring for water quality and quantity.
- The quality of pumping discharge from the excavated areas are to meet the applicable quality objectives for discharge as per O. Reg. 387/04, O., Reg. 64/16 and O.Reg. 63/16 conditions and also shall conform to OPSS 517;
- All groundwater monitoring/observation wells and water wells encountered during construction located within the construction alignment (**Figures 10** and **11**) shall be decommissioned as per the requirements made under O. Reg. 903 as amended. Any water wells identified by LINK427 within the construction lands will be decommissioned in accordance with the requirements made under O. Reg. 903 as amended; and
- LINK427 will prepare and submit annual monitoring reports by August 31 of each year until construction is completed and for one year after construction completion.

6.1.5 Drainage and Stormwater Management

6.1.5.1 Existing Conditions

The existing Highway 427 does not currently exist between Highway 7 and Major Mackenzie Drive. The extension of the highway will be through a corridor of mainly agricultural lands and some natural valley features, surrounded by employment and industrial areas.

In the proposed extension area, runoff is primarily through the agricultural lands, and in the cases of the industrial areas in this sector, runoff will be collected through storm sewers.

6.1.5.2 EA Commitments

The following EA commitments relevant to this DCR have been met:

- Flat-bottomed grass-lined swales are proposed throughout the entire study area to provide adequate conveyance capacity of peak flows, while also providing some degree of quality control.
- Quality Treatment –Enhanced Protection Level (Level 1) quality treatment is provided.
- Areas where stormwater management ponds are not feasible, Low-Impact Development features will be considered, such as dry swales. Low Impact Development features will be designed using the CVC and TRCA document Low Impact Development Stormwater Management Planning and Design Guide, dated 2010.
- All cross culverts greater than 6m in span are to be designed based on a 100-year design flow without impacting the current flood elevations.
- Cross culverts less than 6m in span will also be designed based on the 50-year design flow in order to convey all of the flow within the ROW to receiving stormwater management facilities for effective treatment.
- For areas with a drainage area greater than 125ha, structures will be sized to convey the Regional Storm (Hurricane Hazel) with no significant increases in flood levels from that of the existing condition.

6.1.5.3 Stormwater Management Strategy

Stormwater management (SWM) measures will be required for quality and quantity control to avoid negative impacts on local water systems as a result of the project. For this project, quality control measures are required to meet 80% total suspended solids (TSS) removal (MOECC Enhanced level treatment), and quantity control measures are required to ensure post-development runoff flow rates do not exceed pre-development runoff flow rates for the 2 to 100-year storm events. These measures will be covered in a different DCR.

6.1.5.4 Potential Impacts

The works related to this project can potentially have adverse impacts on the natural environment and in particular, watercourses, due to sediment in stormwater originating from the erosion of exposed soils. Ineffective and insufficient stormwater management and sediment control measures can increase fine sediment inputs, impact water quality and increase overland runoff inputs into watercourses. These changes lead to increased flood events, reduced base flows due to sedimentation, decrease habitat diversity and increased channel erosion. Sedimentation from construction activities is a major contributor to these problems.

6.1.5.5 Mitigation Measures

Stormwater management is a component in good erosion and sediment control. Reducing runoff velocities and ensuring that settlement time is incorporated into small storm events will reduce erosion potential and reduce sediment loads into receiving water courses. LINK427 will develop individual Construction Period Drainage and Sediment Management Plan(s) (DSMP) that incorporate each watercourse crossing prior to construction. The purpose of the DSMPs is to provide water quality control of the runoff generated within all drainage catchment areas within the Project Agreement Lands before water is discharged to any watercourse. In addition to the water quality control, DSMPs shall also address attenuation of frequent runoff events, and sediment control. Each DSMP shall be site-specific and based on managing stormwater within each drainage catchment area located within the Project Agreement Lands throughout each phase of construction. Location of drainage management facilities such as temporary sedimentation ponds, sediment detention

basins, swales, and check dams, shall be determined prior to commencing the works within each drainage catchment area. Each DSMP shall be prepared in accordance with the "Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects" (MTO 2007). At a minimum, the DSMP shall include the following components as prescribed in the "Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects":

- Statement of objectives;
- Project description;
- Pre-development site conditions;
- Critical areas of concern;
- Responsibilities and accountability;
- Best Management Practice (BMP) selection and design
- Monitoring and maintenance;
- Contingency plan; and
- Detailed site drawings.

All stormwater management facilities are located outside of environmentally sensitive areas. The locations of the temporary sedimentation ponds during construction will be in the same locations as the ponds proposed in the original EA document (January 2010).

Impacts to the quality and quantity of individual private water wells are not anticipated, however if a well is impacted from dewatering or construction related activity then it will be LINK427s responsibility to mitigate the impact taking necessary measures which may include providing a new well to the impacted party. However, the complaint will be investigated to find out the cause of the impact and until the issue is resolved, LINK427 will need to provide water supply to the impacted property/ resident.

In addition to ensuring that all quantity and quality criteria are met for the project, the EA Notice of Approval included commitments to ensure that a surface water monitoring program be put in place so that all mitigation measures are functioning as intended. LINK427 will implement the surface water monitoring program as approved by MOECC.

Finally, all outlets from stormwater management facilities will be designed with adequate erosion protection measures, as specified in the EA documents.

6.1.6 Erosion and Sediment Control

6.1.6.1 Existing Conditions

LINK427 has developed an Erosion and Sediment Control Plan (ESCP) for the project in order to document the environmental protection measures for preventing and controlling erosion and sedimentation during construction.

The ESCP provides the knowledge, awareness and methods necessary to complete the required work tasks in a manner that avoids or minimizes erosion and the potential impacts to the environment from sediment. The ESCP lays out the framework for ensuring that the design and construction activities are carried out in compliance with the terms and conditions of any project level permits, licenses, authorizations or agreements. As with all environmental management plans, the ESCP is a "living document" that will be reviewed and updated as the project progresses through the various stages of design and construction. In the formulation of the ESCP, the appropriate agencies are being consulted for their input. This keeps the information in the plan relevant to current site activities and operations.

The topography within the project area is generally flat, with a slightly downward slope from the northwest to the southeast. The dominant hydrologic features within the Lands include Rainbow Creek and Robinson Creek that are part of the Humber River Watershed. The valley land of local water courses (i.e. Rainbow Creek, Robinson Creek and Humber River) has cut through the glaciolacustrine deposits (silt and clay) into the underlying Halton Till. Areas within the watercourse valleys have alluvial coarse textured deposits, whereas the remaining surficial deposits consist primarily of glaciolacustrine silt and clay. The erodibility of the predominant surficial soils can generally be described as low to moderately erodible, with higher erodibility in the stream valleys.

For this work, the ESC measures employed will be industry-standard, proven techniques to prevent erosion of exposed soils and the transport of sediment from construction areas to watercourses, wetlands and protected retained natural areas.

The project has two approaches to erosion and sediment control based on qualitative risk:

1. General ESC for areas with moderate to low risk (the flat areas underlain by clay to silt till and glaciolacustrine deposits), and
2. Site specific ESC for areas of concern (i.e., near watercourses and watercourse valleys) that will be included in Drainage and Sediment Management Plans (DSMPs).

ESC measures will be monitored and maintained throughout the construction of the project.

6.1.6.2 Potential Impacts and Mitigation Measures

Sedimentation from construction activities has been known to be a major contributor to increased fine sediment inputs, impacts on water quality and increased overland runoff inputs into watercourses. These changes lead to increased flood events, reduced base flows due to sedimentation, decreased habitat diversity and increased channel erosion that can negatively impact aquatic resources and other natural features. The potential for erosion and downstream sediment transport will be minimized with the application of ESC measures. Stormwater runoff will be managed to prevent overland flow from entering the construction area.

Erosion control measures will be applied to reduce the generation of sediment, and include the following:

- Existing vegetation that is not identified to be removed is to be retained and protected.
- Exposed surfaces will be protected, as practical, to reduce erosion, including:
    - Removing only the vegetation above the ground during clearing
    - Minimizing the amount of area exposed at one time, including staging grubbing.
- Excavated materials requiring stockpiling will be separated at least 30 m from all identified watercourses, wetlands, and retained natural areas. The stockpiles will be placed in non-sensitive areas, protected with silt fence and sprayed with cover crop to mitigate any erosion and/or dust problems.
- Erosion measures will be in place prior to the start of construction and remain in place until restoration is complete and disturbed areas are stabilized against erosion.
- Standard erosion control measures will be installed and maintained following OPSS 805 or manufacturer's instructions.
- For most areas where work will not take place for a period of 45 days or more, exposed soils will be protected from erosion using the appropriate means, such as hydro-seeding or erosion control blankets. For locations near receiving watercourses, stabilization will take place where work will not take place for a period of 15 days or more.
- A qualified environmental inspector will be on-site daily throughout construction to check that ESC measures are installed, functioning, being maintained as per the standards and industry practice.
- The sediment control approach will include:
    - Rock flow check dams (OPSD 219.210 and 219.211), silt fence flow check dams (OPSD 219.190) and/or other suitable measures will be provided in temporary construction ditches and swales, as required, to control flow rates and/or promote settling of sediments within swales prior to discharge.

- On-site stormwater conveyance channels for temporary flow control purposes will have adequate capacity and protection to prevent erosion during storm and runoff events.
- Stormwater outlets shall be stabilized prior to any upstream land disturbing activities.
- Water velocity will be minimized with the use of constructed ditches, berms, and check dams.
- Site entrances will be protected by gravel or other means so that sediment is not tracked off-site.
- Storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site are to be protected from sediment deposition by the use of filters.
- Where sediment-laden standing water must be removed it will be disposed of by the appropriate means to contain sediment (e.g., sediment bags and sediment trap) (OPSD 219.240) and no direct discharge to watercourses will be allowed.
- Standard sediment control measures will be installed and maintained following Ontario Standard Specifications or manufacturer's instructions.
- Dewatering via pumping and isolating the construction zone from outside flows will be used to keep the work in the dry;
- Water will be screened prior to dewatering pump intake;
- Heavy duty silt fence will be installed at or above the regulatory flood line;
- Temporary sedimentation ponds will be used for dewatering prior to discharge to watercourses;
- Temporary diversion swales will be used to convey runoff;
- Dewatering effluent discharge will be directed to sedimentation basins;
- Energy diffusers will be employed for dewatering effluent lines;
- Check dams, sediment barriers, and/or filters will be used prior to discharge; and,
- In-stream control practices will include:
    - Auguring and directional drilling;
    - Sediment/turbidity curtains;
    - Temporary stream crossings via culvert(s);
    - Dry flume/by-pass pumping;
    - Cofferdam; and,
    - Site dewatering.

- All sediment control measures will be installed prior to construction.

6.2 Socio-Economic Environment

6.2.1 Air Quality

6.2.1.1 Existing Conditions

An assessment of potential air quality impacts from the project was documented in detail in the Individual EA (2010) and updated through an air quality assessment in 2015. The TESR (2013) noted that a regional air quality assessment was undertaken to consider effects of the proposed works on regional air quality. The TESR (2016) outlined and updated the main findings to reflect the proposed widening of two additional lanes. The purpose of the air quality assessment was to determine the potential air quality impacts of the Recommended Plan, utilizing the *Ministry of Transportation Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects (MTO Guide)*. The air quality assessment determined that significant regional air quality impacts are not anticipated as a result of the works. The study also provided recommendations for mitigation measures that can be implemented to reduce the potential for air quality effects from construction.

6.2.1.2 Potential Impacts

The air quality assessment examined local air quality impacts, regional air quality impacts, and climate change implications. The local air quality assessment was conducted using CAL3QHCR dispersion modelling software which was developed with all the necessary information for this project.

As part of the Individual EA (2010), regional impacts were determined by assessing the overall change in vehicle use. The analysis focused on pollutants such as oxides of nitrogen (NOX) and particulate matter (total suspended particulates [TSP]), which are important contributions to smog. The increase in Carbon Monoxide, and Coarse Particulate Matter and Carbon Dioxide is directly attributable to an increase in traffic. In addition, greenhouse gases (GHG) impacts were analyzed to assess the impact the project will have on climate change. Overall, project related emissions evaluated are significantly less than the Ontario GHG emissions target.

Some temporary effects could be expected from the construction activities associated with the project. These include operation of heavy equipment, topsoil removal and excavation or grading which could generate dust and result in short term decreases in air quality. The potential for these impacts will be controlled through best management practices and oversight by LINK427 to prevent unnecessary release of emissions and air contaminants.

6.2.1.3 Mitigation Measures

Based on the modelling results, specific local mitigation is not warranted. However, to minimize potential impacts to air quality during construction, the following best management practices for dust and other emissions shall be employed:

- Regular cleaning of construction sites to remove construction debris that may emit dust.
- Include provision of transportation modes with low emission rates.
- Non-chloride dust suppression measures, as identified in OPSS, will be used on unpaved haul roads within the Lands and other traffic areas susceptible to emitting dust (the appropriate dust suppression techniques are subject to the area being free of sensitive plants, nearby watercourses or other ecosystems that may be affected).
- Non-chloride dust suppression methods will be applied during construction of the highway and the concrete processing.
- Trucks will cover their loads when hauling fine-grained materials.
- Various methods will be used to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads.
- Where necessary, paved streets/roads where tracking of soil mud or dust has occurred will be cleaned.
- Posted speed limits will be complied with and, as appropriate, further reductions in speeds when travelling at sites with unpaved surfaces.

- Appropriate methods will be used to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads.
- Enclosures, wet sandblasting and / or other techniques will be used to minimize dust during any sandblasting operations.
- All motorized equipment/vehicles, including emission control devices where installed by the manufacturer, will be regularly maintained to ensure emissions from internal combustion engines is minimized.
- Excessive idling of equipment and idling of equipment that is not in immediate use will be prohibited.

6.2.2 Land Use

6.2.2.1 Existing Conditions

Existing land uses within and surrounding the project Lands are a mix of agriculture, residential, industrial/commercial and recreational uses. The Greenbelt exists to the north of the Lands and a major arterial network (including Highway 427) exists to the south, leading into the City of Toronto.

CP Rail track crosses the eastern portion of the Lands in a northwest-southeast orientation. Commercial / light industrial land uses are present within the Lands on the south side of Rutherford Road and east side of the CP Rail track. The subject area lies within York Region, and is subject to the York Region Official Plan (OP). LINK427 has maintained consultation with CP Rail and all considerations / agreements required for construction will be adhered with.

Future land uses within the Lands are governed by the Regional Municipality of York and the City of Vaughan Official Plans, which were both updated in 2010 after approval of the Individual EA (2010). Construction works related to this DCR do not preclude future municipal plans, particularly those pertaining to future trail plans. The updates to Official Plans were completed in response to population and employment forecasts for the area, and the City anticipates being able to meet those forecasts given the provincial policies of the Growth Plan for the Greater Golden Horseshoe.

The project Lands are bisected by Highway 427, natural heritage features, including tributaries to the Humber River, and a major hydro transmission corridor.

6.2.2.2 Potential Impacts

There are no impacts to the existing or future land uses within the Lands as a result of the proposed Highway 427 Expansion, as these works are contained with the ROW outlined in the previous EAs. No additional property is required for the construction works proposed in DCR #3, therefore no mitigation measures are required.

6.2.2.3 Mitigation Measures

The majority of the construction works are accommodated within the ROW outlined in the previous EAs. Therefore, no new private property is required. No mitigation measures are required.

6.2.3 Noise and Vibration

The DCR #3 construction works will be a temporary source of localized noise. The nature of the construction activities is such that the noise levels will vary temporally and spatially as different activities take place at different locations.

Some night work is anticipated in the City of Vaughan and the City of Toronto as the project construction schedule dictates. A Noise By-law exemption was obtained from City of Vaughan for the construction activities associated with DCR #3. City of Toronto indicated that noise bylaw exemption was required for Provincial highway works. All works within the City of Vaughan and City of Toronto that are included in this DCR will be completed adhering to the applicable Noise Control By-laws as well as LINK427's Construction Noise and Vibration Plan.

6.2.3.1 Mitigation Measures

Implementation of the following measures is recommended to help mitigate any potential noise and vibration impacts:

- LINK427 will be required to keep idling of construction equipment to a minimum and to maintain equipment in good working order to reduce noise from construction activities.

- Noise emissions from construction equipment will also be subjected to the limits set out in the MOECC Publication NPC-115 and the *Noise Control Guideline for Class Environmental Assessment of Undertakings.*
- The MTO Environmental Guide for Noise (October 2006) will be followed.
- Heavily loaded trucks will be routed away from residential streets, where possible, in order to limit vibration impacts.
- The separation distance between the construction staging areas and nearby receptors will be maximized to the greatest extent possible to reduce noise and vibration impacts.
- Responses to noise and vibration complaints will be done in accordance with the project's Complaint Protocol.
- In the presence of persistent noise and vibration complaints, all construction equipment shall be verified to comply with MOECC NPC-115, NPC-118 and Ontario Model Municipal Noise Control By-Law guidelines.
- As some construction activities are expected to be undertaken at night and/or on weekends, exemptions from any applicable municipalities (i.e. City of Vaughan) Noise Bylaws will be obtained.

While no significant adverse noise and vibration effects are anticipated due to the limited nature of the activities, a Construction Noise and Vibration Plan has been developed and will be implemented as per the EA Conditions of Approval throughout the construction period.

6.2.4 Waste Management/ Contaminated Property/ Excess Materials Management

6.2.4.1 Existing Conditions

A Contamination Overview Study (COS) of the Lands was completed as part of the Individual EA to determine the presence and significance of any actual or potential sources of contamination within the Lands. The COS identified areas of potential environmental concern and Phase I and Phase II Environmental Site Assessments were completed by MTO in 2016 for properties identified as having a high potential for environmental impacts (high potential to encounter contaminated material).

Based on the findings of the Phase I and II ESAs and subsequent environmental investigations and delineation programs completed by LINK427 in 2017 and 2018, the following was confirmed:

- Groundwater quality within the Lands meets the generic Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the *Environmental Protection Act*, Ministry of the Environment, April 15, 2011 (MOECC Site Condition Standard (SCS)).
- Areas were identified within the Lands where soil quality does not meet the applicable MOECC SCS and remedial activities will be completed prior to construction activities outlined in DCR #3. The Sites with confirmed soil contamination include:
    - 6400 Langstaff Road (PIN #: 033180168);
    - 6350 Langstaff Road (PIN #:033180157);
    - 10220 Huntington Road (PIN # 033210209).
    - 9571 and 9667 Huntington Road (portions of PIN 033200244, PIN 033200246 and PIN 033200258)

6.2.4.2 Potential Impacts

Where possible, the areas of known contamination identified above will be remediated prior to construction activities within those areas; therefore, the potential for adverse impacts associated with construction activities in DCR #3 is low.

All remedial work will be completed in accordance with the Waste and Contamination Management Plan (WCMP), applicable regulations and best management practices, and will fulfil the requirements of the Individual EA (2010), TESRs (2013 and 2016) and MTO Best Management Practices.

In the event that unknown contamination is discovered during the course of construction activities, procedures and steps outlined in the WCMP will be implemented and procedures for working in contaminated areas will apply.

6.2.4.2.1 Mitigation Measures

Remedial excavations will be completed prior to the construction works outlined in DCR #3, in those areas with confirmed soil contamination. Mitigation measures will not be required during construction activities outlined in DCR #3.

The construction activities for DCR #3 will not involve the production of any excess soils that requires offsite management. Should there be any excess soils generated as part of construction activities associated with DCR #3, they will be managed in accordance with the project's WCMP, the project's Earth Management Plan (EMP) and with OPSS 180 (Management of Excess Materials).

6.2.4.2.2 Management of Designated Substances and Excess Materials

A designated substance survey (DSS) was previously completed for building structures within the Lands that will require demolition. The construction activities covered within DCR #3 does not include building demolition therefore, the management of designated substances is not required and the potential for impacts is low.

Excess materials generated during construction works will be managed in accordance with the WCMP, MOECC regulations and OHSA requirements. Permits and approvals will be obtained (as required).

6.2.4.3 Mitigation Measures

Excess materials generated or encountered during construction activities will be managed in an environmentally acceptable manner, recycled and/or processed and disposed according to current legislation and practices in accordance with OPSS 180 and the LINK427 EMP. Specifically:

- Deposited waste and recyclable materials (such as metal, plastic etc.) will be removed and property managed off-site for reuse, recycling or disposal.
- Waste and recyclable materials will be segregated and separated where practicable, removed and/or managed off-site for reuse, recycling or disposal.
- In the event that suspect designated substances are identified during design and/or construction activities, additional testing and DSS reports will be completed (as required).

6.2.5 Traffic

6.2.5.1 Existing Conditions

The works outlined in DCR #3 require traffic staging along Langstaff Road and Major Mackenzie Drive, as discussed in **Section 5.1.4.**

The current traffic configurations at Langstaff Road and Mackenzie Drive are provided in **Table 8**.

Table 8: Langstaff Road and Major Mackenzie Drive Existing Conditions

Crossing Road	No. Lanes Per Direction	Median Divider / Barrier? (Y / N)	Bike Lane? (Y / N)	Sidewalk? (Y / N)	Paved Road Surface? (Y / N)
Langstaff Road	2	N	Y	N	Y
Major Mackenzie Drive	1	N	N	N	Y

6.2.5.2 Potential Impacts

The following provides the potential impacts expected along Langstaff Road, CPR/McGillivray, and Major Mackenzie Drive as part of DCR #3 works.

Active Transportation

All existing cycling facilities will be maintained for the duration of construction. Any impacts to cycling facilities will be temporary in nature. The existing bike lanes on Langstaff Road will be maintained throughout construction and the existing shoulders on Major Mackenzie Drive will remain at a minimum. Signage will be installed to safely direct pedestrians and cyclists through the work zones.

Transit

Currently, there are no transit systems that operate transit stops along Langstaff Road, McGillivray Road and Major Mackenzie Drive within the planned work zones. The transit stops located on Huntington will remain unimpacted.

Short-Duration Temporary Traffic Impacts

During the various construction activities, short-duration temporary traffic impacts will be required to facilitate the implementation of long-duration detours and lane shifts, as well as other activities, including utility relocations / installations, and large material deliveries (concrete, structural steel, rebar, etc.) which may not fit into work zones adjacent to the detours and lane shifts. Short-duration temporary traffic impacts include lane closures, lane shifts, road closures, and detour routes, which will be implemented for a single shift, and then removed, thereby restoring traffic to the regular conditions. All temporary short duration traffic impacts will be in accordance with the Ontario Traffic Manual, Book 7.

Long-Duration Temporary Traffic Impacts

The long-duration temporary traffic impacts included in the scope of DCR #3 are described in detail in **Section 5.1.3**.

Permanent Traffic Impacts

The scope of work at these locations within DCR #3 are only temporary (lasting the duration of the construction period) to facilitate construction of the new alignments. Therefore, there are no permanent traffic impacts resulting from the works associated with this DCR #3.

6.2.5.3 Mitigation Measures

A TMP has been developed to consider the local mobility of people, goods, and long-haul transportation that will be affected by the construction of the proposed works. This plan outlines the various procedures to be implemented to mitigate traffic impacts. The primary goal for LINK427 and all members associated with this project is to minimize the impacts to the various road users and ensure public safety as they travel through the work zones. This will be accomplished through a variety of methods, as described below.

Limit Traffic Restrictions to Non-Peak Hours

The most significant method of mitigating traffic impacts will be scheduling traffic restrictions to non-peak hours. These would be reflective of the prescribed hours of work outlined by MTO and those substantiated through traffic and queue analysis. This will ensure that peak traffic will be able to safely flow through the work zones unimpeded and eliminate any delays or traffic queuing.

PVMS Boards

One of the tools for notifying the road users of planned traffic pattern changes and assisting with incident management notifications will be implementation of numerous Portable Variable Message Signs (PVMS) boards across the Project limits. PVMS boards will be placed on high volume roadways and highways approaching the construction limits to address the impacts of the immediate work zone or the length of the corridor in general.

Communication Procedures

Another tool for notifying various road users of planned traffic pattern changes will be utilizing the established regular communications procedures with stakeholders and the public such as the project website and email notifications to subscribers. These would be published a minimum of 48-hours prior to the implementation of any scheduled traffic

impacts and traffic pattern changes, both permanent and temporary. This would be especially important during major traffic events, as they will provide alternate routes and advise of extensive traffic delays. Use of these procedures will ensure motorists will be able to understand expected delays well in advance of entering the work zones and explore alternative solutions if needed to minimize delays.

6.3 Cultural Environment

6.3.1 Archaeological Resources

An overview of the archaeological features found within the Lands were documented in the Individual EA (2010) and a Stage 1 through 3 Archaeological Assessment were completed as part of previous Environmental Assessments.

6.3.1.1 Potential Impacts

Archaeological assessments have been undertaken for all properties impacted by the proposed works. These lands are considered clear of archaeological potential.

6.3.1.2 Mitigation Measures

During construction there remains the low probability of encountering deeply buried archaeological resources. In the event that the following situations are encountered during construction, work must stop immediately and the actions undertaken as listed below:

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources will cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- In the event that human remains are encountered during construction, the proponent or person discovering human remains will immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Government Services at (416) 326-8393.
- The *Cemeteries Act*, R.S.O. 1990, c.C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.
- During construction, the Coleraine Burying Grounds (Coleraine Cemetery) and the Coleraine Schoolhouse Site located on the south side of Major Mackenzie Drive will be protected to ensure protection from construction activities.

Should the boundaries of the project Lands change and extend outside of the proposed ROW, additional Stage 2 Archaeological Assessment work may be required.

6.3.2 Built Heritage and Cultural Landscapes

Cultural Heritage Evaluation and Documentation Reports were completed for the Highway 427 Expansion project during the Individual EA (2010) and subsequent studies. The construction activities covered in DCR #3 are within the vicinity of the Colerain Cemetery and McKinnon Site which are protected sites however, construction will not impact any built or cultural heritage landscapes within the Lands.

6.3.2.1 Mitigation Measures

Mitigation measures include fencing and protection of both the sites mentioned above. No additional mitigation measures are required as the proposed construction activities result in no additional impacts to cultural or built heritage as identified in the Individual EA (2010).

7 Summary of Environmental Concerns, Mitigation Measures and Commitments

Table 9 below summarizes the environmental impacts associated with the Detail Design and outlines commitments for mitigation measures and future work. The table below also references the commitments and mitigation measures identified as part of the Individual EA (2010), the TESR (2013) and TESR (2016). This table is only a summary to show that the appropriate mitigation measures and design features are consistent with the commitments outlined in the Individual EA (2010), TESRs (2013 and 2016), as well as this DCR.

7.1 Pending Approvals

Pending approvals associated with the work under this DCR include:

- Environmental Activity and Sector Registry (EASR)
- Fish Collection Permit

All permitting and approval requirements will be confirmed and obtained as required. Works which are subject to a given permit will commence only after the permit is obtained.

7.2 Granted Approvals

The following approvals have been granted with the work under this DCR:

- Overall Benefit permit for SAR bats under the *Endangered Species Act*.
- Noise By-law exemption (City of Vaughan)

Table 9: Summary of Environmental Concerns, Mitigation Measures and Commitments

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
Natural Environment		
Terrestrial Ecosystems	**MTO** **MNRF** **TRCA** **MOECC**	***General Vegetation Protection Mitigation Measures*** ■ Clearing, grubbing and follow-up construction activities will be carefully planned prior to the start of construction in order to foresee and mitigate any environmental issues before they occur. ■ Vegetation removal (i.e., clearing and grubbing) completed as part of DCR #3 will be restricted to within the Lands, as identified in the design drawings. ■ LINK427 has carefully reviewed construction impacts and made extensive efforts to minimize vegetation removals, including altering construction approaches to avoid entering valleys where possible, and to minimize impact where equipment is required to enter sensitive areas. ■ Grading limits have also been refined to retain as much vegetation as possible, including a number of mature trees at West Robinson Creek. ■ LINK 427 will protect and retain existing vegetation and trees, within identified protected vegetation areas. ■ Prior to heavy machinery working adjacent to identified natural areas and vegetation communities, tree protection barriers shall be installed outside the drip-line of the significant features to protect any vegetation that is to be retained and is in the vicinity of exposure to damage by machinery or other sources. This includes, but is not limited to, where vegetation removals will occur within forested communities. LINK427 shall ensure that all protection fencing conforms to the OPSS for the Protection of Trees (OPSS 801.07.02) and that the fencing is installed outside of the drip-line of the identified vegetation communities or natural heritage features. The boundaries of the Lands and protected vegetation will be clearly delineated on construction specifications and will be fenced prior to the start of works associated with DCR #1. The fencing will be retained in place throughout the duration of works associated with DCR #3. ■ Erosion and sediment control (ESC) measures will be installed according to the ESC Plan and as located on the design drawings, and will be maintained throughout construction. ■ LINK427 will ensure the use of appropriate vegetation clearing techniques (e.g. trees to be felled away from the retained natural areas).

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ Tree grubbing will be restricted to the required activity zone. Where possible, tree stumps will be cut flush to the ground and grubbing will be avoided to minimize soil disturbance, particularly in erosion prone areas. ■ In the event that adjacent vegetation communities or planted trees are accidently damaged during construction activities, LINK427 will implement appropriate contingency measures such as pruning tree limbs or roots that are accidently damaged using proper arboricultural techniques. ■ Tree/shrub debris will be stored outside identified protected vegetation. ■ Any trees/shrubs that are felled will be removed or mulched as soon as possible. During the breeding bird season (April 15th to August 15th) if trees or shrubs need to be removed, a clearance by a qualified biologist will be undertaken prior to any removals. ■ Vegetation removals (including non-woody vegetation) shall take place outside of the appropriate timing windows for breeding birds and bats (see **Section 6.1.2** for further details). ■ Exposed surfaces shall be stabilized and seeded with a temporary seed mix in areas where woody vegetation planting is not to occur within 45 days from completion of the works. Other exposed surfaces will be seeded as per the Landscape Plan discussed in a future DCR. ■ Temporary stockpiles will be seeded with a temporary seed mix consisting of Oats (*Avena sativa*) in spring/summer and winter wheat (*Triticum aestivum*) in fall as recommended by MNRF to quickly stabilize these areas. ■ Areas within the Lands with a high proportion of invasive species (i.e., Buckthorn and Common Reed) will be delineated in the field by LINK427 Plant Ecologist/Botanist(s) prior to the start of clearing activities (DCR #1). Grubbing and topsoil stripping from these identified areas will require separate disposal in accordance with the Invasive Species Management Program (ISMP) to avoid the spread of these species within the Lands. ■ LINK427 will restrict earth movement immediately adjacent to woodlands during periods of high dust generation. Non-chloride dust suppressants will be applied during dry periods to those areas which generate large amounts of dust. ■ Construction vehicle access will be limited to the existing roadways and construction paths, away from the protected vegetation.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work

		■ Vehicle re-fueling stations will be located within a centralized location on-site away from the protected vegetation.
		■ For areas immediately adjacent to the protected vegetation, supervision of the construction will occur.
		■ LINK427 shall undertake environmental inspection during construction to ensure that protection measures are implemented, maintained and repaired and remedial measures are initiated where warranted.
		■ There shall be no storage of materials within adjacent natural areas.
		■ LINK427 will ensure appropriate clearing and disposal of all construction-related debris following construction.
		■ A Vegetation Restoration Plan (VRP) has been developed in consultation with the MNRF and the TRCA. Once completed, the VRP will be used as the guiding document for future vegetation restoration activities. A final copy of the VRP will be provided to the MOECC. The VRP will be integrated with the erosion control plan, the invasive species management plan and requirements of the ESA permit for SAR Bats. The VRP and Landscape Plan, which is to be implemented as part a future DCR, include the following elements:
		  ■ Planting at stormwater ponds will be designed to stabilize inlet and outflow areas and provide shading and bank stabilization. Additional planting around each pond will contribute to vegetative cover.
		  ■ Native species will be utilized where possible, particularly adjacent to sensitive areas and valleys.
		  ■ Vegetation enhancement will be performed in areas where it is likely to be successful and will contribute ecological benefit.
		  ■ Areas of meadow marsh habitat will be created and integrated with the stormwater management system.
		  ■ Site-specific mitigation will be performed at key locations such as woodlands and valleys, to enhance existing vegetation and habitat.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ Other locations along the highway such as interchanges and embankments will be vegetated with a combination of aesthetic and naturalized plantings. ***Site-specific Mitigation Measures*** *Highway 427 Structures over Rainbow Creek* ■ LINK427 will retain the vegetation that is not directly impacted by construction of the new structure. ■ LINK427 will replace and enhance riparian vegetation removed or disturbed by the bridge construction by planting clusters of native tree and shrub species, as well as native grasses and herbaceous species, to provide overhead cover to the ROW reach. In order to restore and enhance this valley, the area disturbed during construction will be restored to resemble the existing species assemblage of the community (Deciduous Forest) while also improving its ecological function and integrity by planting native and non-invasive species. ■ Edge management treatments will be implemented along the edges of the retained forest community. ■ Invasive species management measures will be implemented according to the ISMP, to be provided in the VRP. ■ The deciduous forest at the Rainbow Creek crossing is identified as SAR Bat Habitat and specific mitigation requirements will be applied to this restoration area under the ESA Overall Benefit Permit. This includes limitation of vegetation removal, woodland restoration and edge management. *Highway 427 Structures over West Robinson Creek* ■ LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure. ■ LINK 427 will replace and enhance riparian vegetation removed by the bridge construction by planting clusters of native tree and shrub species along the banks within the ROW. Riparian vegetation will be planted on the outer channel banks where possible to help stabilize the eroding banks. Floodplain planting will include woody vegetation. ■ Banks will be stabilized where required using bioengineering techniques within the ROW. ■ Impacts to the existing pond will be minimized. ■ A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. Specifically, this area will be

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		restored to a Dry-Fresh Graminoid Meadow, which is expected to provide foraging habitat for Barn Swallows. This shall include restoration of vegetation in areas disturbed during construction with native plant species in order to replace and enhance the existing vegetation cover within valley. ■ Mature Bur Oak trees have been flagged by LINK427 and those that can be retained (i.e. 3 of the 4 trees) have been fenced with tree protection fencing. *Langstaff Road Structure over Rainbow Creek* ■ LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure. ■ LINK427 will replace and enhance riparian vegetation removed on the valley slope by the culvert construction by planting clusters of native tree and shrub species along slopes and within the ROW. ■ A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. The area disturbed during construction will be restored through riparian plantings of native and non-invasive species. *Major Mackenzie Drive Structure over West Robinson Creek* ■ LINK 427 will retain the vegetation that is not directly impacted by construction of the new structure. ■ LINK 427 will replace and enhance riparian vegetation removed by the bridge construction by planting clusters of native tree and shrub species along the banks within the ROW, and in other areas to improve vegetation cover. ■ To restore and enhance this valley, the area disturbed during construction will be restored using Edge Management treatments adjacent to the existing vegetation. ■ Native and non-invasive species will be used for planting. ■ A VRP and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. This valley will be restored as Deciduous Forest (FOD) with native species and re-seeded with native seed varieties.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
Wildlife, Wildlife Habitat and Species at Risk (SAR)	**MTO MNRF TRCA MOECC**	Mitigation measures to address potential impacts to Migratory Birds include: ■ Vegetation clearing, grubbing and other construction activities which may be disruptive to migratory birds will comply with the MBCA, 1994 and Migratory Bird Regulations (MBR 2012). Timing restrictions will be complied with during construction activities, particularly vegetation clearing. Specifically, clearing of vegetation will occur outside of the breeding bird season (April 15th to August 15th). ■ Where vegetation clearing and grubbing cannot be conducted outside of the breeding bird season (April 15th to August 15th), a qualified Avian Biologist will be retained and shall conduct a nest survey, according to MBCA guidance (i.e., within 'simple habitats' only). ■ Clearing shall only be undertaken if no active nests or active breeding pairs are identified within the clearing area by the qualified Avian Biologist. ■ The two culverts (Langstaff Road and Major Mackenzie Drive) that are proposed for removal will be inspected for nesting activity prior to removal. If there is any evidence of or potential for their use for nesting of migratory birds, their removal shall be scheduled outside of the migratory bird nesting period. ■ If the structures cannot be removed outside the identified nesting season, bird nesting preventative measures (such as wire screens or tarps) shall be implemented to prevent new nesting prior to April 1 and maintained until August 30 of the calendar year in which they were installed. At a minimum, the preventative measures shall be installed at structures where evidence of past nesting was observed. These measures shall be periodically checked, and maintained as required so as not to entrap birds, and shall be removed following construction. Mitigation measures to address potential impacts to general wildlife include: ■ All construction workers will be trained in advance of starting work regarding potential to encounter wildlife while undertaking their activities, and the appropriate response if an encounter occurs. ■ Any wildlife incidentally encountered during construction will not be knowingly harmed. ■ Under no circumstances will any animal (e.g., bird, reptiles, mammals etc.) be knowingly harmed, harassed or otherwise disturbed. If an animal is encountered, it will be allowed to move away on its own.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ If small wildlife (e.g. turtles, amphibians) are stranded within the construction zone, the MTO will be contacted and the animals will be captured and released by a qualified individual (e.g., LINK427 SAR Biologist). ■ In the event that small wildlife encountered does not move away from the construction zone and construction activities are such that continuing construction in the area would result in harm to the animal, all activities will stop and the MTO will be notified immediately. ***Wildlife Movement Opportunities*** Wildlife movement was a specific consideration in the structure design at the main valley crossings. Specifically, design criteria for the four main valley crossings included: ■ Maintenance of a minimum height of 3 m and a minimum OR of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). OR is the cross-sectional area of a structure (square metres) divided by the distance wildlife must travel through (or under). It is a measure of the tunnel effect of a structure that may influence use by various wildlife species. The ultimate design heights and ORs based on the four General Arrangements (**Appendix E.1**) meet or exceed these minimum criteria (all four structures meet the 3-m minimum height and provide ORs > 3 for the ultimate 10-lane scenario). ■ Specific design aspects have been integrated into the detail design of the structures to enhance their function as eco-passages and make them more 'wildlife-friendly' including: ▪ Selecting suitable substrate materials conducive to animal movement and footing of ungulates. ▪ Selecting cover elements (e.g., woody cover / masses, brush piles, boulders, vegetation) to provide a natural transition with habitat features on either side of the structures and provide cover under the structure. ▪ Restoring adjacent vegetation areas disturbed for construction access using native species, replacing and enhancing the existing vegetation cover along the valleys. ■ A Wildlife Fence Plan has been developed for the project with the sole purpose of keeping wildlife off the highway ROW and funneling wildlife to the main valley crossings structures. The type of wildlife

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		fence (e.g., height and size of openings) has been chosen based on the wildlife found in various areas along the length of the highway. The Wildlife Fence Plan will be incorporated into a future DCR Mitigation measures to address potential impacts to Barn Swallow include: ■ Moth-balling or removal of the two barn structures with confirmed Barn Swallow nesting habitat will occur outside of the Barn Swallow active season (i.e., May 1 to August 31). ■ LINK427 will provide alternative housing structures (i.e., nesting kiosks) prior to the next Active Barn Swallow Season (i.e., May 1). LINK427 have installed alternative nesting structures prior to May 1, 2018. Mitigation measures to address potential impacts to SAR Bats include: ■ LINK427 will adhere to all of the conditions in the 17(2)(c) Permit issued by the MNRF for SAR Bats, including but not limited to: ▪ Works within the Bat Species habitat shall be conducted between October 1 and March 31, of any year that the permit is in effect, unless otherwise directed by the MNRF ▪ Overall Benefit Activities will be implemented according to the permit and habitat structures will be installed between October 1 and March 31 and will be in place prior to December 31, 2018. Overall benefit measures include habitat enhancement (i.e., restoration of woodland habitat), installation of habitat structures (i.e., bat boxes and BrandenBark™ structures) and all associated monitoring / reporting. ▪ Design of the habitat enhancement / restoration of woodland habitat related to the permit obligations is still ongoing and will be included in a future DCR. The following mitigation measures will be followed in the event of an encounter with a SAR: ■ A SAR sighting is defined as an observation of a SAR where no action is required. ■ A SAR occurrence is defined as an observation of a SAR where capture and relocation is required. ■ In the event that SAR wildlife is encountered in the immediate work area, the protocol outlined below shall be followed: ▪ Work in the immediate vicinity of the observation must come to a stop.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		▪ Should an Ecologist/Biologist not be on-site, one will be contacted immediately. ▪ Ecologist/Biologist will notify the District MNRF Biologist within 48 hours of any observation of Endangered and Threatened species and/or immediately for any species going to a wildlife custodian. ▪ It is not necessary to notify the District MNRF Biologist with observations of Special Concern species or general wildlife sightings (deer, raccoon etc.). ▪ A 30-m setback from the area of the species location will be applied to allow the species to vacate the area naturally within a 24-hour period and then exclusionary fence is to be installed if appropriate. ▪ Should a SAR be encountered during construction activities completed during the winter months (e.g. dislodged from hibernation), the species will immediately be placed in appropriate containers and stored in a dark, warm, quiet place and be transported to an appropriate wildlife sanctuary/rehabilitation facility as soon as possible. Onsite Ecologists/Biologist will advise of the transportation arrangements and consult with MNRF to notify them of the transportation. ▪ Work is to not commence again in the immediate area of the observation until further instructed by onsite Ecologist/Biologist. ▪ Any required SAR relocation must be conducted by a qualified Biologist or Ecologist.
Fish and Fish Habitat	**MTO MNRF TRCA DFO**	■ All instream or near stream works will be conducted during the appropriate in-water timing window. A warmwater construction timing window (in-water work is permitted from July 1 to March 31) will be applied to protect the resident warmwater fish communities present in watercourses further downstream. ■ Sediment and erosion control measures will be implemented during all phases of construction, clean-up and restoration to prevent sediment laden runoff from entering any of the watercourses directly from the construction zone. At a minimum, the project ESCP will address the following aspects: ■ Perimeter silt fence will be installed between the work areas and all reaches of those watercourses where works are required, including ditch and drainage works that drain to watercourses that support fish habitat.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		▪ 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 stabilized. ▪ All exposed and newly constructed 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. ■ All near-water construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty/reinforced fencing for all disturbed areas of the embankments that drain to the streams. Silt fencing will be regularly inspected and maintained as required. ■ If required at the Langstaff Road and Major Mackenzie structures, only clean materials free of fine particulate matter will be placed in the water for temporary construction measures (e.g., temporary flow management dams will be constructed of 'pea gravel' bags, geotextile fabric or other clean material), or permanent works (e.g., culvert and channel substrates, cobble/boulder material). ■ Temporary dewatering of the construction zones will be required for the culvert removals at Langstaff Road and Major Mackenzie Drive and for the new structure installation at Langstaff Road.All temporary dewatering will be done using appropriate energy dissipation and settling / filtration measures for discharge to ensure no erosion or sediment release occurs in the watercourses. No dewatering discharge will be released directly to the watercourses. If temporary dewatering of the near stream construction zone is required, dewatering will be discharged through a filter bag / splash pad located at least 30 m from the watercourses. ■ All structure installations and channel restoration works will be completed 'in the dry'. For the Langstaff Road and Major Mackenzie structures, an appropriate temporary flow bypass system will be required to maintain existing watercourse flow around the construction zone to downstream fish habitat. To minimize the potential for impacts, works near watercourses will be conducted during low-flow periods. ■ All dredged, salvaged or stockpiled materials will be located a safe distance from the watercourses edges, stabilized and a physical barrier placed between the stockpile and the watercourse to prevent the migration of any sediment or other material to the watercourse.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ All work areas or other disturbed surfaces draining to the watercourses and/or in the floodplain will either be temporarily or permanently stabilized and re-vegetated with appropriate native, non-invasive species a maximum of 15 days following construction. ■ The erosion and sediment control measures will be left in place, monitored and maintained in proper working order until all disturbed areas draining to the watercourses are fully stabilized, including establishment of vegetative cover. ■ No equipment shall cross or otherwise enter the watercourses except as outlined above (if necessary). ■ All activity 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. Storage, maintenance or refueling or maintenance of equipment will be conducted at least 30 m away from the watercourses. LINK427 will implement the project Spills Prevention and Emergency Response Plan throughout construction. ■ All on-site crew members operating construction vehicles will be appropriately trained in handling a potential spill and have WHMIS Training. ■ Every effort will be made to retain as much of the natural vegetation as reasonably possible to help ensure bank stability and control erosion, and to expedite the recolonization of native plant species. ■ All riparian vegetation removed to construct the highway works will be replaced with a mix of appropriate native species. Additional riparian plantings may be incorporated to enhance existing conditions along the ROW. Only native shrub and tree species, compatible with the site conditions will be used. ■ A CISEC certified inspector will be on-site regularly throughout construction, responsible for ensuring the sediment and erosion control measures are functioning and all mitigation measures are being implemented. ■ A Scientific Collectors Permit will be obtained in order to conduct a fish salvage prior to any works being conducted for the culvert removals and structure installation works at Langstaff Road and Major Mackenzie Drive using appropriate techniques to capture and transfer unharmed any stranded fish as specified in the permit. ***Site-specific Mitigation Measures***

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		Highway 427 Structures over Rainbow Creek ■ Additional erosion protection along the crossing walls will be included in the design to protect against future channel meandering. *Highway 427 Structures over West Robinson Creek* ■ Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks. ■ Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage. ■ The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight. *Langstaff Road Structure over Rainbow Creek* ■ Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks. ■ Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage. ■ The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight. ■ The upstream and downstream connection of the reinstated channel to the existing channel will transition smoothly to avoid development of scour and erosion. ■ The channel reinstatements be properly designed to incorporate form and function of the existing fish habitats. *Major Mackenzie Drive Structure over West Robinson Creek* ■ Vegetative rock buttresses using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks. ■ Re-instatement of a natural channel through the proposed new crossing structure will improve fish habitat and passage.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight. ■ The upstream and downstream connection of the reinstated channel to the existing channel will transition smoothly to avoid development of scour and erosion. ■ The channel reinstatements be properly designed to incorporate form and function of the existing fish habitats.
Groundwater and Hydrogeology	**MTO MOECC TRCA Property Owner**	■ Dewatering activities shall be conducted in accordance with control procedures as specified in OPSS 517 Control of Water from Dewatering Operations. Appropriate dewatering measures shall be implemented to manage any groundwater encountered during grading activities, and dewatering discharge water will be filtered as necessary to prevent transport of sediment to natural surface water receptors; ■ A Spill Prevention and Control Management Plan shall be prepared; ■ Surface runoff will be directed to roadside ditches and ditch conditions shall be improved to minimize groundwater recharge impacts; ■ Groundwater monitoring wells (screened in the shallow overburden) will be installed, if not already present, near the groundwater dewatering locations to closely monitor groundwater quantity and quality during the dewatering activities; ■ The environmental quality of pumped water discharged to the natural environment must meet the requirements provided in O. Reg. 387/04 and O. Reg. 63/16; and ■ Salt usage and runoff will be minimized during road de-icing applications by following best practices consistent with those used across North America and employ the latest winter maintenance technologies (alternative to and environmentally friendlier than using road salt). ■ The following preliminary design commitments shall be implemented by LINK427: ■ Monitoring of private wells will be completed prior to construction to establish background conditions, subject to obtaining permission to access the property and the well(s) by the land owner. Monitoring of private wells located outside of the ZOI of the potential dewatering areas for the Highway 427 extension between Zenway Boulevard and Major Mackenzie Drive are not required. Deep wells located within the ZOI will not need monitoring because the depth of the wells are more than 15 m, significantly deeper

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		than any level of groundwater lowering in a potential dewatering area. Shallow wells, if present within the ZOI, may require monitoring for water quality and quantity. ■ The quality of pumping discharge from the excavated areas are to meet the applicable quality objectives for discharge as per O. Reg. 387/04, O., Reg. 64/16 and O.Reg. 63/16 conditions and also shall conform to OPSS 517; ■ All groundwater monitoring/observation wells and water wells encountered during construction located within the construction alignment (**Figures 12** and **13**) shall be decommissioned as per the requirements made under O. Reg. 903 as amended. Any water wells identified by LINK427 within the construction lands will be decommissioned in accordance with the requirements made under O. Reg. 903 as amended; and ■ LINK427 will prepare and submit annual monitoring reports by August 31 of each year until construction is completed and for one year after construction completion.
Drainage and Stormwater Management	**MTO MOECC MNRF TRCA DFO**	■ LINK427 will develop individual Construction Period Drainage and Sediment Management Plan(s) (DSMP) that incorporate each watercourse crossing prior to construction. ■ Location of drainage management facilities such as temporary sedimentation ponds, sediment detention basins, swales, and check dams, shall be determined prior to commencing the works within each drainage catchment area. Each DSMP shall be prepared in accordance with the "Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects" (MTO 2007). At a minimum, the DSMP shall include the following components as prescribed in the "Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects": ■ Statement of objectives; ■ Project description; ■ Pre-development site conditions; ■ Critical areas of concern; ■ Responsibilities and accountability; ■ Best Management Practice (BMP) selection and design ■ Monitoring and maintenance; ■ Contingency plan; and ■ Detailed site drawings.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ All stormwater management facilities are located outside of environmentally sensitive areas. The locations of the temporary sedimentation ponds during construction will be in the same locations as the ponds proposed in the original EA document (January 2010). ■ Impacts to the quality and quantity of individual private water wells are not anticipated, however if a well is impacted from dewatering or construction related activity then it will be MTO's responsibility to mitigate the impact taking necessary measures which may include providing a new well to the impacted party. However, the complaint will be investigated to find out the cause of the impact and until the issue is resolved the MTO will need to provide water supply to the impacted property/ resident. ■ In addition to ensuring that all quantity and quality criteria are met for the project, the EA Notice of Approval included commitments to ensure that a surface water monitoring program be put in place so that all mitigation measures are functioning as intended. LINK427 will implement the surface water monitoring program as approved by MOECC. ■ Finally, all outlets from stormwater management facilities will be designed with adequate erosion protection measures, as specified in the EA documents.

Erosion and Sediment Control	**MTO
	MNRF
	TRCA
	MOECC**
		Erosion control measures will be applied to reduce the generation of sediment, and include the following:
		■ Existing vegetation that is not identified to be removed is to be retained and protected.
		■ Exposed surfaces will be protected, as practical, to reduce erosion, including:
		  ■ Removing only the vegetation above the ground during clearing
		  ■ Minimizing the amount of area exposed at one time, including staging grubbing.
		■ Excavated materials requiring stockpiling will be separated at least 30 m from all identified watercourses, wetlands, and retained natural areas. The stockpiles will be placed in non-sensitive areas, protected with silt fence and sprayed with cover crop to mitigate any erosion and/or dust problems.
		■ Erosion measures will be in place prior to the start of construction and remain in place until restoration is complete and disturbed areas are stabilized against erosion.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work

		■ Standard erosion control measures will be installed and maintained following OPSS 805 or manufacturer's instructions.
		■ For most areas where work will not take place for a period of 45 days or more, exposed soils will be protected from erosion using the appropriate means, such as hydro-seeding or erosion control blankets. For locations near receiving watercourses, stabilization will take place where work will not take place for a period of 15 days or more.
		■ A CISEC certified inspector will be on-site regularly throughout construction to check that ESC measures are installed, functioning, being maintained as per the standards and industry practice.
		■ The sediment control approach will include:
		  ■ Rock flow check dams (OPSD 219.210 and 219.211), silt fence flow check dams (OPSD 219.190) and/or other suitable measures will be provided in temporary construction ditches and swales, as required, to control flow rates and/or promote settling of sediments within swales prior to discharge.
		  ■ On-site stormwater conveyance channels for temporary flow control purposes will have adequate capacity and protection to prevent erosion during storm and runoff events.
		  ■ Stormwater outlets shall be stabilized prior to any upstream land disturbing activities.
		  ■ Water velocity will be minimized with the use of constructed ditches, berms, and check dams.
		  ■ Site entrances will be protected by gravel or other means so that sediment is not tracked off-site.
		  ■ Storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site are to be protected from sediment deposition by the use of filters.
		  ■ Where sediment-laden standing water must be removed it will be disposed of by the appropriate means to contain sediment (e.g., sediment bags and sediment trap) (OPSD 219.240) and no direct discharge to watercourses will be allowed.
		  ■ Standard sediment control measures will be installed and maintained following Ontario Standard Specifications or manufacturer's instructions.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work

		▪ Dewatering via pumping and isolating the construction zone from outside flows will be used to keep the work in the dry;
		▪ Water will be screened prior to dewatering pump intake;
		▪ Heavy duty silt fence will be installed at or above the regulatory flood line;
		▪ Temporary sedimentation ponds will be used for dewatering prior to discharge to watercourses;
		▪ Temporary diversion swales will be used to convey runoff;
		▪ Dewatering effluent discharge will be directed to sedimentation basins;
		▪ Energy diffusers will be employed for dewatering effluent lines;
		▪ Check dams, sediment barriers, and/or filters will be used prior to discharge; and,
		▪ In-stream control practices will include:
		  ▪ Auguring and directional drilling;
		  ▪ Sediment/turbidity curtains;
		  ▪ Temporary stream crossings via culvert(s);
		  ▪ Dry flume/by-pass pumping;
		  ▪ Cofferdam; and,
		  ▪ Site dewatering.
		▪ All sediment control measures will be installed prior to construction.

Socio-Economic Environment		
Air Quality	**MTO** **MOECC** **MNRF**	▪ Regular cleaning of construction sites to remove construction debris that may emit dust. ▪ Include provision of transportation modes with low emission rates. ▪ Non-chloride dust suppression measures, as identified in OPSS, will be used on unpaved haul roads within the Lands and other traffic areas susceptible to emitting dust (the appropriate dust suppression techniques are subject to the area being free of sensitive plants, nearby watercourses or other ecosystems that may be affected).

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ Non-chloride dust suppression methods will be applied during construction of the highway and the concrete processing. ■ Trucks will cover their loads when hauling fine-grained materials. ■ Various methods will be used to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads. ■ Where necessary, paved streets/roads where tracking of soil mud or dust has occurred will be cleaned. ■ Posted speed limits will be complied with and, as appropriate, further reductions in speeds when travelling at sites with unpaved surfaces. ■ Appropriate methods will be used to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads. ■ Enclosures, wet sandblasting and / or other techniques will be used to minimize dust during any sandblasting operations. ■ All motorized equipment/vehicles, including emission control devices where installed by the manufacturer, will be regularly maintained to ensure emissions from internal combustion engines is minimized. ■ Excessive idling of equipment and idling of equipment that is not in immediate use will be prohibited.
Land Use	**MTO**	The majority of the construction works are accommodated within the ROW outlined in the previous EAs. Therefore, no new private property is required. No mitigation measures are required.
Noise and Vibration	**MTO** **MOECC**	■ LINK427 will be required to keep idling of construction equipment to a minimum and to maintain equipment in good working order to reduce noise from construction activities. ■ Noise emissions from construction equipment will also be subjected to the limits set out in the MOECC Publication NPC-115 and the *Noise Control Guideline for Class Environmental Assessment of Undertakings.* ■ The MTO Environmental Guide for Noise (October 2006) will be followed. ■ Heavily loaded trucks will be routed away from residential streets, where possible, in order to limit vibration impacts. ■ The separation distance between the construction staging areas and nearby receptors will be maximized to the greatest extent possible to reduce noise and vibration impacts.

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
		■ Responses to noise and vibration complaints will be done in accordance with the project's Complaint Protocol. ■ In the presence of persistent noise and vibration complaints, all construction equipment shall be verified to comply with MOECC NPC-115, NPC-118 and Ontario Model Municipal Noise Control By-Law guidelines. ■ As some construction activities are expected to be undertaken at night and/or on weekends, exemptions from any applicable municipalities (i.e. City of Vaughan) Noise Bylaws will be obtained.
Waste Management / Contaminated Property / Excess Materials Management	**MTO MNRF TRCA DFO**	■ Deposited waste and recyclable materials (such as metal, plastic etc.) will be removed and property managed off-site for reuse, recycling or disposal. ■ Waste and recyclable materials will be segregated and separated where practicable, removed and/or managed off-site for reuse, recycling or disposal. ■ Concrete materials from off-site sources will be assessed (as required) to determine suitability prior to crushing and/or processing activities. ■ Permits and approvals associated with the management and processing of excess materials will be obtained as required. ■ Designated substances will be managed by persons qualified and trained for the specific substances in accordance with applicable regulations. All materials resulting from demolition will be identified and classified under O. Reg. 347 and managed in an environmentally responsible manner. ■ In the event that suspect designated substances are identified during design and/or construction activities, additional testing and DSS reports will be completed (as required).
Traffic	**MTO General Public**	■ A TMP has been developed to consider the local mobility of people, goods, and long-haul transportation that will be affected by the construction of the proposed works. This plan outlines the various procedures to be implemented to mitigate traffic impacts. The primary goal for LINK427 and all members associated with this project is to minimize the impacts to the various road users and ensure public safety as they travel through the work zones. This will be accomplished through a variety of methods, as described below.
Cultural Environment		

Environmental Issues / Concern	Agencies	Proposed Mitigation / Commitments to Future Work
Archaeological Resources	**MTO MTCS**	In the event that the following situations are encountered during construction, work must stop immediately and the actions undertaken as listed below: ■ Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources will cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*. ■ In the event that human remains are encountered during construction, the proponent or person discovering human remains will immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Government Services at (416) 326-8393. ■ The *Cemeteries Act*, R.S.O. 1990, c.C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services. ■ During construction, the Coleraine Burying Grounds (Coleraine Cemetery) and the Coleraine Schoolhouse Site located on the south side of Major Mackenzie Drive will be protected to ensure protection from construction activities.
Built Heritage and Cultural Landscapes	**MTO MTCS**	No additional mitigation measures are required as the proposed construction activities result in no additional impacts to cultural or built heritage as identified in the Individual EA (2010).

8 Project Monitoring

During constructionLINK427 will oversee the mitigation measures and key design features to confirm that they are not only implemented as required, but that they are consistent with the previous EA commitments, including external notifications and consultation. In addition, LINK427 will assess the effectiveness of the environmental mitigation measures to confirm the following:

- Mitigation measures are providing the intended control and/or protection;
- The control and/or protection provided by mitigation measures is adequate;
- Additional mitigation measures are provided, as required, for any unanticipated environmental problems that may develop during construction;
- Information is available regarding required mitigation measures; and
- Environmental monitoring, after a project is completed, may involve follow-up monitoring of significant measures and/or significant concerns.

Condition 8 of the MOECC Notice of Approval (November 2010) outlines the requirements for a Complaint Protocol. The Complaint Protocol, established for the Highway 427 Expansion project addresses how LINK427 will respond to complaints made during the construction and operation of the project. During construction and operation of the Highway 427 Expansion project, this Protocol will act as a tool to ensure that all complaints are addressed, recorded, tracked and handled in an expeditious and efficient manner.

Per Condition 4 and 5 of the MOECC Notice of Approval (November 2010), a Compliance Monitoring Program (CMP) was developed and an Annual Compliance Report was submitted to MOECC on October 30, 2015. The purpose of the CMP is to enable the monitoring of the fulfillment of the provisions of the EA. The CMP identifies the parties responsible for project compliance monitoring and provides the program scope and actions required during the project's detail design, construction, operation and maintenance stages. The Annual Compliance Report describes its compliance with the conditions of approval set out and describes the results of the CMP. Per Condition 5 of the MOECC Notice of Approval and Individual EA (2010), Annual Compliance reporting which describes compliance with the conditions in the Notice of Approval is being submitted to MOECC annually on or before September 30th of each year.

LINK427 has also developed an Environmental Management System (EMS) that intends to administer environmental management processes within the Highway 427 Expansion Project that complies with the ISO 14001:2004 Standard, and will be applied throughout the Project Term. The EMS will manage significant environmental aspects so as to limit the impacts on the environment and demonstrates the processes to be used to comply with all LINK427's environmental obligations. LINK427 will comply with the requirements of the Environmental Approvals as per Schedule 17(2)(C) and complete the ESA monitoring and has obtained the Overall permit for SAR bats.

Construction is subject to daily general on-site inspection to ensure the execution of the environmental component of the work and to deal with environmental problems that develop during construction. This is the primary method for compliance monitoring.

8.1 Groundwater Monitoring

A groundwater monitoring program is being implemented to confirm that there are no adverse impacts to groundwater resources with regards to the construction activities of the Highway 427 Expansion and to identify construction related impacts early in order to carry mitigation measures, if necessary. The program includes:

- Pre-construction monitoring: weekly, 1 month before start of construction;
- Construction monitoring: dependent upon the length of construction; with a minimum frequency of once a month; and

- Post-construction monitoring: weekly, for 2 weeks after the end of construction.

8.2 Surface Water Monitoring

In accordance with Condition 6 of the EA Conditions of Approval a Surface Water Monitoring program has been developed and will be implemented throughout the construction period to monitor and identify mitigation measures, where required. LINK427 will regularly monitor water quality throughout construction to determine the impact of site runoff on Total Suspended Solids (TSS) and turbidity. The data will provide a means to detect and assess the impacts on the receiving watercourses. The program relies on standard monitoring parameters reported in a number of other studies, allowing both for comparison with the post-construction monitoring results and similar monitoring efforts.

Appendices

Appendix A: Study Notification Materials

August 23, 2017

RE: NOTICE OF COMMENCEMENT
HIGHWAY 427 EXPANSION, DETAIL DESIGN AND CONSTRUCTION

LINK427 has been selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to undertake the design, build, finance and maintenance of the Highway 427 Expansion project within the City of Vaughan and the City of Toronto.

Please see the attached Notice of Commencement for additional information and a key plan.

The purpose of this letter is to notify you of this project and provide you with an opportunity to identify any interests you may have.

This project is being carried out in accordance with the approved environmental planning process for projects under the MTO *Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000) and has now progressed to Detail Design. Design and Construction Reports (DCRs) will be prepared to document the Detail Design process, including environmental investigations, potential environmental effects, proposed mitigation measures, commitments to future work and monitoring. The DCRs will each be made available for a 30-day public and agency review period. Notices will be published in local newspapers, on the Project website (www.427expansion.ca) and distributed by mail to those on the project contact list to clearly identify the start and end dates of the review period, list locations where the DCR may be reviewed, and describe the process for submitting comments, including Project Team contact information.

Public Information Centres (PICs) will be held during the detail design process to allow the public an opportunity to review and comment on the project.

We encourage you to actively participate in the study by visiting our project website (www.427expansion.ca), or by contacting the staff identified on the attached "Notice of Commencement" with your comments or information requests.

Under the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and the *Access to Information Act*, comments and information regarding this project, with the exception of personal information, will become part of the public record. If you have accessibility requirements in order to participate in this project, please contact the undersigned.

Yours truly,

Aitor Arbesu Iglesias
Project Director

Encl. Notice of Commencement

cc: Chris Tschirhart, Environmental Director – LINK427

23 Août 2017

RE: AVIS DE LANCEMENT
PROLONGEMENT DE L'AUTOROUTE 427, DÉTAILS CONCERNANT LA CONCEPTION ET LA CONSTRUCTION

Le Ministère des transports (MTO) et Infrastructure Ontario ont choisi **LINK427** pour entreprendre la conception, la construction, le financement et l'entretien du projet de prolongement de l'autoroute 427 dans la Ville de Vaughan et de Toronto.

Veuillez trouver ci-joint l'Avis de lancement pour des renseignements complémentaires et le plan d'ensemble.

L'objectif de cette lettre est de vous faire part de ce projet et de vous donner la chance d'identifier des intérêts que vous pourriez avoir à ce sujet.

Ce projet est effectué conformément au processus de planification environnementale autorisé pour les projets en vertu des normes d'évaluation environnementale du Ministère des transports (MTO) pour les routes provinciales (2000), devenu maintenant une conception détaillée. Les Rapports de conception et de construction (RCC) seront préparés pour élaborer le processus de conception détaillée, comprenant des enquêtes environnementales, la prise en compte d'effets environnementaux potentiels, les mesures d'atténuation proposées, les engagements envers les futurs travaux et la surveillance. Tous les RCC seront mis à la disposition du grand public et aux agences lors d'une période d'examen de 30 jours. Des avis seront publiés dans les journaux locaux, sur le site Web du projet (www.427expansion.ca) et distribués par courrier à celles et ceux qui sont sur la liste de distribution du projet, pour leur signaler du début de la période d'examen et des emplacements où chaque RCC sera mis à disposition, ainsi qu'une description du processus pour soumettre des commentaires, y compris les coordonnées de l'équipe de projet.

Des Centres d'information publique (CIP) se tiendront pendant toute la durée du processus de conception détaillée pour permettre au grand public d'évaluer et de commenter sur les détails du projet.

Nous vous encourageons à participer activement à l'étude en visitant le site web du projet (www.427expansion.ca) ou en contactant le personnel indiqué dans « l'Avis de lancement » avec vos commentaires et vos demandes d'information.

En vertu de la Loi sur l'accès à l'information et la protection de la vie privée, les commentaires et les informations associés à ce projet, avec l'exception des renseignements personnels, seront divulgués au public. Avec l'exception des renseignements personnels, tous les commentaires seront divulgués au public. Si vous avez des exigences en termes d'accessibilité pour participer à ce projet, veuillez contacter la personne ci-dessous.

Cordialement,

Aitor Arbesu Iglesias
Directeur de projet

P.J. Avis de lancement
cc: Chris Tschirhart, Directeur en charge de l'environnement – LINK427

NOTICE OF COMMENCEMENT FOR DETAIL DESIGN AND CONSTRUCTION

Highway 427 Expansion

THE PROJECT

LINK427 has been selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to undertake the design, build, finance and maintenance of the Highway 427 Expansion project within the City of Vaughan and the City of Toronto. The *Highway 427 Transportation Corridor Environmental Assessment (EA)* received approval from the Ministry of Environment and Climate Change (MOECC) in November 2010. The project was updated through completion of a Transportation Environmental Study Report (TESR) in 2016 to add additional lanes to the proposed Highway 427 extension. A separate TESR was completed in 2013 for the widening of existing Highway 427 between Albion Road to Highway 7.

The Highway 427 Expansion project includes the design and construction of the following:

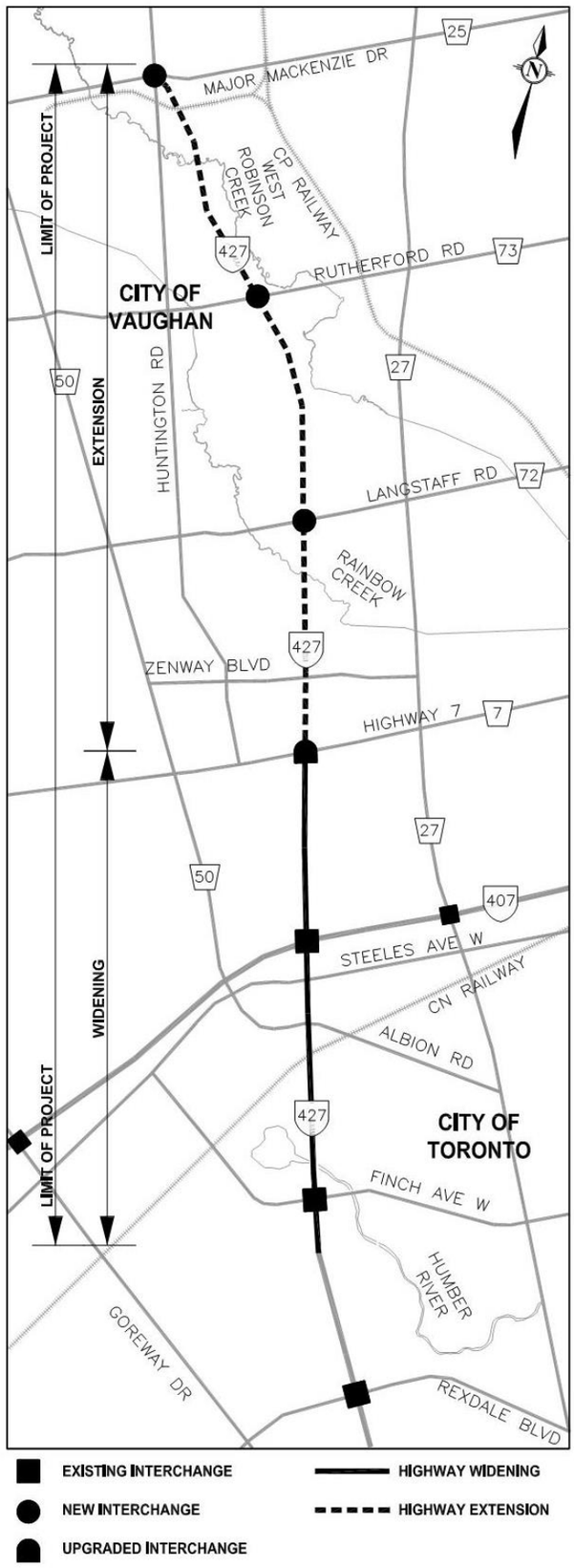
- A new 6.6 km extension from Highway 7 to Major Mackenzie Drive with:
  - eight lanes from Highway 7 to Rutherford Road;
  - six lanes from Rutherford Road to Major Mackenzie Drive;
  - three new interchanges (Langstaff Road, Rutherford Road and Major Mackenzie Drive);
  - new median High Occupancy Toll (HOT) lanes.
- A 4.0 km road widening from Finch Avenue to Highway 7:
  - from six to eight lanes between Finch Avenue to south of Steeles Avenue;
  - from four to eight lanes, from south of Steeles Avenue to Highway 7;
  - new median High Occupancy Toll (HOT) lanes.

THE PROCESS

This project is being carried out in accordance with the approved environmental planning process for projects under the MTO *Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000) and has now progressed to Detail Design.

Public Information Centres (PICs) will be held throughout the detailed design process to allow the public an opportunity to review and comment on project details.

Design and Construction Reports (DCRs) will be prepared to document the Detail Design process, including environmental investigations, potential environmental effects, proposed mitigation measures, commitments to future work and monitoring. The DCRs will each be made available for a 30-day public and agency review period and notices will be published in local newspapers, on the Project website www.427expansion.ca and



distributed by mail to those on the project contact list advising of the start of each review period and locations where each DCR will be available for review.

COMMENTS

We are interested in hearing any comments that you may have regarding this project. If you wish to obtain additional information, provide comments or sign up for the project mailing list please contact those listed below, or visit the project website at www.427expansion.ca.

If you have any accessibility requirements in order to participate in this project please contact one of the Project Team members listed below.

Mr. Chris Tschirhart
LINK427
Environmental Director
1 Royal Gate Blvd.
Woodbridge, ON. L4L 8Z7
Ph: 1-888-352-8085
Email: ask@427Expansion.ca

Mr. Aitor Arbesu Iglesias
LINK427
Project Director
1 Royal Gate Blvd.
Woodbridge, ON. L4L 8Z7
Ph: 1-888-352-8085
Email: ask@427Expansion.ca

Information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* and the *Access to Information Act*. With the exception of personal information, all comments will be part of the public record.

Des renseignements sont disponibles en français en composant 1-888-595-3152.

AVIS DE LANCEMENT DES DÉTAILS DE CONCEPTION ET DE CONSTRUCTION

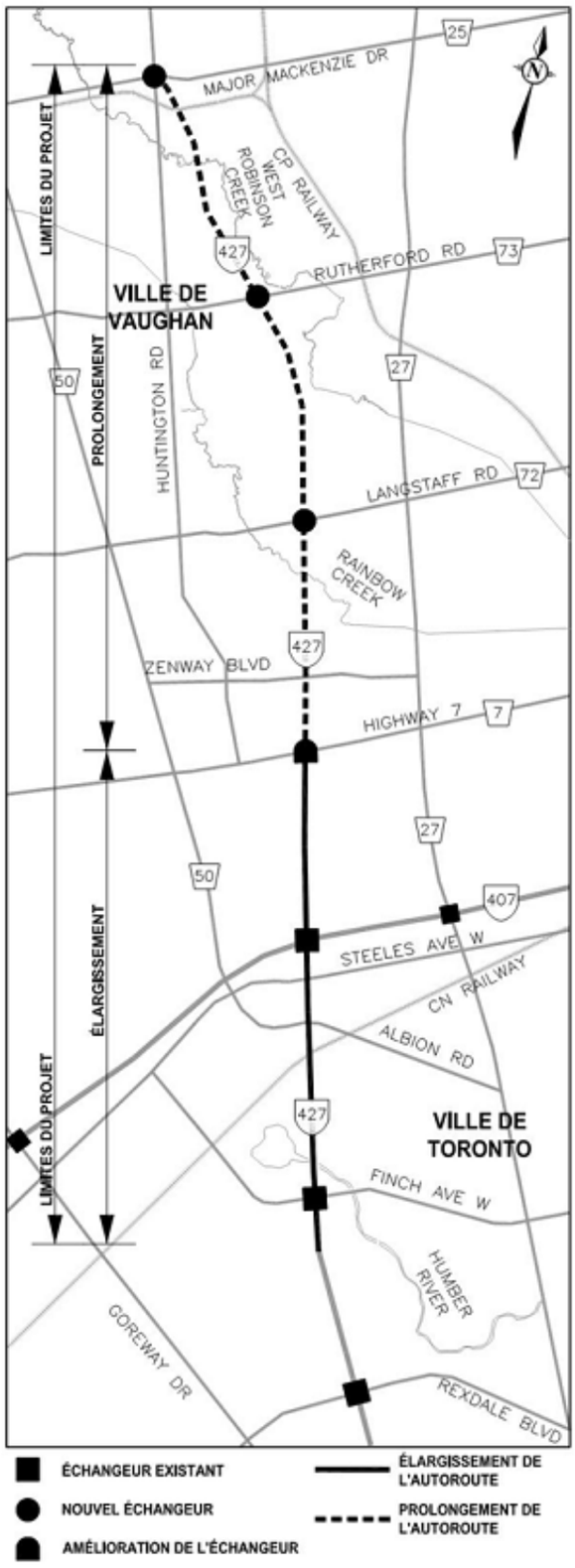
Prolongement de l'autoroute 427

LE PROJET

Le Ministère des transports (MTO) et Infrastructure Ontario ont choisi **LINK427** pour entreprendre la conception, la construction, le financement et l'entretien du projet de prolongement de l'autoroute 427 dans la Ville de Vaughan et de Toronto. *L'évaluation environnementale du corridor de transport de l'autoroute 427* a été approuvée par le Ministère de l'environnement et du changement climatique en novembre 2010. Le projet a été mis à jour par l'achèvement du Rapport d'étude environnementale sur les transports (REET) en 2016 dans le but d'ajouter de nouvelles voies au prolongement suggéré de l'autoroute 427. Un autre REET avait été achevé en 2013 pour l'élargissement de l'autoroute 427, entre Albion Road et la route 7.

Le projet de prolongement de l'autoroute 427 comprend la conception et la construction de ce qui suit :

- Un nouveau tronçon de 6,6 kilomètres de la route 7 à Major Mackenzie Drive comportant
  - huit voies de la route 7 à Rutherford Road;
  - six voies de Rutherford Road à Major Mackenzie Drive;
  - trois échangeurs à Langstaff Road, Rutherford Road et Major Mackenzie Drive;
  - nouvelles voies médianes réservées aux véhicules multioccupants à accès spécial tarifé (VMOT)".
- Une route de 4 kilomètres qui s'élargit au de l'avenue Finch à la route 7
  - passant de six à huit voies, de l'avenue Finch au sud de l'avenue Steeles;
  - passant de quatre à huit voies, de l'avenue Steeles à la route 7;
  - nouvelles voies médianes réservées aux véhicules multioccupants à accès spécial tarifé (VMOT)".



LE PROCESSUS

Ce projet est effectué conformément au processus de planification environnementale autorisé pour les projets en vertu des normes d'évaluation environnementale du Ministère des transports (MTO) pour les routes provinciales (2000), devenu maintenant une conception détaillée.

Des Centres d'information publique (CIP) se tiendront pendant toute la durée du processus de conception détaillée pour permettre au grand public d'évaluer et de commenter sur les détails du projet.

Les Rapports de conception et de construction (RCC) seront préparés pour élaborer le processus de conception détaillée, comprenant des enquêtes environnementales, la prise en compte d'effets environnementaux potentiels, les mesures d'atténuation proposées, les engagements envers les futurs travaux et la surveillance. Tous les RCC seront mis à disposition au grand public et aux agences lors d'une période d'examen de 30 jours. Des avis seront publiés dans les journaux locaux, sur le site Web du projet (www.427expansion.ca) et distribués par courrier à celles et ceux qui sont sur la liste de distribution du projet, pour leur signaler du début de la période d'examen et des emplacements où chaque RCC sera mis à disposition.

COMMENTAIRES

Nous aimerions recevoir vos commentaires à l'égard de ce projet. Si vous désirez obtenir des renseignements supplémentaires, fournir des commentaires ou faire partie de la liste de distribution du projet, veuillez contacter les

personnes ci-dessous ou visiter le site Web du projet à www.427expansion.ca.

Si vous avez des exigences en termes d'accessibilité pour participer à ce projet, veuillez contacter un des membres de l'équipe de projet ci-dessous.

M. Chris Tschirhart
LINK427
Directeur en charge de l'environnement
1 Royal Gate Blvd.
Woodbridge, ON. L4L 8Z7
Tel : 1-888-352-8085
Courriel : ask@427Expansion.ca

M. Aitor Arbesu Iglesias
LINK427
Directeur de projet
1 Royal Gate Blvd.
Woodbridge, ON. L4L 8Z7
Tel : 1-888-352-8085
Courriel : ask@427Expansion.ca

Les informations seront recueillies conformément à la *Loi sur l'accès à l'information et la protection de la vie privée*. Avec l'exception des renseignements personnels, tous les commentaires seront divulgués au public.

Des renseignements sont disponibles en français en composant 1-888-595-3152.

Ministry of Transportation
Major Projects Office
Central Region

159 Sir William Hearst Avenue
Building D, 7th Floor
Toronto, ON M3M 0B7
Tel.: 416-235-3749
Fax: 416-235-3576

Ministère des Transports
Bureau grands projets
Région du Centre

7e étage, édifice D
159, avenue Sir William Hearst
Toronto, ON M3M 0B7
Tél.: 416-235-3749
Téléc. 416-235-3576

Ontario

August 23, 2017

«Name»
«Organization»
«Address»

Dear «Greeting»:

Re: Notice of Commencement, Highway 427 Expansion Project
Detail Design and Construction
Ministry of Transportation

LINK427 has been selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to undertake the design, build, finance and maintenance of the Highway 427 Expansion project within the City of Vaughan and the City of Toronto.

The purpose of this letter is to notify you of project start-up and inquire if your community has an interest in this study. We also welcome the opportunity to meet with you to discuss this project.

This project is being carried out in accordance with the approved environmental planning process for projects under the MTO *Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000) and has now progressed to Detail Design. Design and Construction Reports (DCRs) will be prepared to document the Detail Design process, including environmental investigations, potential environmental effects, proposed mitigation measures, commitments to future work and monitoring. The DCRs will each be made available for a 30-day public and agency review period. Notices will be published in local newspapers, on the Project website (www.427expansion.ca) and distributed by mail to those on the project contact list to clearly identify the start and end dates of the review period, list locations where the DCR may be reviewed, and describe the process for submitting comments. Public Information Centres (PICs) will be held during the detail design process to allow an opportunity to review and comment on the project.

As part of the Environmental Assessments for the Highway 427 Expansion, a complete Archaeological Assessment was undertaken. LINK427 will follow all protocols as outlined in the Environmental Assessments regarding informing and contacting Indigenous communities regarding any archaeological artefacts that may be found as a result of construction activities.

Under the *Freedom of Information and Protection of Privacy Act* and the *Access to Information Act*, comments and information regarding this project, with the exception of personal information, will become part of the public record. If you have accessibility requirements in order to participate in this project, please contact the undersigned.

If you would like to provide comments, or if you require further information regarding this project, please feel free to contact me by phone at 416-235-4188 or by e-mail at Pauline.VanRoon@ontario.ca. In addition, if you are interested in meeting as a result of receiving this letter, please contact me to arrange a meeting at your earliest convenience.

Sincerely,
Ministry of Transportation

Pauline Van Roon
Head, Planning & Engineering

cc: C. Copeland - MTO Environmental Planner
A. Arbesu - LINK427

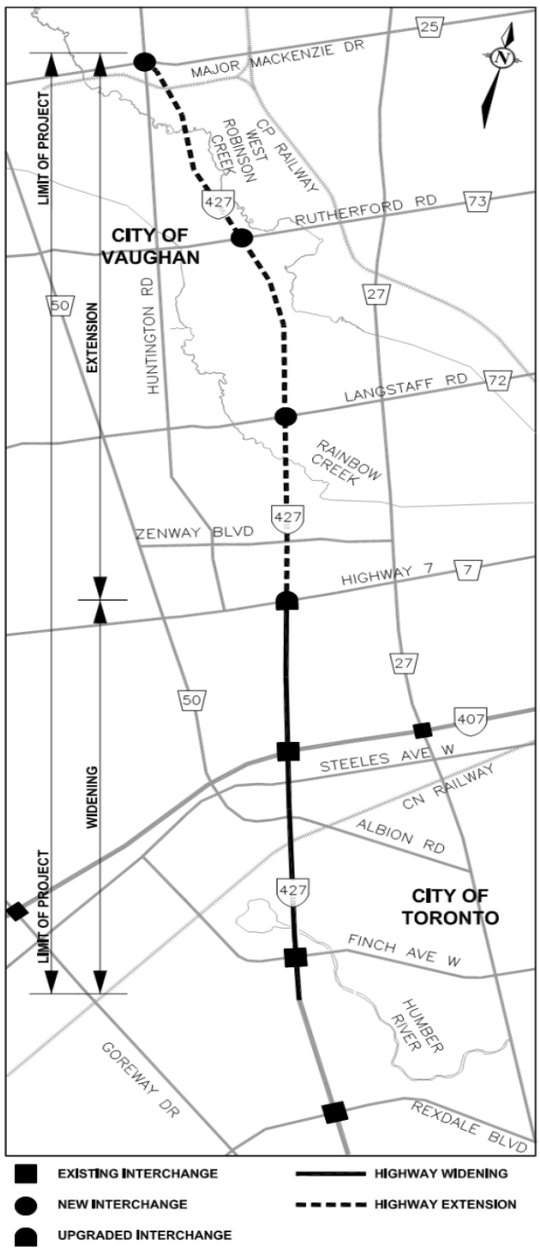
Encl.: Notice of Commencement

NOTICE OF PUBLIC INFORMATION CENTRE
HIGHWAY 427 EXPANSION PROJECT
DETAIL DESIGN AND CONSTRUCTION REPORTS

THE PROJECT

LINK427 has been selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to undertake the design, build, finance and maintenance of the Highway 427 Expansion project from Finch Avenue to Major Mackenzie Drive within the City of Vaughan and the City of Toronto.

The Highway 427 Transportation Corridor Environmental Assessment (EA) received approval from the Ministry of Environment and Climate Change (MOECC) in November 2010. The project was updated through completion of a Transportation Environmental Study Report (TESR) in 2016 to add additional lanes to the proposed Highway 427 extension. A separate TESR was completed in 2013 for the widening of the existing Highway 427 between Albion Road to Highway 7. This meeting is to introduce the construction works contained in the Design and Construction Reports (DCR #2 and DCR #3), and to provide agencies, interested groups, business representatives and members of the general public with an opportunity to review and comment on the design details, results of the consultation process, construction staging and environmental impacts and mitigation measures.



PUBLIC CONSULTATION

This first Public Information Centres (PIC) has been arranged for members of the project team to be available to discuss the project and answer any questions.

The first PIC is scheduled as follows:

Date:	**January 25, 2018**
Location:	**Element Hotel - Vaughan Southwest** **6170 Hwy 7, Vaughan** **Vaughan, Ontario**
Time:	**4:00 pm to 8:00 pm**

THE PROCESS

This project is being carried out in accordance with the approved environmental planning process for Group 'A' projects under the *MTO Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000). In accordance with MTO's Class EA, DCR #2 and #3 have been prepared and made available for public review.

COMMENTS

We are interested in hearing any comments that you may have regarding this study. If you wish to obtain additional information or provide comments, please consult the project website at: **www.427expansion.ca**. With the exception of personal information, all comments will become part of the public record. Comments on these DCR's can be provided by mail, e-mail, or online to:

Mr. Christopher Tschirhart
Environmental Director
LINK427
1 Royal Gate Blvd., Suite G
Woodbridge, ON L4L 8Z7
Phone: 1-888-352-8085

E-mail: ask@427Expansion.ca

Mr. Aitor Arbesu Iglesias
Project Director
LINK427
1 Royal Gate Blvd., Suite G
Woodbridge, ON L4L 8Z7
Phone: 1-888-352-8085

E-mail: ask@427Expansion.ca

If you have any accessibility requirements in order to participate in this project please contact one of the Project Team members listed above.

Information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* and the *Access to Information Act*. With the exception of personal information, all comments will be part of the public record.

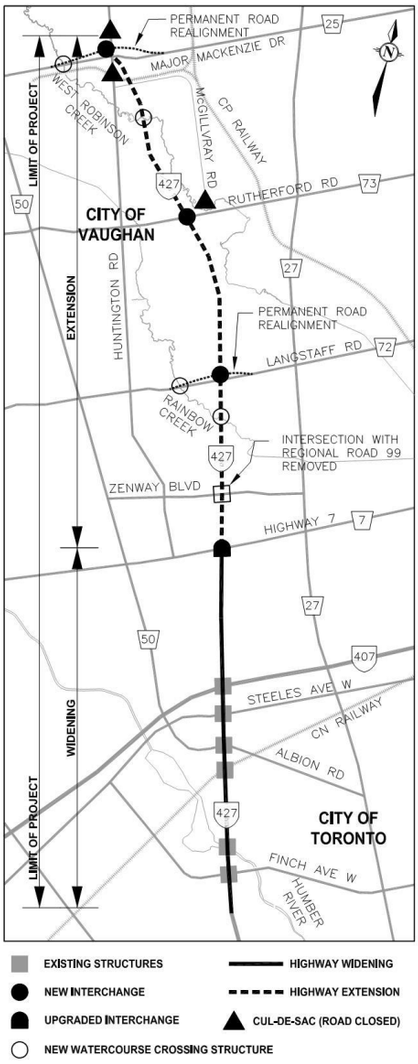
Des renseignements sont disponibles en français en composant 1-888-595-3152.

NOTICE OF PUBLIC INFORMATION CENTRE
HIGHWAY 427 EXPANSION PROJECT

THE PROJECT

LINK427 has been selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to undertake the design, build, finance and maintenance of the Highway 427 Expansion Project from Finch Avenue to Major Mackenzie Drive within the City of Vaughan and the City of Toronto.

The Highway 427 Transportation Corridor Environmental Assessment (EA) received approval from the Ministry of Environment and Climate Change (MOECC) in November 2010. The project was updated through completion of a Transportation Environmental Study Report (TESR) in 2016 to add additional lanes to the proposed Highway 427 extension. A separate TESR was completed in 2013 for the widening of the existing Highway 427 between Albion Road to Highway 7.



PUBLIC CONSULTATION

The first Public Information Centre (PIC) for this project was held in January 2018. **The second PIC is planned for May 22, 2018.** This second PIC will provide agencies, interested groups, business representatives and members of the general public with an opportunity to review and comment on the following elements of construction:

- Detours and staging at Langstaff Road and Major Mackenzie Drive;
- Finish grading and construction of interchange ramps at Langstaff Road and Major Mackenzie Drive;
- Construction of a new underpass at Langstaff Road;
- Construction of two new Highway 427 overpasses (one for northbound lanes and one for southbound lanes) at Canadian Pacific Railway Intermodal Terminal & McGillivray Road;
- Construction of a new overpass at Major Mackenzie Drive;
- Construction of two new Highway 427 overpasses (one for northbound lanes and one for southbound lanes) at West Robinson Creek;
- Replacement of the existing Major Mackenzie Drive culvert with a new overpass structure at West Robinson Creek;
- Replacement of the existing Langstaff Road culvert with an overpass at Rainbow Creek; and
- Construction of two new Highway 427 overpasses (one for northbound lanes and one for southbound lanes) at Rainbow Creek.

Members of the project team will be available to discuss the project and answer any questions. The construction elements will be documented in a DCR to be tabled for public review after this PIC.

The PIC is scheduled as follows:

Date:	**May 22, 2018**
Location:	**Element Hotel - Vaughan Southwest** **6170 Highway 7, Vaughan, Ontario**
Time:	**4:00 pm to 8:00 pm**

THE PROCESS

This project is being carried out in accordance with the approved environmental planning process for Group 'A' projects under the *MTO Class Environmental Assessment (Class EA) for Provincial Transportation Facilities* (2000). In accordance with MTO's Class EA, DCRs will be prepared with input from this PIC and will be made available for public review.

COMMENTS

We are interested in hearing any comments that you may have regarding this project. If you wish to obtain additional information or provide comments, please consult the project website at: **www.427expansion.ca**. Comments can be provided by mail, e-mail, or online to:

Mr. Aitor Arbesu Iglesias

Project Director
LINK427
1 Royal Gate Blvd., Suite G
Woodbridge, ON L4L 8Z7
Phone: 1-888-352-8085
E-mail: ask@427Expansion.ca

If you have any accessibility requirements in order to participate in this Public Information Centre please contact us at the coordinates above.

Information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* and the *Access to Information Act*. With the exception of personal information, all comments will be part of the public record.

Des renseignements sont disponibles en français en composant 1-888-595-3152.

Highway 427 Expansion Project
Public Information Centre (PIC)
Tuesday, May 22, 2018

Comment Sheet

Name (optional):_____
Email (optional):_____
Phone number (optional):_____

Do you have any concerns or comments regarding the Highway 427 Expansion Detail Design and Class Environmental Assessment Study? Please respond in the box below.

— It is nice to see that all "structures" are coming & designed well.

— Hwy. 427 Extension needs to connect to future "GTA West" or at least make the provisions to connect & extend.

— There is no mention of "GTA West" on PIC boards!

— Please provide transit way on "the highway extension"

— Pedestrian crossings on the "interchanges" will be nice where intersecting on Arterial Roads.

Please see back →

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and the Access to Information Act. With the exception of personal information, all comments will be part of the public record. If you have any accessibility requirements in order to provide comments, please notify one of the Project Team members at this event or email ask@427expansion.ca or call 1-888-352-8085. Des renseignements sont disponibles en français en composant 1-888-595-3152.

PTO

— Highway 427 ends abruptly on Major Mac. please provide smooth passage at the same time protecting opportunities to extend in future.

—

Highway 427 Expansion Project
Public Information Centre (PIC)
Tuesday, May 22, 2018

Comment Sheet

Name (optional):____ _____
Email (optional):____ _____
Phone number (optional):____ _____

Do you have any concerns or comments regarding the Highway 427 Expansion Detail Design and Class Environmental Assessment Study? Please respond in the box below.

- I am very pleased that MTO & LINK 427 team is proceeding with the project on schedule & providing us the opportunity to consult & input.
- Please consider car-pool lot on Major Mackenzie Road. This will help people to carpool!
- Glad to know that there is carpool lot on Longstaff Road. Please coordinate timeline with the Hwy 427 extension
- Highway 427 should end on a "Highway" & not on "Arterial Road".

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and the Access to Information Act. With the exception of personal information, all comments will be part of the public record. If you have any accessibility requirements in order to provide comments, please notify one of the Project Team members at this event or email ask@427expansion.ca or call 1-888-352-8085. Des renseignements sont disponibles en français en composant 1-888-595-3152.

Highway 427 Expansion Project
Public Information Centre (PIC)
Tuesday, May 22, 2018

Comment Sheet

Name (optional):_____
Email (optional):_____
Phone number (optional):_____

Do you have any concerns or comments regarding the Highway 427 Expansion Detail Design and Class Environmental Assessment Study? Please respond in the box below.

— Please consider extensive "provisions" where the Highway 427 extension is ending so there is no "traffic jams" at the terminus!

— Please consider "truck only lane" or provisions to connect CP Vaughan.

— All interchanges should have two left turn & two right turning lane.

— Glad to know that you are providing "BAT BOXES" & other measures for endangered species!

— All new structures are coming well & optimally designed.

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and the Access to Information Act. With the exception of personal information, all comments will be part of the public record. If you have any accessibility requirements in order to provide comments, please notify one of the Project Team members at this event or email ask@427expansion.ca or call 1-888-352-8085. Des renseignements sont disponibles en français en composant 1-888-595-3152.

June 7, 2018

RE: COMMENTS RECEIVED AT PUBLIC INFORMATION CENTRE

The purpose of this letter is to acknowledge receipt of your comments provided at the Highway 427 Expansion project Public Information Centre #2 on May 22, 2018, and to provide a response to these comments.

Please see the responses to each of your comments/questions provided in the table below.

1	Please consider carpool lot on Major Mackenzie Road. This will help people carpool.	The current EA and most recent TESR did not include for these facilities although the original EA did protect for a future Transitway Station/Carpool Lot at Major Mackenzie Drive. Although the current Highway 427 Expansion Project does not include any carpool lots, the ministry is proceeding with the design & construction of a carpool lot in the NW quadrant of Highway 427 & Langstaff Road under a separate contract.
2	Glad to know that there is a carpool lot on Langstaff Road. Please coordinate timelines with the Hwy 427 extension.	As noted above the current Project does not include the construction of the Langstaff carpool lot. The ministry will be constructing the carpool lot at Langstaff Road.
3	Highway 427 should end on a “highway” and not on “arterial road.”	The original EA did not include an extension of Highway 427 past Major Mackenzie Drive. In the future, if the province decides to move forward with the GTA West project an extension from the Highway 427 terminus at Major Mackenzie Drive will be provided north to the GTA West.
4	Please consider extensive “provisions” where the Highway 427 extension is ending so there is no “traffic jam” at the terminus.	The designed configuration of the terminus has been developed in accordance with the EA and TESR. The geometry and provisions have been designed in accordance with current MTO standards. In addition, a queue warning system will be installed to provide additional information to motorists as required.
5	Please consider “truck only lane” or provisions to connect CP Vaughan.	The current EA and TESR did not include provisions for a dedicated "truck only lane" or a connection to CP Vaughan. It is not anticipated that such provisions will be required.

6	All interchanges should have two left turn and two right turning lanes.	The Interchange off-ramps have been designed based on projected traffic volumes and the required turning movements.
7	Hwy 427 extension needs to connect to future “GTA West” or at least make the provisions to connect and extend.	The original EA and the current EA and TESR do not include the construction of an extension beyond Major Mackenzie Drive. However, the current design will be able to accommodate (with some re-configuration) a future connection to the GTA West if it is re-activated.
8	There is no mention of “GTA West” on PIC boards.	The original EA and the current EA and TESR do not include an extension to GTA West. The province has put the GTA West project on hold.
9	Please provide transit way on the highway extension.	This current Project does not include for the design and construction of the transitway but the 60m wide corridor will remain protected for future implementation of the transitway.
10	Pedestrian crossings on the “interchanges” will be nice where intersecting on arterial roads.	Pedestrian Crossings will be provided at all crossing roads as required.
11	Highway 427 ends abruptly on Major Mackenzie Dr. Please provide smooth passage at the same time protecting opportunities to extend in future.	The designed configuration of the terminus has been developed in accordance with the EA and TESR. The geometry and provisions have been designed in accordance with current MTO standards. The design allows for the future expansion northerly.

Under the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and the *Access to Information Act*, comments and information regarding this project, with the exception of personal information, will become part of the public record. If you have accessibility requirements in order to participate in this project, please contact the undersigned.

Yours truly,

Aitor Arbesu Iglesias
Project Director

cc: Paul Neals, Environmental Director – LINK427

1 Royal Gate Blvd.
Woodbridge, ON L4L 8Z7
1-888-352-8085 | 427expansion.ca

Appendix B: Agency Correspondence Table

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
Agencies	
Ministry of Natural Resources & Forestry – Aurora District Meetings from February – May 2018	
■ Ministry of Natural Resources & Forestry administrates the Species At Risk Act. Species at risk habitat exists within the confines of the project. Portions of this habitat exists within DCR #2.	■ BAT SAR Habitat within the confines of DCR #2 have been earmarked in the field and are protected. No removal of this Habitat area will occur until such time as the Species At Risk Permit is Approved by the Minister of Natural Resource and Forestry
■ Ministry of Natural Resources and Forestry is one of the review agencies for the administration of the Vegetative Restoration Framework and Vegetation Restoration Plan, An alternative process to formulate the Vegetation Restoration Plan has been agreed upon by LINK427, MTO and MNRF.	■ The alternative review process has been entered into with monthly review meetings and a three stage review process. The first draft of the VRP has been submitted for review by the Ministry, March 2018. The finalized VRP will be submitted in March of 2018. ■ LINK427 reviewed the current design in detail to minimize vegetation impacts at the valley crossings and presented the information comparing impacts on the valleys.
■ MNRF asked how a specific area adjacent to the fill slope was determined to be temporary.	■ LINK427 indicated that this was part of the grading limit and not part of the fill slope. It would be revegetated so it is a temporary impact area.
■ MNRF indicated that LINK427 designs increases fill volumes by 30%.	■ LINK427 indicated that footprint was the important part, not the volumes because the footprint reflects area of lost vegetation whereas the volume only adds height to that area and the height does not represent an impact.
■ MNRF indicated that the “valley form” was being affected by the fill introduced into the valley by the LINK427 design.	■ LINK427 indicated that regional flood levels are not affected by the LINK427 design when compared to the RCD. This has been demonstrated by the modelling, which takes into account the fill being introduced into the valley. Therefore, the additional fill volume has no adverse hydraulic affect.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
■ MNRF indicated that the issue was with the valley form, not the flooding/hydraulics. The valley form is the function of the structure length and more fill in the valley changes the valley form. MNRF indicated that it was not raised as an issue because the RCD spanned the valley.	■ LINK427 indicated that the 'valley form' was not raised as an issue previously and clarified that the EA bridges did not fully span the valleys and that agency meeting minutes from the EA (March 27, 2009) indicate that agencies (MNRF, TRCA) had accepted spans that were much smaller than where they ended up – and there was fill in the valleys required for those spans. In the case of the main West Robinson Creek crossing, the span discussed at all the meetings and accepted by the agencies was actually smaller than the current span of the LINK427 design.
■ MNRF noted that valley form' refers to the LINK427 design "throttling the valley", as stated in his e-mail comments. MH elaborated that assessing valley form entailed addressing how wildlife could be moved under the LINK427 designed spans, considering that the vegetation under the structures wouldn't survive etc.	■ LINK427 would revise drawings in keeping with MNRFS recommendations and submit along with the updated Table 2 evaluation.
■ MNRF requested to see an updated bridge memo.	■ LINK427 confirmed that it would be provided and worked with the CA to try and provide MNRF with the 2 m rise in bridge height that MNRF was requested.
■ With regards to Table 2, MNRF stated that the comparison should include the numbers, such as the amount of fill, openness ratio, etc.	■ LINK427 stated that the comparison to the RCD would remain in Table 2 with the addition of a comparison to the existing conditions.
■ MNRF enquired whether contents of Table 2 would be in the DCR.	■ LINK427 assured that they are in the DCR as well as the PIC boards with the disclaimer that the DCR will contain the details.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
■ MNRF enquired what changes would be made to Table 2. TRCA indicated that comparing existing conditions against, RCD, and LINK design would be more defensible. ■ MNRF indicated that they are in a good position to support the changes as presented, and to keep the CA involved in processes so they are aware.	■ LINK427 confirmed that they would remove %, adjust the comparison to show the EA, RCD and link design
Toronto and Region Conservation Authority Meetings from January – May 2018	
■ Toronto and Region Conservation Authority is one of the review agencies for the administration of the Vegetative Restoration Framework and Vegetation Restoration Plan, An alternative process to formulate the Vegetation Restoration Plan has been agreed upon by LINK427, MTO and TRCA. ■ Some relocation of utilities require permits from the TRCA. ■ In response to TRCA Polices regarding Stormwater TRCA was consulted broadly regarding both the hydraulics of the crossings (meeting October 10th 2017) at which point they stated within the meeting that they had no issues with the hydraulics and floodplain related impacts at all of the proposed crossings. ■ TRCA requested to further clarify what 'erosion setback' was used to size Rain-5 as it is noted that the meander belt was no used.	■ The alternative review process has been entered into with quarterly review meetings and a three stage review process. The first draft of the VRP has been submitted for review by the TRCA, March 2018. The finalized VRP will be submitted in March of 2018. ■ LINK427 and the appropriate utility companies will be obtaining these permits as required. ■ TRCA stated that in general there are no concerns from their part for the approach modifications discussed (treatment train as opposed to wet ponds). It was agreed LINK427 would supply them with a report for review. That was submitted in March. It was agreed that the approach to Stormwater Management by LINK427 is consistent with the Original Environmental Assessment. ■ LINK427 noted that the erosion allowance was determined based on a review of the existing planimetric form and local meander amplitudes. This was a slight departure from the geomorphological recommendations outlined within the EA. As part of the LINK427 design, the subject reach in the vicinity of Langstaff Road was

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
	assessed. The subject reach was relatively straight with limited evidence of adjustment, and local meander amplitudes up to 10 m were observed.
■ TRCA noted that there are a few increases to the Regional Flood lines that impact properties outside of MTOs ownership. If the increases are valid, TRCA asks LINK427 to explore all opportunities to reduce and impacts as a result of the proposed bridges.	■ LINK427 noted that in order to ensure that the fluvial geomorphological recommendations and terrestrial passage requirements are met at this crossing, the crossing structure at section has been updated with a CONCSPAN arch and a low flow channel has been added. The results show minor increases to the regional storm event that are not considered to be significant due to the steep slopes on either side of the channel and no adverse impact on private properties is expected. However, significant water level reductions compared to existing conditions for the more frequent storm events (2 yr-100yr) at multiple cross-sections upstream and one downstream of the proposed structure can be observed as a result of the update.
■ With regards to Rain-3, TRCA asks to confirm that proposed brush piles will not impact the flows or flood lines signifyingly. This has not been modelled, but could be if required.	■ LINk427 notes that brush piles have been modified to include a woody crown and root ball, which are relatively porous features. The brush piles are to be secured to the ground using duckbill anchors. LINK427 does not anticipate the features to significantly impact flood conveyance, given their small size and porous nature.
■ TRCA was additionally consulted on the proposed SWM and drainage approach in pre-consultation meeting on December 6, 2017. The overall approach for SWM was discussed.	■ LINK427 worked with the construction team and the crane company to determine how girders would be places and actual areas required, with a focus on minimizing the impacts.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
■ Rainbow Creek span reductions and the required construction area to be able to construct.	
■ TRCA requested drawings to show the final footprint comparison of the RCD vs. the LINK427 Design.	■ LINK427 provided drawings.
■ TRCA enquired if the pad for the crane at West Robinson Creek would be as close to the creek as indicated on the LINK427 design slide. TRCA requested that the pad be moved further back because the creeks are subject to more regular flooding in recent years, and the 2 year storm event is even more common.	■ LINK427 enquired what storm level the TRCA is recommending to design to, to which TRCA mentioned that there is no specific standard but something needs to be done to ensure that during a flood event the construction site does not erode into the river. LINK427 indicated that all pads will be engineered and certified.
■ TRCA summed up that more detail on the distance between the crane pads and the creek and any measures that will be in place to protect the watercourse should be shown.	■ LINK427 provided more detailed drawings including ESC measures. LINK427 also indicated that there are fewer impacts with the LINK427 design compared with the RCD.
■ TRCA requested for the refined information on hydraulic performances.	■ LINK427 indicated that the Hydraulic Performance is more refined than what was previously submitted and submitted the updated information. LINK427 discussed the comparison between the RCD and the LINK427 design and that all the flows were lower except for ROB-5 where a minor impact was noted (11cm increase over the RCD which resolved within 55 m upstream).
■ TRCA mentioned that issues with the geomorphology of Rainbow Creek are to be managed.	■ LINK427 explained that the offset protection in front of the bridge abutments will provide a permanent terrestrial passage area (must meet the minimum width requirement as per the MTO's requirements.)

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
■ TRCA mentioned they want confirmation of the areas where LINK427 states that there are no differences between the RCD and the LINK427 design. TRCA wants to see the offset protection measures as well as the comparison.	■ LINK427 provided an addendum to the memo with more detail to demonstrate the comparison between the RCD and the LINK427.
■ TRCA asked about the terrestrial passage in the LINK427 design to ensure it is no less than MTO guidelines.	■ LINK427 indicated that passage requirements will be maintained and the channel was well carved into the till and the creeks will not widen out over time.
■ TRCA mentioned that at ROB-5 vegetation will not survive below the bridge to control the creek meander and this could result in the loss of wildlife passage.	■ LINK427 committed to using rock in the design of offset protection.
■ TRCA noted that an area of concern for West Robinson Creek is that pier coming close to the creek requiring bank protection and offset protection.	■ LINK427 indicated once vegetation is removed, impacts on creek channel will be minimal, less than what would occur with alluvium channels.
■ TRCA noted due to design changes, the comparative evaluation results need to be updated.	■ LINK427 updated and provided comparison.
■ LINK427 demonstrated that with either design, the bridge will block light and moisture causing permanent die-off.	■ The LINK427 design does not introduce any additional permanent vegetation impacts.
Municipalities	
City of Vaughan (CoV) Review of 50% Design Package (4, 4a, 5, 5a)	
■ CoV requested a minimum coverage of 2.1 m under the stream bed at Langstaff Road Underpass, compared to the 1.8m shown on the drawings.	■ Link complied with request.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
■ CoV requested that the project's design allow for future trail crossings identified in the Vaughan Pedestrian and Bicycle Master Plan trail network.	■ Link confirmed the design of the structures do no preclude the installation of the future trails.
■ CoV requested if the Langstaff Road culvert design could allow for embedded conduits and junction boxes for lighting.	■ The culvert comes in pre-cast sections and therefore the embedded conduits are not feasible. Future lighting work by the City can be surface mounted on the structure.
■ CoV asked if surface treatment (concrete pavement) could be used within the under structure crossings instead of vegetation & gravel.	■ The EA did not include for this to be constructed.
■ CoV requested bike lanes to be incorporated during staging.	■ Bike lanes have been incorporated into construction staging
■ CoV requested various structure, multiuse path and sidewalk dimensions.	■ Design dimensions are in conformance with those outlined in the Project Agreement.
York Region (YR) Review of 50% Design Package (4, 4a, 5, 5a)	
■ YR noted that raised cycle tracks on both sides of the roadway are preferred instead of bike lanes adjacent to traffic.	■ Bike lane locations are in conformance with Project Agreement.
■ YR suggested having 50 mm and 75 mm conduits on both sides of overpass at CPR/McGillivray.	■ Suggestion noted.
■ YR raised concern about construction at Baron's street which may occur at the same time as YR contract 16-104.	■ Link will work together with YR to coordinate.
■ YR requested bicycle height rail on both side of the Major Mackenzie over West Robinson Creek bridge.	■ Project Agreement stipulates that there is a multi-use path on the south side only.
■ YR had comments on multiple dimensions on the Major Mackenzie structures.	■ Link confirmed that bridge dimensions are as per Project Agreement.
■ YR has requested speed reduction on on-ramps to facilitate pedestrian and cyclist crossings.	■ Link confirmed speed limits are as per Project Agreement for on ramps.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
DCR Overview Meeting – Meeting on May 15, 2018	
■ Representatives from: ■ York Region ■ City of Vaughan	
■ Is utility relocation work underway?	■ Enbridge on Zenway is complete. Others are gearing up but haven't started. Toronto Hydro has started. C. Need presence on site as it's in the vicinity of York Region infrastructure.
■ What is the timing for completion of work at Langstaff interchange?	■ 2020.
■ What level of consultation did you go through with CP Rail?	■ Preliminary design brought to them in November 2017. MTO proceeding with obtaining permit for structures.
■ Clarification on pedestrian and cyclist paths on Major Mackenzie Dr Crossing over West Robinson?	■ Pedestrian on north side sidewalk and multi-use path on south side (cyclist and pedestrian – 3.5 m).
■ Combining DCR 3 and 4?	■ Progressing as if it will be one DCR – DCR 3. Won't be making reference to a specific DCR at the PIC to avoid confusion.
■ When will Huntington Rd closure have a date?	
■ Where will Huntington closure begin?	■ Date TBC. Traffic analysis needs to be completed.
■ When will overpass structure be done?	■ North of MMD.
■ C. Need to discuss plans for old infrastructure at Hwy 427 overpass and MMD. MTO in discussion with York Region. There will be a gate on the overpass that will be implemented with the MTO.	■ After closure, this will start.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
Potentially Interested Stakeholders	
Vaughan Bicycle User Group (BUG)	
The proposed 427 Expansion will be crossing several existing vital links within the industrial and commercial areas of West Vaughan. Several nature trails also exist in the area and will be affected by the proposed path of the 427. These links and trails are well used by cyclists at the present time and measures need to be taken to facilitate the continued safety of the users or to enhance it. The BUG would like to request that space for dedicated bicycle lanes be included for each of the crossings over or under the proposed 427 path. Provisions must be implemented now, even where no cycling facilities currently exist to avoid creating bottlenecks or obstacles for cyclists in the future. We know the Vaughan Active Transportation Plan updated in 2012 includes cycling infrastructure at these crossings. We heard they will be completed before 2031. Cyclists prefer separate cycling facilities such as cycle tracks. We need a minimum of 3.5m boulevard space to accommodate a 1.5m sidewalk and 1.5m cycle track plus buffer on each side of the boulevard. Sidewalks should be a minimum 2m on the structure if we have road bike lanes. Again, we need the crossing platform to include these spaces now to prevent future restrictions. The Vaughan Active Transportation Plan shows several trails crossing the proposed path of the Highway 427 Expansion. Therefore, we request the 427 crossing structures are built to include future trail crossings at locations noted below. Typically, these crossings trails are 3m wide plus a minimum of 1.5m side clearance on both sides.	■ Draft response has been prepared and is being reviewed.

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
Minimum clear height is 3m. Specifically we need the following: • Please allow for an underpass crossing north of Rainbow Creek; • A trail is proposed to connect to the south side of Langstaff Road at approximately Sta. 9+400. Ensure that works at Langstaff include a trail connection. Please allow for a trail connection beneath the proposed Langstaff ramps at Sta. 9+520. • A trail is proposed in the hydro corridor which will require the following modifications: ➢ Sta. 10+400. Please ensure that works at Langstaff include ➢ provisions for a trail connection; ➢ Between Sta.12+600 and 13+300 A trail crossing is desired across highway 427; ➢ West of Sta. 9+760 A crossing will be required at Rutherford Road; • A trail is proposed adjacent to the south side McGillvary Road. Please ensure that the proposed overpass width at Sta. 16+050 allows for a trail crossing underneath. Vaughan BUG would appreciate being kept informed of this EA progress directly and would welcome any further correspondence on this project. Since 2014, the Vaughan BUG's main mission is to promote cycling as an effective and a sustainable transportation option, encourage safe cycling, increase driver's awareness and seek improved cycling facilities and infrastructure in Vaughan. Thank you for your time and consideration.	

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
York Region Cycling Coalition	
We have a brief, but important comment based on the information presented. We did not see any reference to the implementation of safe cycling infrastructure at the new 427 interchanges. The 400 series highways are huge barriers to connectivity in the City of Vaughan and York Region. The crossing points over the 407, 400 and 404 are dangerous and do not adequately consider safe, active transportation facilities. The Province has an opportunity not to make the same mistakes with the new 427 interchanges. We do not want another impediment, blocking cyclists from traversing to Peel Region. Can you please confirm that these initial designs will ultimately consider and incorporate safe cycling infrastructure? The York Region Cycling Coalition is a significant coalition of cycling clubs with a collective membership of over 2,500 members. The YRCC has a simple purpose of promoting safety amongst cyclists and motorists and improving cycling in York Region.	Thank you for bringing to our attention the concerns of the York Region Cycling Coalition. LINK 427 has made specific design accommodations for cyclists at the major arterial crossings of Highway 427 in York Region. These accommodations are designed to ensure that the level of protection for cycling infrastructure remains consistent before, during, and after construction of the new interchanges. The design accommodations are as follows: Langstaff – There are bike lanes on both sides. Bicycle crossing locations are also designed at this intersection. Major Mackenzie Drive – There will be a sidewalk on the north side and a multi-use path on the south side. Rutherford – Structure allows for future expansion to a 6-lane road with a multi-use path and sidewalk on the boulevard. Zenway – Will have a sidewalk on both sides but not a dedicated bike lane. Highway 7 Bridge structure – Is being widened with approximately 300 mm wider shoulders. There are no dedicated bike lanes, however the structure has incorporated a new parapet wall with bicycle rail on top. In addition, LINK427 would like to inform you of our plan for managing cyclists and maintaining existing infrastructure during construction staging. The methods that we will use will depend on the type of closure and location. For short duration traffic impacts (temporary lane restrictions) on Regional Roads, if there are existing bike lanes or sidewalks, we would ensure that cyclists and pedestrians have either a clear, delineated path

Highway 427 Expansion Project Agency Comments received as a result of consultation requests and resulting meetings between the Organizations and LINK427 Staff	Highway 427 Expansion Project LINK427 Responses
	through the work zone or lane restriction, or are escorted through the work area by traffic control personnel. For long duration traffic impacts (detours) on Regional Roads, we are required to ensure that if the road has existing bike lanes or sidewalks, the detour will be designed with the same provisions. We trust that this is good news for you and your coalition and addresses your concerns. Thank you again for your constructive input.

Appendix C: Public Information Centre Display Materials

WELCOME TO PUBLIC INFORMATION CENTRE #2

Detail Design and Class Environmental Assessment Study for the Highway 427 Expansion Project

At this PIC, you will have a chance to review:

- An overview of the Project
- The steps in the Environmental Assessment (EA) process
- The Detail Design and Construction Activities
- The Existing Conditions in the Project Lands
- Potential Environmental Impacts and Proposed Mitigation

This information will be documented in a Design and Construction Report (DCR), which will be made available for public review as part of the Environmental Assessment process.

HIGHWAY 427 EXPANSION

Project Description

The overall detail design scope of the Highway 427 Expansion Project includes the following:

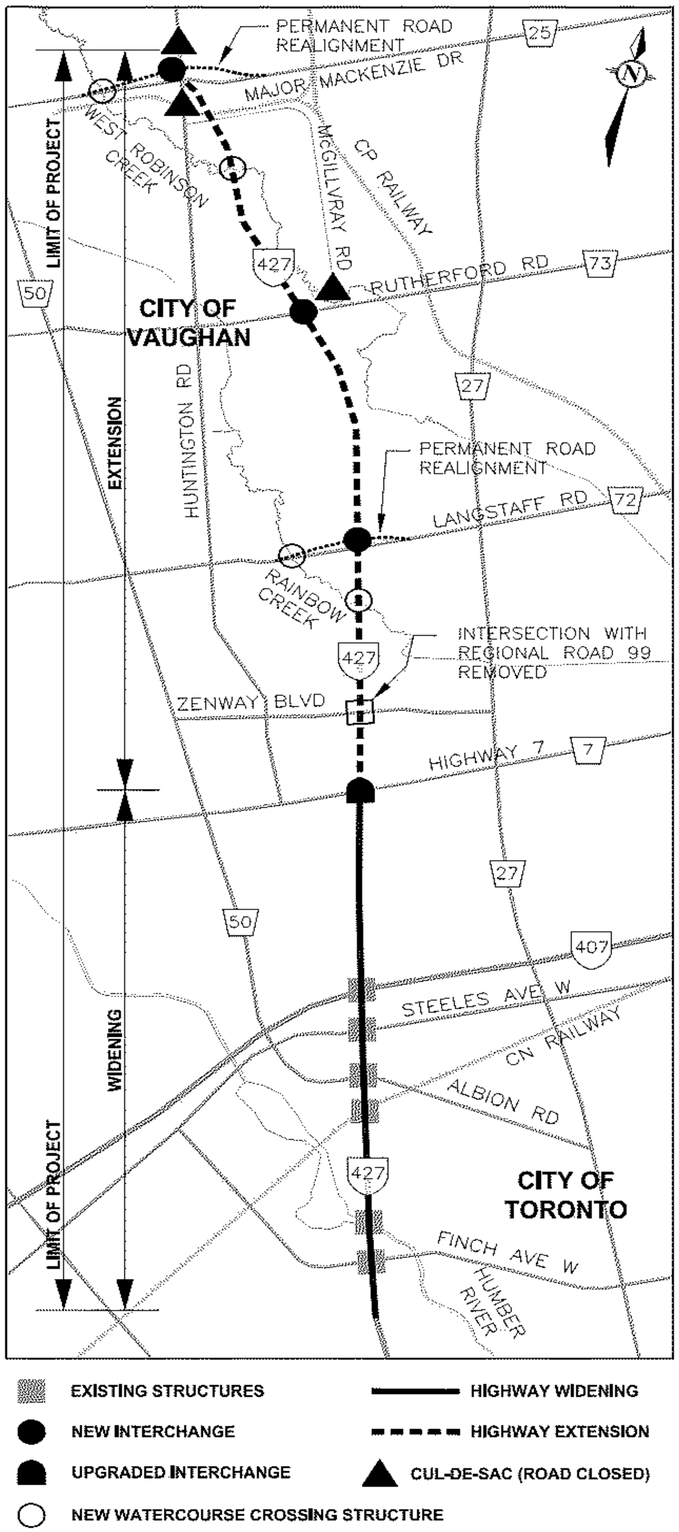
4.0 km Highway Widening from Finch Avenue to Highway 7:

- from six to eight lanes between Finch Avenue to south of Steeles Avenue;
- from four to eight lanes, from south of Steeles Avenue to Highway 7; and
- new median managed lanes.

New 6.6 km Highway Extension from Highway 7 to Major Mackenzie Drive with:

- eight lanes from Highway 7 to Rutherford Road;
- six lanes from Rutherford Road to Major Mackenzie Drive;
- three new interchanges (Langstaff Road, Rutherford Road and Major Mackenzie Drive); and
- new median managed lanes.

Project Limits



HIGHWAY 427 EXPANSION

Environmental Assessment Process – Preliminary Design

This project is based on the following previous Preliminary Design and Environmental Assessment (EA) studies that together document the key elements of the Project:

- **427 Transportation Corridor Environmental Assessment Report (January 2010)**, Group 'A' Class EA for the extension of Highway 427 from its existing terminus at Highway 7 to Major Mackenzie Drive.

- **Highway 427 from Albion Road to Highway 7 Preliminary Design and Class EA Study Transportation Environmental Study Report (November 2013)**, Group 'B' Class EA for the widening of the existing Highway 427 from 1.5 km south of Albion Road to Highway 7.

- **Transportation Environmental Assessment Report, Highway 427 Extension Widening From Highway 7 to Major Mackenzie Drive (January 2016)**, Group 'B' Class EA to widen the planned extension of Highway 427 from Highway 7 to Major Mackenzie Drive.

Individual EA Highway 427 Extension (Highway 7 to Major Mackenzie Drive)
January 2010

→

TESR Widening of Highway 427 Extension (Hwy 7 to Major Mackenzie Drive)
January 2016

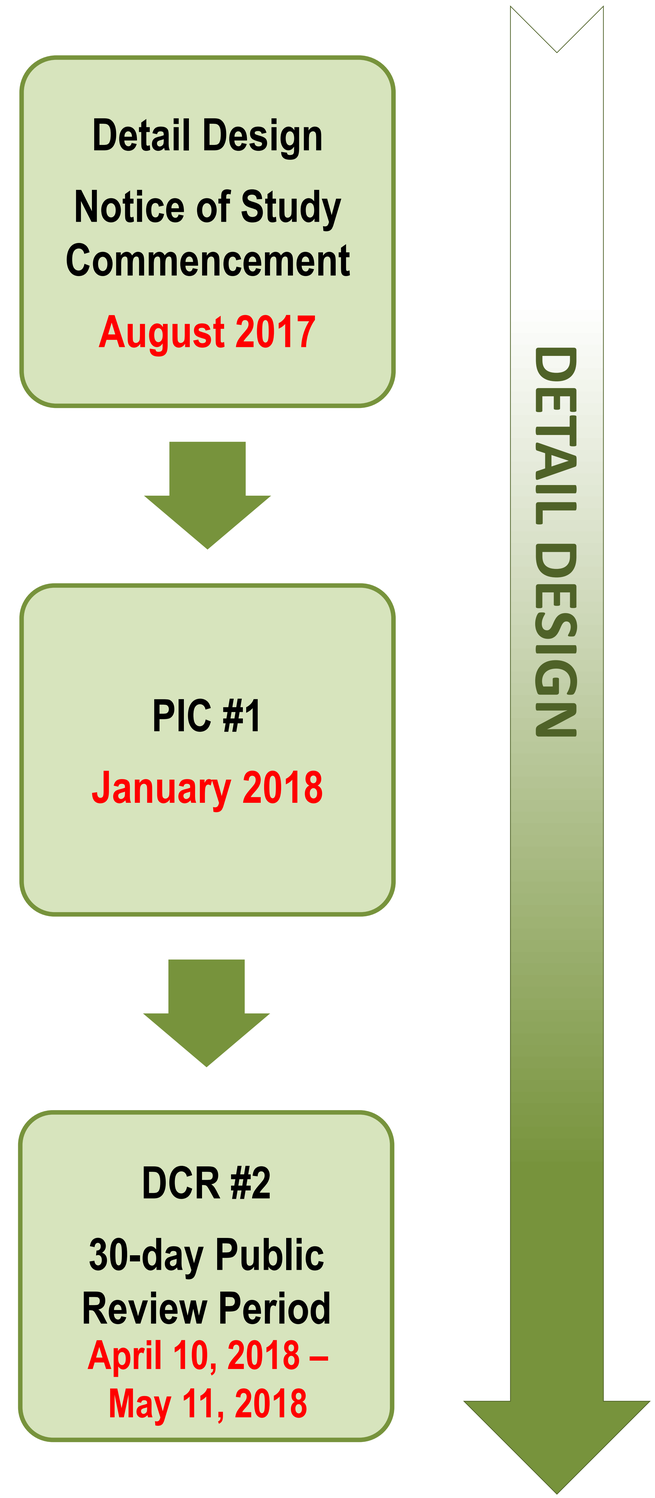
+

TESR Widening of Existing Highway 427 (Albion Road to Highway 7)
November 2013

PRELIMINARY DESIGN

Environmental Assessment Process – Detail Design

- This project is being carried out in accordance with the approved environmental planning process for Group 'A' projects under the *MTO Class Environmental Assessment for Provincial Transportation Facilities* (Class EA).
- Based on the Design-Build / AFP Approach to this project, Detail Design will progress in a staged manner making it necessary to document the process in more than one Design and Construction Report (DCR).
- A series of DCRs are being prepared to document the Detail Design process for the various project components. DCR #1 was prepared for advanced clearing and filed for public review in November, 2017.
- PIC #1 was held in January, 2018 and documented the works in DCR #2, which included:
  - Construction of the widening of Highway 427 between Finch Avenue to Highway 7;
  - Extension of the existing Highway 427 from Highway 7 to Major Mackenzie Drive;
  - Construction of three new Highway 427 interchanges at Langstaff Road, Rutherford Road, and Major Mackenzie Drive
- DCR #2 was filed for public review from April 10, 2018 to May 11, 2018.

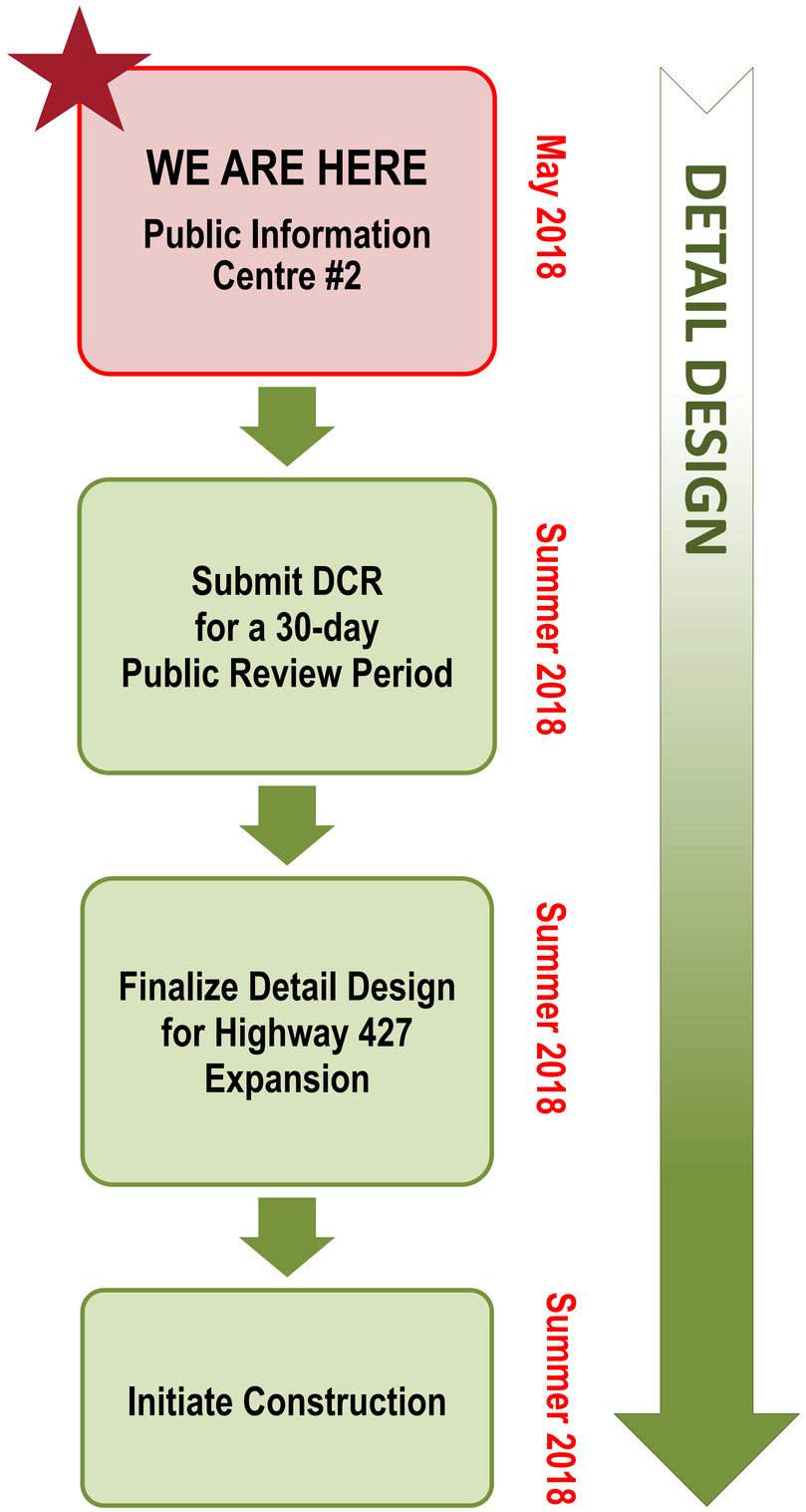


Environmental Assessment Process – Detail Design

This PIC presents the Detail Design process that will be documented in an upcoming Design and Construction Report (DCR) which will include the following:

- An overview of the project and the EA process;
- A summary of consultation activities undertaken;
- A detailed description of the undertakings;
- A description of potential effects on the environment, as well as proposed mitigation measures; and
- Commitments to future work and monitoring.

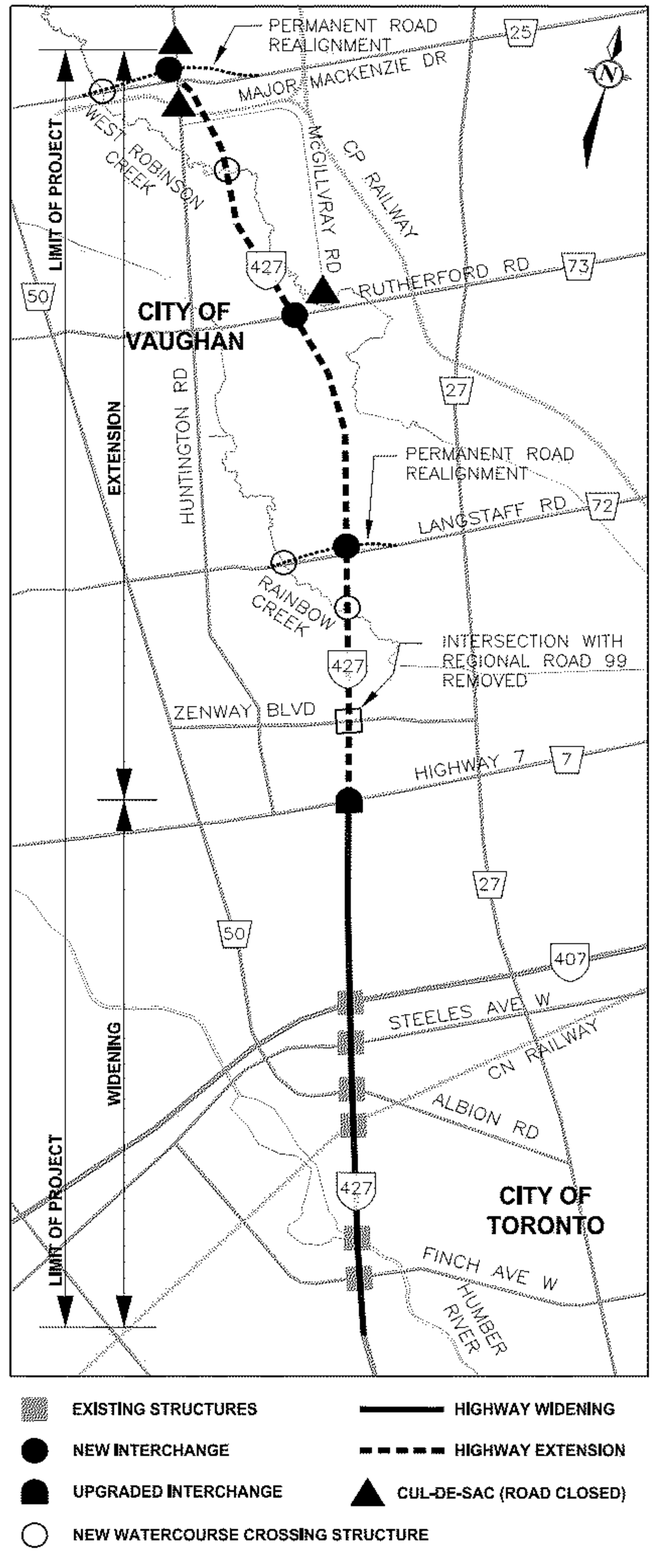
- In accordance with the MTO Class EA, the next DCR will be submitted for a 30-day public review period in Summer 2018.
- The detail designs for the construction works addressed by the next DCR will be finalized taking into consideration comments received.
- Construction will commence on the works contained in the next DCR in Summer 2018.



Overview of the Proposed Construction Works

The following is an overview of the proposed construction works presented as part of this PIC:

- The construction of new Highway 427 bridges (one for northbound lanes and one for southbound lanes) over Rainbow Creek.
- Replacement of the existing Langstaff Road culvert with a new precast concrete arch structure over Rainbow Creek.
- Construction of new interchange bridge structure at Langstaff Road including detours, staging, grading and construction of interchange ramps using the previously constructed components built in DCR #2, including the new alignments.
- Construction of new Highway 427 bridges (one for northbound lanes and one for southbound lanes) over West Robinson Creek.
- Construction of new Highway 427 bridge structures (one for northbound lanes and one for southbound lanes) at CPR & McGillivray Road.
- Replacement of the existing Major Mackenzie Drive culvert with a bridge over West Robinson Creek.
- Construction of a new interchange bridge structure at Major Mackenzie including detours, staging, grading and construction of interchange ramps using the previously constructed components built in DCR #2, including the new alignments.



Detail Design Refinements and Bridge Design Optimization

- The Ministry of Transportation's (MTO) Highway 427 Extension Corridor Environmental Assessment Report (2010) identifies the potential that aspects of the project may change when it advances from Preliminary Design to Detail Design. These changes reflect the typical process of design refinement as more specific information is incorporated, findings are updated and refined, and construction-related requirements are considered.

- One such opportunity identified by LINK427 was the chance to optimize the hydraulic performance of the bridges. It was found that the hydraulic criteria related to the flow rates of the watercourses had been updated by the Toronto and Region Conservation Authority after completion of the Preliminary Design in the EA. This resulted in lower flow rates in Rainbow Creek and West Robinson Creek and a consequent reduction in floodplain elevations compared to those contemplated with the original bridge structures from the Preliminary Design.

- Therefore, lower flow rates had important implications for the span length of the bridges over Rainbow Creek and West Robinson Creek and created an opportunity for LINK427 to engineer the optimal span lengths for the bridges. As a result, it was possible to refine the Preliminary Design bridge structures and reduce the overall bridge length to match the hydraulic needs while still meeting all of the project requirements.

- Based on the LINK427 refinements, the following optimizations to the watercourse crossings have been made as part of the Detail Design:
  - Highway 427 crossing over Rainbow Creek – optimized span length
  - Langstaff Road crossing over Rainbow Creek – optimized span length and structure type
  - Highway 427 crossing over West Robinson Creek – optimized span length
  - Major Mackenzie Drive crossing over West Robinson Creek – optimized span length

- In addition, the opportunity was found to optimize one of the new interchanges as part of the Detail Design:
  - Major Mackenzie Drive Interchange – combination of two structures into one

- Each of these Detail Design optimizations identified above are discussed further in the display boards to follow together with the other components included in the DCR.

HIGHWAY 427 EXPANSION

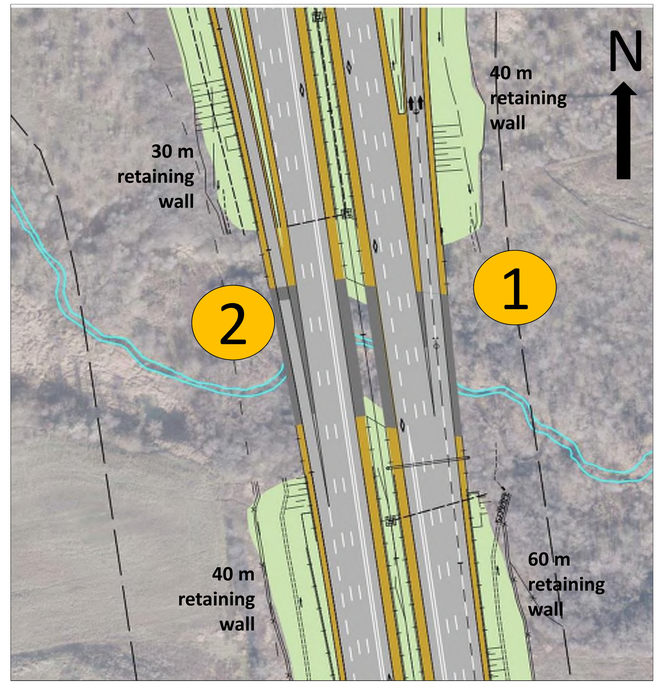
Highway 427 Crossing Over Rainbow Creek

Structure for Northbound Lanes: 1

- Single span bridge
- Total length of 49.4 m, with a height of 5.5 – 6 m and a width of 34.6 m
- 1 Median Managed Lane and 3 General Purpose Lanes (GPL)
- 2 lane off-ramp to Langstaff Road

Structure for Southbound Lanes: 2

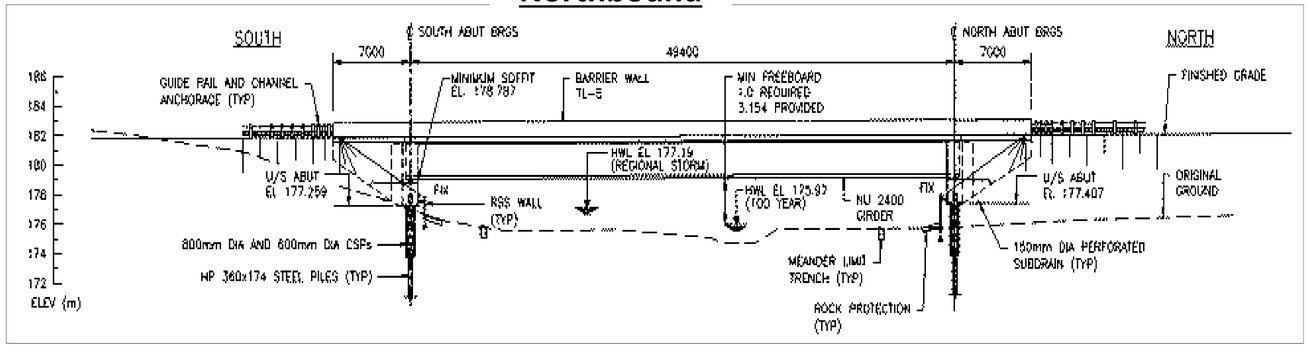
- Single span bridge
- Total length of 47.7 m, with a height of 5.5 – 6 m and a width of 32.2 m
- 1 Median Managed Lane and 3 General Purpose Lanes (GPL)
- 1 lane on-ramp from Langstaff Road



Detail Design Optimization

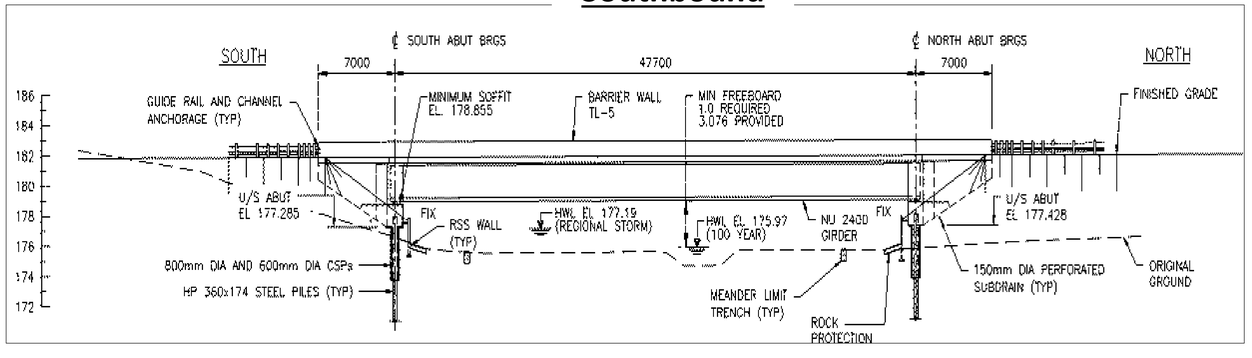
- Compared to the preliminary design, the LINK427 detail design results in approximately a 59% reduction in span length and a reduction from a three span bridge to a single span (for each northbound and southbound structures).
- The LINK427 detail design reduces the Openness Ratio (OR) relative to the preliminary design by approximately 32%, but it still exceeds the required minimum design criteria provided in the EA by 500% (for the ultimate 10-lane scenario).
- The LINK427 detail design provides the same bridge height as the preliminary design, which exceeds the EA design criteria of 3 m height for wildlife passage by 66% - 100%.
- Since the LINK427 detail design exceeds the minimum OR and minimum height design criteria, it will maintain the function for the movement of all animals through the valley, including large mammals (e.g. White-tailed Deer).
- Retained Soil Systems (RSS) walls are provided along the corners of the structure and extend back parallel to the roadway 30-60m. This is done to preserve the natural environmental as this is a bat sensitive area.
- As part of the consultation process, LINK427 continues to engage the MTO and the MNRF in discussions regarding the detail design of this crossing. Final details will be provided in the next DCR that will be made available for public review as part of the EA process.

Northbound



ELEVATION
NTS

Southbound



ELEVATION
NTS

Highway 427 Crossing Over Rainbow Creek

VEGETATION

Existing Conditions

- Vegetation in the Rainbow Creek valley is classified as Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3) dominated by non-native willow trees, Green Ash and Manitoba Maple (an invasive species). The understory of this common vegetation community type is dominated by Buckthorn (an invasive species) and much of the ground layer is dominated by the highly invasive Dog-Strangling Vine.
- Vegetation communities on the tablelands approaching the valley include Mineral Cultural Thicket (CUT1) and Dry-Moist Old Field Cultural Meadow (CUM1-1), both of which are very common vegetation communities in Ontario and both also contain a high proportion of non-native species.
- No regionally rare flora species were documented by LINK427 at this location.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- The deciduous forest at the Rainbow Creek crossing is identified as SAR Bat Habitat and specific mitigation requirements will be applied to this restoration area under the ESA Overall Benefit Permit. This includes a number of measures detailed on the following board as well as vegetation specific measures such as:
  - Limitation of vegetation removal;
  - Woodland restoration; and
  - Edge management.

HIGHWAY 427 EXPANSION

Highway 427 Crossing Over Rainbow Creek

WILDLIFE AND SPECIES AT RISK

Existing Conditions

- Wildlife documented at this crossing are primarily common, tolerant, urban-adapted and open-country species which is expected given the habitat conditions present.
- The forested habitat at Rainbow Creek crossing has been identified as habitat for three bat Species at Risk and therefore an Overall Benefit Permit from the MNRF has been acquired to address impacts to these species and their habitat.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites presented on a separate board, the following site specific mitigation measures will be applied:

- Clearing and grubbing activities will be conducted outside of the SAR bat maternity roosting season (March 31 to October 1).
- LINK will adhere to all of the conditions in the Overall Benefit Permit issued by the MNRF for SAR Bats, including but not limited to:
    - Works within the Bat Species habitat shall be conducted between October 1 and March 31, of any year that the permit is in effect;
    - Overall Benefit Activities will be implemented according to the permit, including habitat enhancement (i.e., restoration of woodland habitat), installation of habitat structures (i.e., bat boxes and BrandenBarkTM structures) and all associated monitoring / reporting.

Highway 427 Crossing Over Rainbow Creek

FISH AND FISH HABITAT

Existing Conditions

- Rainbow Creek is a natural watercourse with good water quality flowing through an alluvial floodplain with well-defined, but moderately unstable banks. Nutrient loading is the primary source of pollution to this watercourse, as Rainbow Creek is bordered by row-crop agriculture, forest and industrial areas.
- The watercourse meanders naturally, with a predominately flat morphology (80%) with occasional riffles (20%). The substrate is silty-sand, with sand, gravel, cobble and boulder in the riffle sections.
- Rainbow Creek has low to moderate sensitivity habitat, with undercut banks, boulders, cobbles, and aquatic macrophytes providing adequate instream cover. Riffles provide suitable spawning and nursery habitat, supporting essential life-cycle functions for common, tolerant warmwater bait and forage fish.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- All near-water construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty fencing for all disturbed areas of the embankments that drain to the watercourse.
- LINK427 will follow the erosion and sediment control measures to prevent/control potential for erosion and sediment caused by their construction methods and operations so as to meet all legislative requirements.

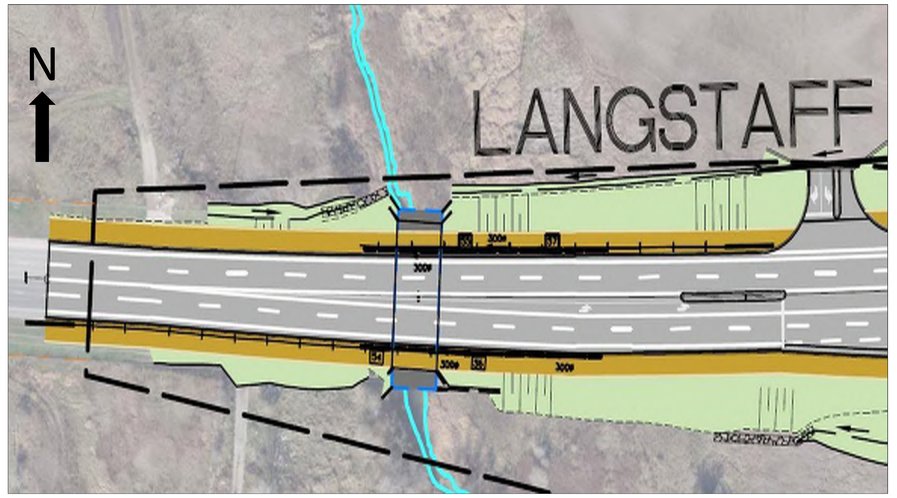
- If any temporary dewatering of the near stream construction zones is required in order to construct bridge or retaining walls, appropriate energy dissipation and settling/filtration measures will be used for discharge to ensure no erosion or sediment release occurs in the watercourses. If temporary dewatering of the near stream construction zone is required, dewatering will be discharged through a filter bag/splash pad located at least 30 m from the watercourse.
- Additional erosion protection along the crossing walls will be included in the design to protect against future channel meandering.

HIGHWAY 427 EXPANSION

Langstaff Road Crossing Over Rainbow Creek

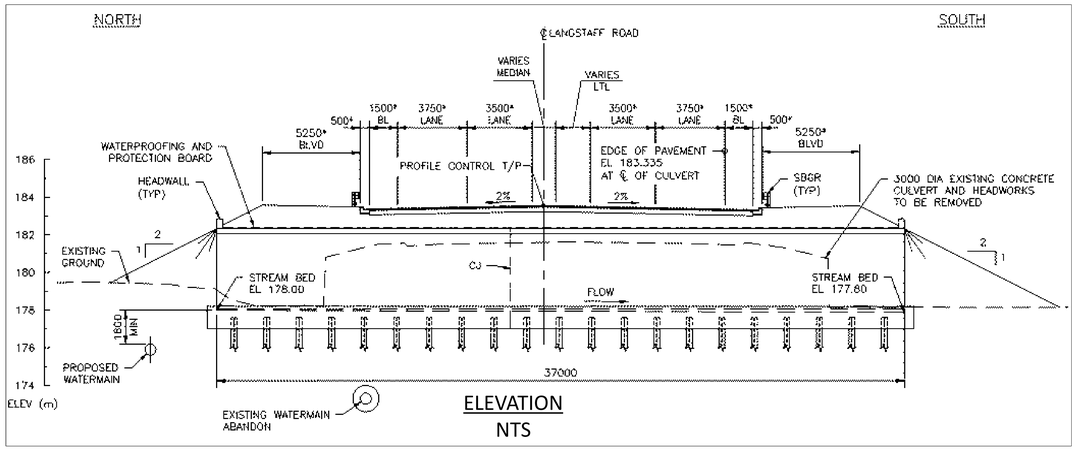
Precast Concrete Arch Structure

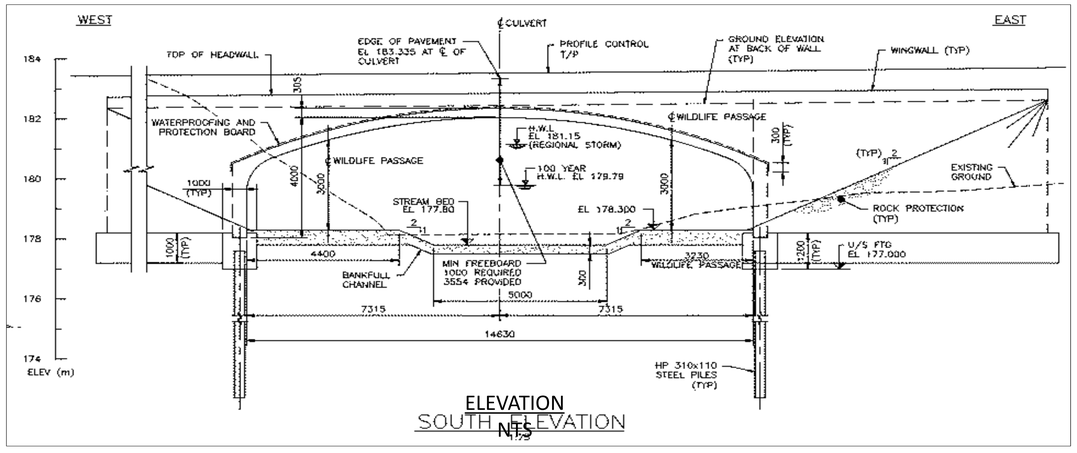
- Structure will accommodate four lanes (two lanes in each direction).
- Replace existing 3 m diameter Corrugated Steel Pipe (CSP) culvert with a precast concrete arch structure with a width of 14.63 m (reduced from 72 m), and a height of 3 - 3.5 m (reduced from 4.5 - 5 m).
- This structure, once constructed, will maintain cyclist access on Langstaff Road. This structure will also accommodate pedestrian access by means of a graded boulevard.
- The EA provided a 2 span bridge, 72 m long, to replace the existing CSP culvert. The design has been resized to accommodate the Regional Storm event and includes two wildlife passages. The proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities.



Detail Design Optimization

- Compared to the preliminary design, the LINK427 detail design results in approximately an 80% reduction in span length and a change from two spans to a precast concrete arch structure.
- The LINK427 detail design reduces the Openness Ratio (OR) relative to the preliminary design by approximately 89%, but it still exceeds the required minimum design criteria provided in the EA by 133%.
- The LINK427 detail design reduces the bridge height compared to the preliminary design by approximately 1.5 m, but meets the preliminary design criteria of 3 m height for wildlife passage and increases the span width compared to the existing culvert (CSP) by 387%.
- Since the LINK427 detail design exceeds the minimum OR and meets the minimum height design criteria, it will provide opportunity for the movement of all animals through the valley, including large mammals (e.g. White-tailed Deer), greatly improving the existing condition at this crossing.





HIGHWAY 427 EXPANSION

Langstaff Road Crossing Over Rainbow Creek

VEGETATION

Existing Conditions

- Vegetation is classified as Dry-Moist Old Field Cultural Meadow (CUM1-1) with a Mineral Cultural Thicket (CUT1) inclusion. These are very common, tolerant communities that have a high proportion of non-native and invasive species.
- No regionally rare flora species were documented by LINK427 at this location.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- A Vegetation Restoration Plan and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation with the new alignment. A native marsh seed mix will be used along riparian zones and a native slope mix will be used elsewhere within the valley.

WILDLIFE AND SPECIES AT RISK

Existing Conditions

- Wildlife documented at this crossing are primarily common, tolerant, urban-adapted and open-country species which is expected given the habitat conditions present.
- No SAR have been documented in the vicinity of the crossing.

Site Specific Mitigation Measures

No site specific mitigation measures are warranted at this location however, mitigation measures that are common to all sites will be implemented. These measures are presented on a separate board.

HIGHWAY 427 EXPANSION

Langstaff Road Crossing Over Rainbow Creek

FISH AND FISH HABITAT

Existing Conditions

- Rainbow Creek is naturally meandering, with a riffle/run/pool/flat sequence flowing through a meadows mixed with deciduous trees. Approximately 80 m downstream, the right bank shows evidence of erosion where the flow has scoured the outside bend during high flow conditions.
- Abundant cattails, phragmites and grasses provide emergent cover upstream, but there is no aquatic vegetation present downstream. Rainbow Creek has low to moderate sensitivity habitat suitable to support multiple life-cycle functions for common, tolerant warmwater bait and forage fish.
- The existing structure is a round, CSP (3 m in diameter) that conveys the flow of Rainbow Creek underneath Langstaff Road.
- There are no permanent obstructions to fish migration.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- Vegetative rock buttress using native riparian plant will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks.
- Re-instatement of a natural channel through the proposed new crossing structure to improve fish habitat and passage.
- The much wider and higher proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities, as well as sunlight.
- All construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty fencing for all disturbed areas of the embankments that drain to the watercourse. Silt fencing will be regularly inspected and maintained as required.

HIGHWAY 427 EXPANSION

Highway 427 Crossing at Langstaff Road and Associated Impacts

New Structure

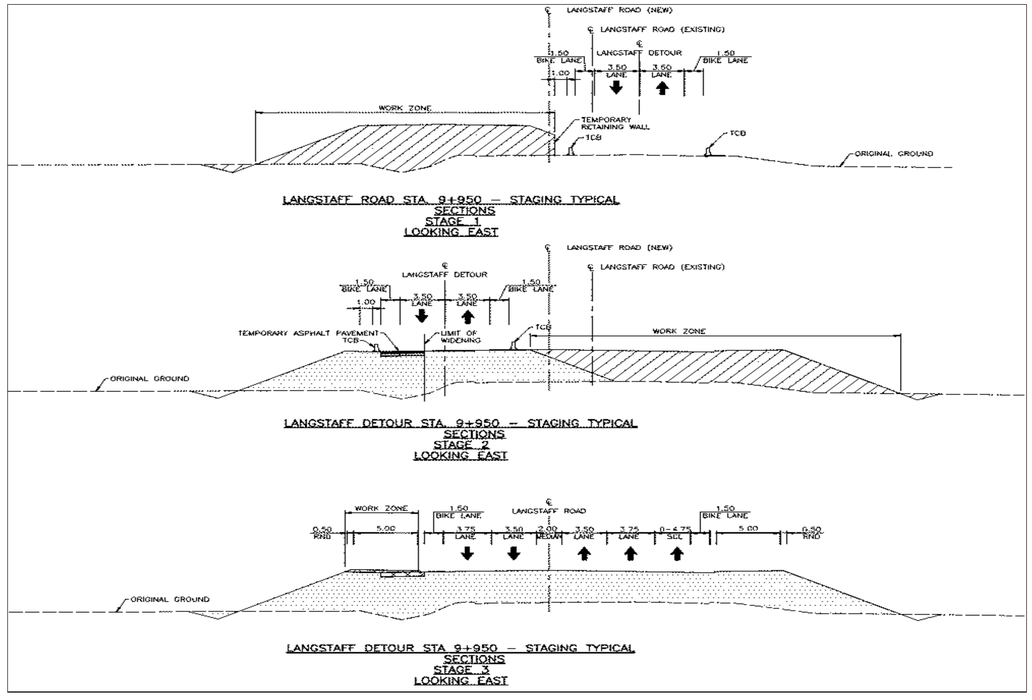
- Two-span bridge with a total length of 73.9 m.
- 4 lanes (two lanes in each direction).
- This structure, once constructed, will maintain cyclist access on Langstaff Road. This structure will also accommodate pedestrian access by means of a raised concrete sidewalk.

Detail Design Optimization

- Langstaff Road and New Interchange will be relocated north of the existing Langstaff Road alignment in order to minimize impacts to users during construction.

Roadway Construction Staging and Traffic Impacts

- Langstaff Road will undergo a permanent realignment to the north of its existing location, which is a refinement to the preliminary design.
- The traffic will be shifted to the south and reduced to one lane in each direction. Due to a site condition there is not enough room to maintain 4 lanes of traffic and the bike lanes for every stage of construction. As a result, the number of lanes has been reduced to 2, one in each direction, with bike lanes. This is different than the 4 lanes shown in the EA.
- There are no existing pedestrian facilities to be maintained during construction; however, existing bicycle lanes will be maintained during construction.



HIGHWAY 427 EXPANSION

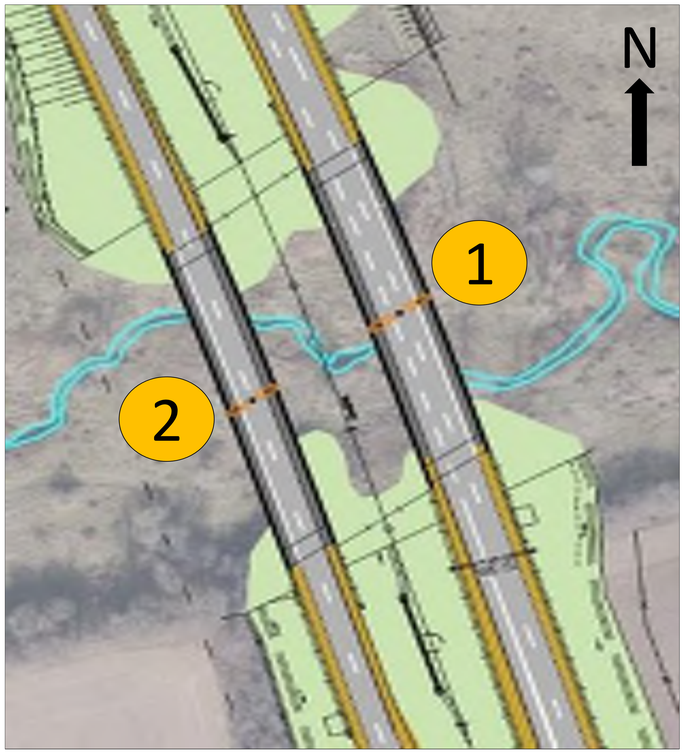
Highway 427 Crossing Over West Robinson Creek

Structure for Northbound Lanes: 1

- Two-span bridge with a total length of 93.1 m, a height of 4.0 – 8.0 m and width of 17.8 m.
- 3 lanes northbound to Major Mackenzie Drive.

Structure for Southbound Lanes: 2

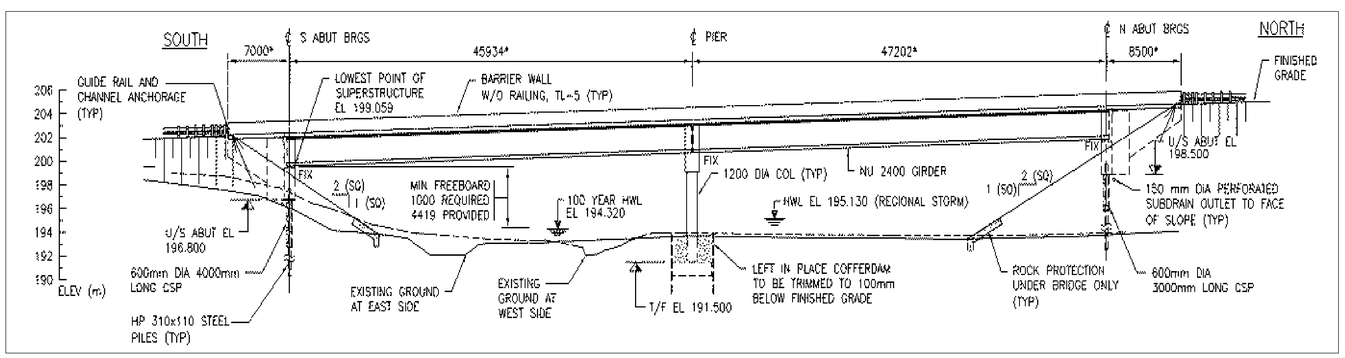
- Two-span bridge with a total length of 93.5 m. a height of 4.0 – 8.0 m and width of 14.1 m.
- 2 General Purpose Lanes (GPL) southbound to Rutherford Road.



Detail Design Optimization

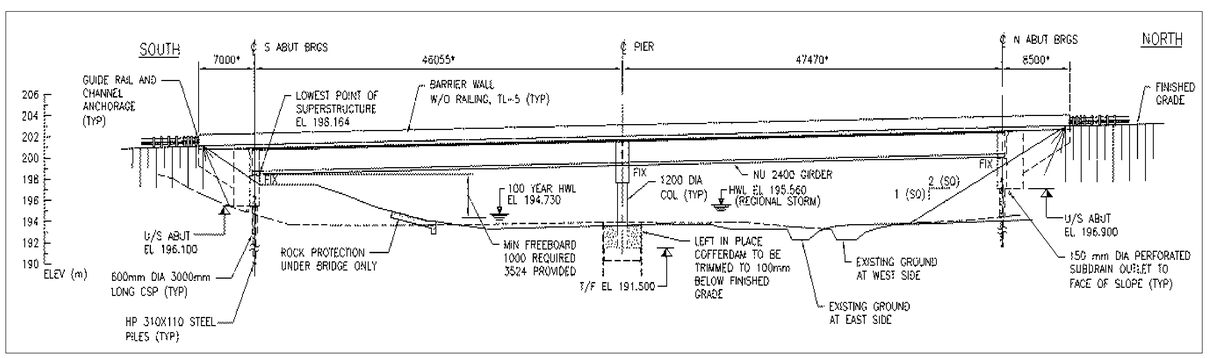
- Compared to the preliminary design, the LINK427 detail design results in approximately a 28% reduction in span length but retains a two span design.
- The LINK427 detail design reduces the Openness Ratio (OR) relative to the preliminary design by approximately 38%, but it exceeds the required minimum design criteria provided in the EA by 933% (for the ultimate 10-lane scenario).
- The LINK427 detail design changes the bridge height compared to the preliminary design. The change ranges from a 0.5 m (11%) decrease to a 3.5 m (78%) increase, which exceeds the EA design criteria of 3 m height for wildlife passage by 33% - 166%.
- Since the LINK427 detail design exceeds the minimum OR and minimum height design criteria, it will maintain the function for the movement of all animals through the valley, including large mammals (e.g. White-tailed Deer).
- As part of the consultation process, LINK427 continues to engage the MTO and the MNRF in discussions regarding the detail design of this crossing. Final details will be provided in the next DCR that will be made available for public review as part of the EA process.

Northbound



ELEVATION
NTS

Southbound



ELEVATION
NTS

Highway 427 Crossing Over West Robinson Creek

VEGETATION

Existing Conditions

- Vegetation at this crossing is classified as a Dry-Moist Old Field Cultural Meadow (CUM1-1) and Mineral Cultural Woodland (CUW1).
- At the time of the 2010 EA, much of the valley was pastured. In the intervening years, the pasture has regenerated to an early successional cultural meadow comprised of a mix of native and non-native species, including a number of invasive species.
- There are a few large, isolated, mature Bur Oak trees within the valley that LINK427 has made efforts to retain, where feasible (3 of the 4 trees are avoided).
- No regionally rare species were documented by LINK427 at this location.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- Specifically, this area will be restored to a Dry-Fresh Graminoid Meadow, which is expected to provide foraging habitat for Barn Swallows (See Wildlife and SAR panel). This shall include restoration of vegetation in areas disturbed during construction with native plant species in order to replace and enhance the existing vegetation cover within the valley.
- Mature Bur Oak trees have been flagged by LINK427 and those that can be retained (i.e. 3 of the 4 trees) have been fenced with tree protection fencing.

Highway 427 Crossing Over West Robinson Creek

WILDLIFE AND SPECIES AT RISK (SAR)

Existing Conditions

- Wildlife documented at this crossing are primarily common, tolerant, urban-adapted and open-country species.
- Barn Swallow (a threatened species) was confirmed nesting in a nearby barn in 2015 and the meadow habitat at West Robinson Creek has been identified as an appropriate Barn Swallow foraging habitat restoration area.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

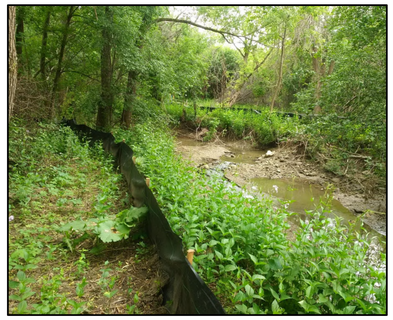
- Habitat restoration for Barn Swallow, including the installation of alternate nesting structures and creation of foraging habitat will be completed in accordance with the Barn Swallow Mitigation and Restoration Record.

Highway 427 Crossing Over West Robinson Creek

FISH AND FISH HABITAT

Existing Conditions

- West Robinson Creek flows southeast through a meadow and adjacent residential property into the Lands and has been degraded as a result of anthropogenic activities. Nutrient and sediment loading from upstream agricultural activities and roadway has impacted West Robinson Creek's water quality.
- Substrate in the runs is silty clay, with some gravel, cobble and sand in the riffle sections. Instream cover is minimal and is provided by vascular plants, undercut banks, cobble and woody debris.
- West Robinson Creek has a low to moderate sensitivity habitat which supports a warmwater fish community consisting of cyprinids and gamefish (Largemouth and Smallmouth Bass).



Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- The bridge will completely span the bankfull channel at this crossing, with only nominal fill into the edges of the valley to support abutment slopes of the proposed bridges.
- The bridge was designed to maintain the natural fluvial geomorphic processes and avoid direct encroachment or infill into bankfull channel.

- All construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty fencing for all disturbed areas of the embankments that drain to the watercourse. Silt fencing will be regularly inspected and maintained as required.
- If any temporary dewatering of the near stream construction zones or isolated in-water area is required, appropriate energy dissipation and settling/filtration measures will be used for discharge to ensure no erosion or sediment release occurs in the watercourses.

HIGHWAY 427 EXPANSION

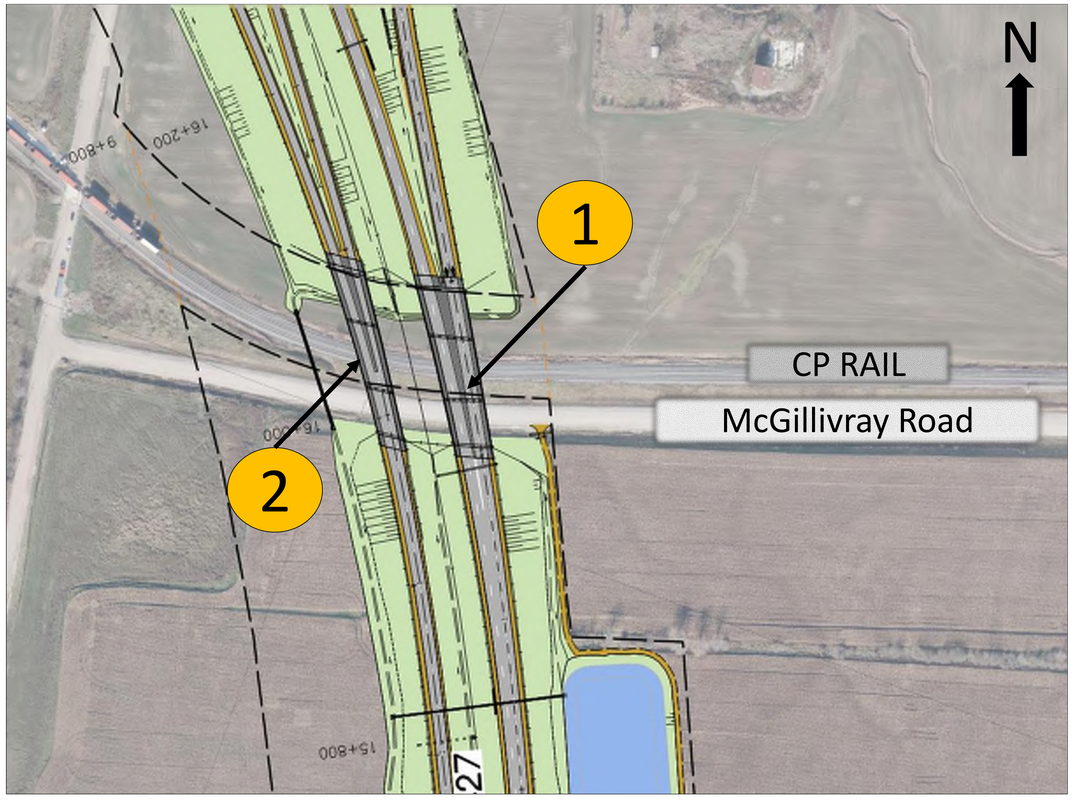
Highway 427 Overpass at CP Rail / McGillivray Road

1 New Structure (Northbound Lanes)

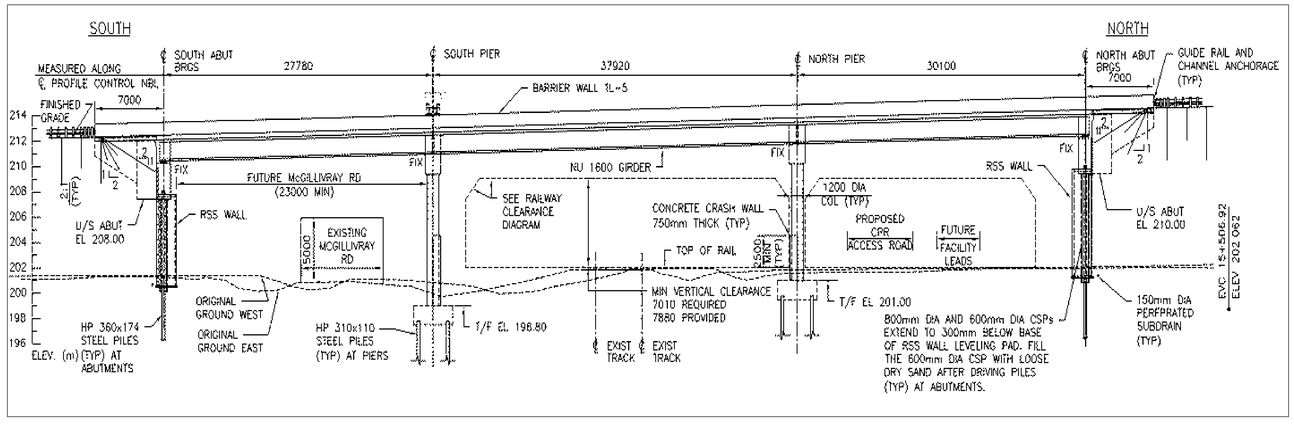
- Three-span bridge with a total length of 95.8 m and minimum height of 7.88 m.
- 4 lanes in the northbound direction towards Major Mackenzie Drive.
- No long-term traffic impacts to the travelling public are expected as a part of these works.

2 New Structure (Southbound Lanes)

- Three-span bridge with a total length of 100.82 m and minimum height of 7.3 m.
- 2 lanes in the southbound direction towards Rutherford Road.
- No long-term traffic impacts to the travelling public are expected as McGillivray Road will not be altered from its current configuration.

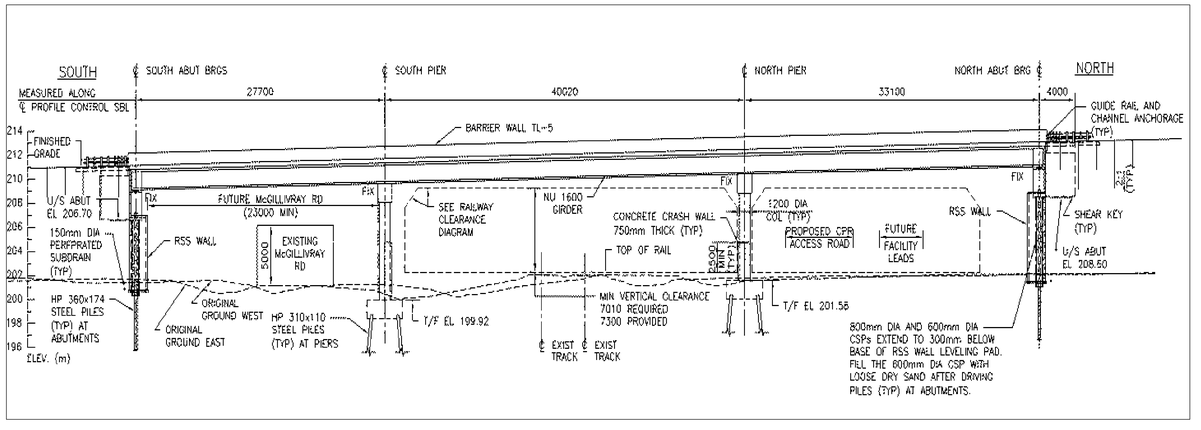


Northbound



ELEVATION
NTS

Southbound



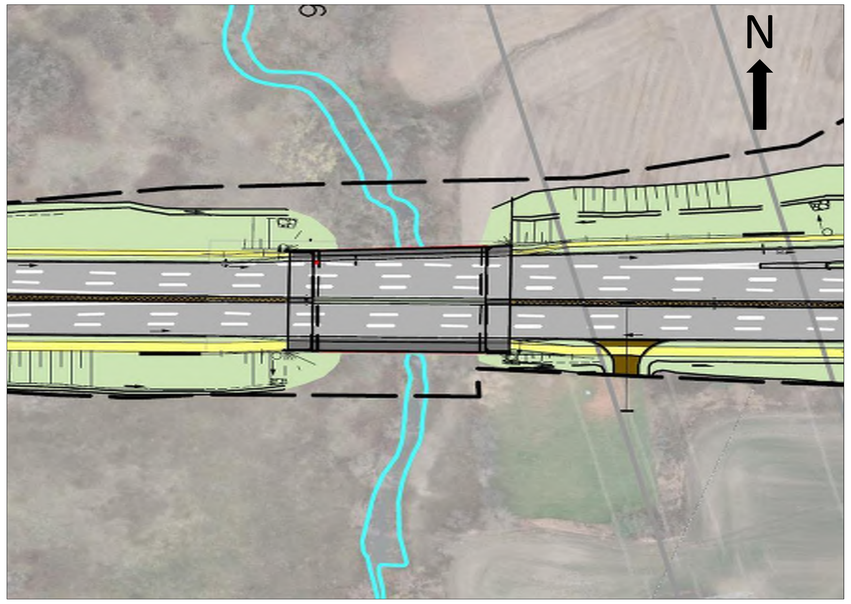
ELEVATION
NTS

HIGHWAY 427 EXPANSION

Major Mackenzie Drive Crossing Over West Robinson Creek

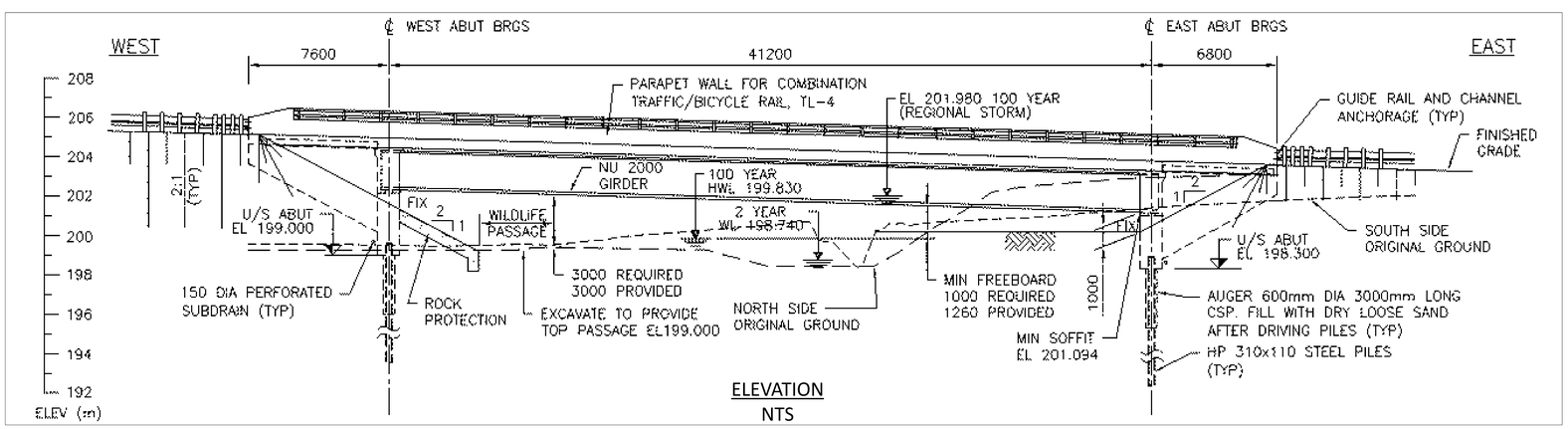
Overpass Structure

- Replaces the existing 3 x 5 m CSP with a single-span bridge with a total length of 41.2 m, a height of 3.0 – 4.0 m and width of 34.6 m
- 3 lanes on Major Mackenzie Drive in each direction.
- Termination of the Highway 427 northbound off-ramp lane onto Major Mackenzie Drive westbound.
- This structure will provide pedestrian and cyclist access on Major Mackenzie Drive by the means of a 1.5 m raised sidewalk on the north and a 3.5 m raised multi-use path on the south.
- A wildlife passage will be provided.



Detail Design Optimization

- Compared to the preliminary design, the LINK427 detail design results in approximately a 41% reduction in span length and a change from a two span structure to a single span structure.
- The LINK427 detail design reduces the Openness Ratio (OR) relative to the preliminary design by approximately 40%, but it exceeds the required minimum design criteria provided in the EA by 500%.
- The LINK427 detail design provides the same bridge height as the preliminary design, which exceeds the required minimum EA design criteria of 3 m by 0% - 33%.
- Since the LINK427 detail design exceeds the minimum OR and minimum height design criteria, it will provide an opportunity for the movement of all animals through the valley, including large mammals (e.g. White-tailed Deer), greatly improving the existing condition at this crossing.



HIGHWAY 427 EXPANSION

Major Mackenzie Drive Crossing Over West Robinson Creek

VEGETATION

Existing Conditions

- Vegetation at this crossing is classified as Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3). The community is dominated by non-native willow trees, Black Walnut and Basswood, with abundant Buckthorn in in the understory and an inclusion of Reed Canary Grass in the riparian zone of the creek.
- Vegetation communities are very common, tolerant communities.
- No regionally rare species were documented by LINK427 at this location.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- A Vegetation Restoration Plan and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment. This valley will be restored as Deciduous Forest (FOD) with native species and re-seeded with native seed varieties.

WILDLIFE AND SPECIES AT RISK (SAR)

Existing Conditions

- Wildlife documented at this crossing are primarily common, tolerant, urban-adapted and open-country species which is expected given the habitat conditions present.
- No SAR have been documented in the vicinity of the crossing.

Site Specific Mitigation Measures

No site specific mitigation measures are warranted at this location however, mitigation measures common to all sites are presented on a separate board.

Major Mackenzie Drive Crossing Over West Robinson Creek

FISH AND FISH HABITAT

Existing Conditions

- West Robinson's Creek naturally meandering system flows underneath Major Mackenzie Drive, and also under a CN Rail crossing further downstream.
- West Robinson Creek has a low to moderate sensitivity habitat to support a warmwater fish community consisting of cyprinids and gamefish (Largemouth Bass).
- The existing culvert structures facilitates the southward flow of West Robinson Creek underneath Major Mackenzie Drive with a concrete twin cell box culvert that conveys flow under the CN Rail crossing.

Site Specific Mitigation Measures

In addition to the mitigation measures that are common to all sites that are presented on a separate board, the following site specific mitigation measures will be applied:

- The bridge will completely span the bankfull channel to avoid direct encroachment/infill into the channel.
- Vegetative rock buttress using native riparian plants will be installed on the meander bends upstream and downstream of the proposed crossing to address the current unstable banks.
- Re-instatement of a natural channel through the proposed new crossing structure to improve fish habitat and passage.
- The much wider and higher structure will enable the re-instatement of open channel sections that will function fluvial geomorphically and accommodate future channel migration opportunities.
- The proposed new structure will accommodate the natural fluvial geomorphic processes and future channel migration opportunities.

- All construction zones will be isolated using standard perimeter silt fencing of the general construction zone up and downstream. The silt fencing will be heavy duty fencing for all disturbed areas of the embankments that drain to the watercourse. Silt fencing will be regularly inspected and maintained as required.

HIGHWAY 427 EXPANSION

Highway 427 Overpass at Major Mackenzie Drive

New Structure

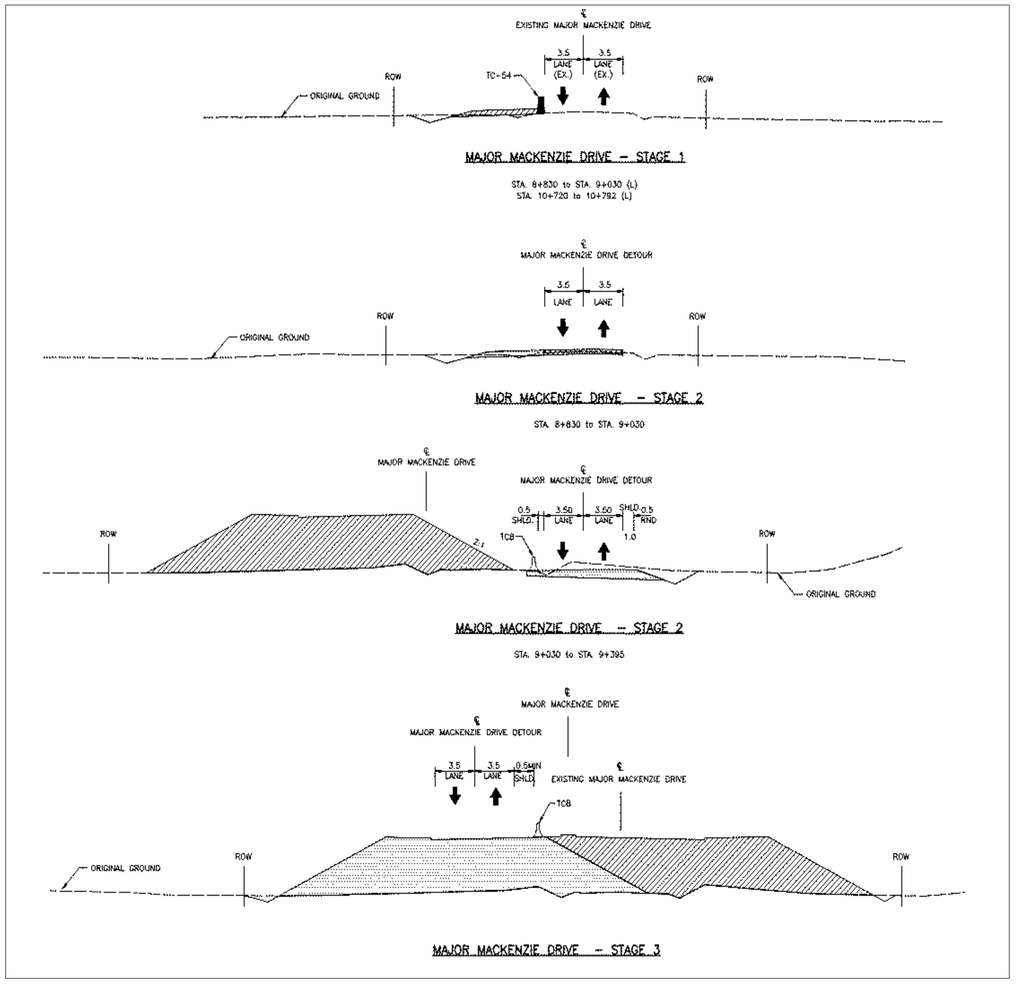
- Single span bridge with a total length of 39 m and a width of 19.1 m
- 1 lane on-ramp from Major Mackenzie Drive westbound to Highway 427 southbound and 1 lane off-ramp from Highway 427 northbound to Major Mackenzie Drive westbound.

Detail Design Optimization

- This design differs from the preliminary design as those two structures (one northbound and one southbound) have been combined into one in the LINK427 detail design. This was accomplished by combining the Highway 427 northbound and southbound off-ramps to minimize construction impacts and to allow for future expansion.

Roadway Construction Staging and Traffic Impacts

- Major Mackenzie Drive will undergo a permanent realignment to the north of its existing location. The existing number of traffic lanes will be maintained during construction but they will be shifted to the south to facilitate construction and then placed on the final alignment.
- To accommodate future expansion, additional fill may be placed in key areas.
- There are no existing pedestrian and cyclist facilities to be maintained during construction.



Environmental Mitigation Measures - Common to all Sites

VEGETATION

- Vegetation clearing, grubbing and construction activities will be carefully planned to anticipate and mitigate environmental issues before they occur.
- Tree clearing and grubbing will be restricted to the required construction activity zone. The limits of the construction zone will be delineated and fenced to protect the vegetation that is not identified for removal.
- Tree/shrub debris will be stored outside identified protected vegetation.
- In the event that adjacent vegetation communities or planted trees are accidently damaged during construction activities, LINK427 will implement appropriate contingency measures such as pruning tree limbs or roots that are accidently damaged using proper arboricultural techniques.
- A Vegetation Restoration Plan and Landscape Plan is being prepared to revegetate disturbed areas following construction and to provide compensation for loss of vegetation within the new alignment.

WILDLIFE AND SAR

- Clearing and grubbing activities will be conducted outside of the migratory bird nesting window (April 15 to August 15). If work is scheduled during this window, clearing and grubbing will be preceded by a survey by a qualified avian biologist to identify active nests. Active nests will not be disturbed.
- All construction workers will be trained in advance of starting work regarding potential to encounter wildlife and SAR while undertaking their activities, and the appropriate response if an encounter occurs.
- Any wildlife encountered will not be knowingly harmed.
- Vegetation debris will be removed or mulched as soon as possible, especially during the breeding bird season (April 15 to August 15) in order to prevent birds from nesting in debris piles.
- A Wildlife Fence Plan is being developed for the project with purpose of keeping wildlife off of the highway ROW and funneling wildlife to the main valley crossings structures. Wildlife fencing and wildlife habitat enhancements are being developed and incorporated into the VRP.

Environmental Mitigation Measures - Common to all Sites

FISH AND FISH HABITAT

- A warmwater permissible in-water timing window of July 1st to March 31st will be implemented. All in-water works will be done in isolation with a fish rescue undertaken from within the isolated area.
- 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.
- All construction-related activities will be controlled to prevent entry of any petroleum products, debris or other potential contaminants/deleterious substances.
- The construction access, work areas and associated requirements for removal of riparian vegetation will be minimized to the extent required for the construction activities, and these areas will be delineated in the field using properly installed protective silt fencing. All temporarily disturbed areas will be re-stabilized following construction using appropriate means.

GROUNDWATER AND HYDROGEOLOGY

- A Groundwater Monitoring Program is being implemented, in accordance with the EA commitments.
- The selection of construction machinery, choice of construction methods and phasing of construction will be used in order to reduce water taking requirements.
- Groundwater dewatering estimated to be less than 50,000 litres per day.
- Potential to impact nearby environmental features is very low due to anticipated low volume pumping.

DRAINAGE AND STORMWATER MANAGEMENT

- The Construction Period Drainage and Sediment Management Plan(s) (DSMP) incorporate each watercourse crossing. The purpose of the DSMPs is to provide water quality treatment of the runoff generated within all drainage catchment areas within the Project Lands before water is discharged to any watercourse.
- The Erosion and Sediment Control Plan (ESCP) for the project documents the environmental protection measures for preventing and controlling erosion and sedimentation during construction works. The ESC (Erosion and Sediment Control) measures required for the works are industry standard proven techniques.
- A Surface Water Monitoring Program will verify that ESC measures are functioning as intended.
- Disturbed floodplain areas to be covered with topsoil, seeded with a native mix, and stabilized with a biodegradable erosion control blanket.
- No anticipated long-term impacts.

Environmental Mitigation Measures - Common to all Sites

NOISE

- LINK427 will keep idling of construction equipment to a minimum and will maintain equipment in good working order to reduce the noise emitted from construction activities.
- As some construction activities are expected to be undertaken during nighttime and/or weekends, exemptions from local Noise Bylaws have been obtained from the City of Toronto and City of Vaughan.
- While no significant adverse noise and vibration effects are anticipated, the Construction Noise and Vibration Plan will be implemented as per the EA Conditions of Approval throughout the construction period.

ARCHAEOLOGY & CULTURAL HERITAGE

- The Highway 427 Expansion Lands have been assessed for archaeological potential. It is unlikely that archaeological resources are present within the study area.
- In the event that deeply buried archaeological deposits are discovered, the Ministry of Tourism, Culture and Sport will be notified immediately. In the event that human remains are encountered, LINK427 will immediately notify the police or coroner and the Registrar of Cemeteries, Ministry of Government Services.
- The Coleraine Burying Grounds (Coleraine Cemetery) and the Coleraine Schoolhouse Site located on the south side of Major Mackenzie Drive will be protected during construction activities.

Environmental Mitigation Measures - Common to all Sites

WASTE MANAGEMENT AND CONTAMINATION

- Based on the findings of the Contamination Overview Study (COS), Phase I and II Environmental Site Assessments (ESAs) and subsequent environmental investigations and delineation programs it was confirmed that ground water quality within the Lands meets the applicable Ministry of the Environment and Climate Change (MOECC) site condition standards (SCS).
- In the event that unknown contamination is discovered during the course of construction activities, procedures and steps outlined in the Waste and Contamination Management Plan (WCMP) will be implemented and procedures for working in contaminated areas will apply.
- While the construction works are not anticipated to result in the production of any excess soils that require offsite management, should there be excess materials generated during construction, they will be managed in accordance with the project's Earth Management Plan, the WCMP and OPSS 180 (Management of Excess Materials).
- Construction activities will include the demolition and removals of existing buildings and structures. Identified designated substances within the building structures will be removed and disposed of in accordance with the WCMP, MOECC regulations and OSHA requirements. Additional Designated Substance Surveys (DSS) and/or sampling programs will be completed (as required) if suspected designated substances or hazardous materials are suspected to be present.
- Excess materials generated during construction activities will be managed in an environmentally acceptable manner, recycled and/or processed and disposed according to current legislation and practices in accordance with Ontario Provincial Standard Specification (OPSS) 180 and the project's Earth Management Plan.

Detail Design Refinements and Net Effects Comparison

- As indicated, through the Detail Design process, LINK427 refined and optimized the watercourse crossing structures and one of the new interchanges. The changes that were introduced to the designs were described in the previous display panels for each of these structures.

- As part of introducing these changes, LINK427 has looked at the potential net effects associated with them in comparison to the preliminary designs from the EA. The results of this assessment are summarized below for each of the factors of the environment where there was a potential for adverse effects.

  - ***Surface Water & Fluvial Geomorphology**:* Through the process of design optimization LINK427 determined that the span length of the preliminary design for watercourse crossing structures could be reduced without any compromise to the hydraulic and geomorphological performance of the structures. Floodlines are not affected by the LINK427 detail designs for the Regulatory Flood, and the minimum required space under each bridge (freeboard) is maintained for the Regulatory Flood. Therefore, the effects due to the changes in the LINK427 detail design are considered insignificant.

  - ***Fish and Fish Habitat:*** There are no direct impacts and the detail design maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features. Therefore, the change is considered to be insignificant since there are no real difference in fish passage or habitat at the watercourse crossings.

  - ***Wildlife Passage:*** The LINK427 detail designs for the watercourse crossings meet or exceed the minimum EA Design Criteria for bridge height of 3 m and exceed the minimum Openness Ratio (OR) of 0.6. Therefore, the difference is considered insignificant because the LINK427 bridges will maintain the function of movement for all animals through the valley, including large mammals such as White-tailed Deer.

  - ***Species at Risk:*** Where there is SAR bat habitat at the Highway 427 crossing of Rainbow Creek, the LINK427 detail design will not have a net change to SAR bat habitat impacts. The permanently impacted SAR bat woodland habitat will be the same or less than the preliminary design. Also, habitat restoration can be achieved as required by the MNRF permit. Therefore, any changes from the LINK427 detail design are considered to be negligible/insignificant.

  - ***Vegetation**:* All mitigation requirements from the EA can be met with the LINK427 designs. As a result, there is only a minor difference between the preliminary design and the LINK427 detail design, which is considered to be minor/insignificant.

- The assessment summarized above will continue to be updated and augmented with information provided through our public consultation (such as this PIC) and our on-going discussions with government and agencies (such as MTO, MNRF and TRCA). The results of this process will be detailed in a future DCR that will be made available for public review as part of the EA process.

Communication Opportunities

Highway 427 Expansion Project Website

- The Highway 427 Expansion project website (www.427expansion.ca) will be the central portal for communication providing updates and information on traffic disruptions, construction activities and progress.

One-Window Communication

- LINK427 has established a one-window communication system for public enquiries, complaints and comments. Members of the public may contact LINK by telephone: 1-888-352-8085 (French Language line: 1-888-595-3152) or by email at ask@427expansion.ca.

- Ce document hautement spécialisé n'est disponible qu'en anglais en vertu du règlement 411/97, qui en exempte l'application de la Loi sur les services en français. Pour de l'aide en français, Appelez le Bureau des services en français au: 1-888-595-3152.

Variable Message Panels

- Portable variable messaging signs (PVMS) will be used at key locations and updated as needed to communicate, in real time, key information related to traffic management.

Notices & Bulletins

- Notices of upcoming consultations or other project activities will be delivered via the Project Mailing List, E-mail List, Project website, and local newspapers. Notices will also be mailed to residents and businesses that reside in a 2km radius of the project boundary.

- Project Bulletins will be prepared monthly, or more frequently if required and may include information on PICs, construction activities, traffic detours and other relevant information. These bulletins will be sent via email and available on the Project website.

Next Steps

Following this Public Information Centre (PIC), we will:

- Review and respond to comments received.
- Refine the Detail Design and mitigation measures based on comments received.
- Prepare the Design and Construction Report for public review.

Thank you for attending this Public information Centre. We welcome your comments. Please fill out the Comment Sheet you were provided when you entered and submit it before you leave, or e-mail / mail it to the address below by **June 5, 2018**. If you have questions about the Project or wish to be added to the mailing list, please contact:

Mr. Aitor Arbesu
Project Director
LINK427
1 Royal Gate Blvd., Suite G
Woodbridge, ON L4L 8Z7
Phone: 1-888-352-8085
E-mail: ask@427Expansion.ca

Comments and information regarding the project are being collected to assist LINK427 in meeting the requirements of the Environmental Assessment Act*. This material will be maintained on file for use during the study and may be included in study documentation. LINK427 will adhere to the privacy protection rules established in the* Freedom of Information and Protection of Privacy Act (FIPPA)*. With the exception of personal information, all comments will become part of the public record.*

www.427expansion.ca

Appendix D: Comparative Evaluation Tables

Table 1:

Long List to Short List
Environmental Net Effects Assessment of Potential Changes

Table 1: Long List to Short List Environmental Net Effects Assessment of Potential Changes					
Environmental Factor	**Criteria**	**Net Effects Comparison of Crossings vs. the IEA/TESR**			
		Rain 3: Rainbow Creek crossing of Highway 427	**Rain 5: Rainbow Creek crossing of Langstaff Road**	**Rob 5: West Robinson Creek crossing of Highway 427**	**Rob 6: West Robinson Creek crossing of Major Mackenzie Drive**
Socio-Economic Environment					
Property and Access	▪ Impacts to Properties	No additional property required	No additional property required	No additional property required	No additional property required
	▪ Potential Effect to Access	No effect to access	No effect to access	No effect to access	No effect to access
	▪ Impacts on Future Land Use	No additional impacts on future land use	No additional impacts on future land use	No additional impacts on future land use	No additional impacts on future land use
Community Effects	▪ Noise Impacts	No additional noise impacts	No additional noise impacts	No additional noise impacts	No additional noise impacts
	▪ Impacts to cemeteries, school, places of worship, unique community features	No impacts to cemeteries, school, places of worship unique community features	No impacts to cemeteries, school, places of worship unique community features	No impacts to cemeteries, school, places of worship unique community features	No impacts to cemeteries, school, places of worship unique community features
	▪ Effects of community activity/mobility	No effects of community activity/mobility	No effects of community activity/mobility	No effects of community activity/mobility	No effects of community activity/mobility
	▪ Effects of aesthetics/community character	No effects of aesthetics/community character	No effects of aesthetics/community character	No effects of aesthetics/community character	No effects of aesthetics/community character
Government Land Use Strategies	▪ Compatibility with government goals/objectives/policies	Compatible with government goals/objectives/policies	Compatible with government goals/objectives/policies	Compatible with government goals/objectives/policies	Compatible with government goals/objectives/policies
	▪ Effects on approved private development proposals	No effects on approved private development proposals	No effects on approved private development proposals	No effects on approved private development proposals	No effects on approved private development proposals
Cultural Environment					
Archaeology	▪ Impacts to historic/archaeological sites	No effects to historic/archaeological sites	No effects to historic/archaeological sites	No effects to historic/archaeological sites	No effects to historic/archaeological sites
Heritage Features	▪ Impacts to built heritage features & cultural landscape units	No effects to built heritage features & cultural landscape units	No effects to built heritage features & cultural landscape units	No effects to built heritage features & cultural landscape units	No effects to built heritage features & cultural landscape units
	▪ Impacts to Provincial and local parks/recreation sites	No effects to Provincial and local parks/recreation sites	No effects to Provincial and local parks/recreation sites	No effects to Provincial and local parks/recreation sites	No effects to Provincial and local parks/recreation sites
Natural Environment					
Groundwater and Surface Water	▪ Impacts to groundwater	No net change to potential groundwater effects	No net change to potential groundwater effects	No net change to potential groundwater effects	No net change to potential groundwater effects
	▪ Impacts to surface water	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
	▪ Effect on watercourses that do not support direct fish habitat within the crossing location	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
Fish and Fish Habitat	▪ Effect on watercourses that are confirmed to support direct fish habitat/use within the crossing location	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
	▪ Effect on watercourses that have potential to support direct fish habitat/use within the crossing location	Not applicable. The watercourse has been confirmed to support direct fish habitat/use.	Not applicable. The watercourse has been confirmed to support direct fish habitat/use.	Not applicable. The watercourse has been confirmed to support direct fish habitat/use.	Not applicable. The watercourse has been confirmed to support direct fish habitat/use.
Wetlands	▪ Effects on Wetland	No wetlands affected	No wetlands affected	No wetlands affected	No wetlands affected
Wildlife Passage	▪ Impacts to wildlife movement	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
Species at Risk (SAR) and SAR Habitat	▪ Effect on SAR and SAR and Habitats	Potential change in effect. Carried forward for further assessment	No SAR habitat.	No SAR habitat.	No SAR habitat.

Table 1: Long List to Short List Environmental Net Effects Assessment of Potential Changes					
Environmental Factor	**Criteria**	**Net Effects Comparison of Crossings vs. the IEA/TESR**			
		Rain 3: Rainbow Creek crossing of Highway 427	**Rain 5: Rainbow Creek crossing of Langstaff Road**	**Rob 5: West Robinson Creek crossing of Highway 427**	**Rob 6: West Robinson Creek crossing of Major Mackenzie Drive**
Significant Wildlife Habitat	▪ Effect on Significant/Sensitive Wildlife Species and Habitats	No net change to significant wildlife habitat	No net change to significant wildlife habitat	No net change to significant wildlife habitat	No net change to significant wildlife habitat
Fluvial Geomorphology	▪ Impacts to channel geomorphology	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment
Designated Natural Features, Management Plans, Programs and Protection/Enhancement Programs	▪ Effect on identified designated natural features including: ESAs, ANSIs, Regional Greenland systems and Greenbelt Plan Areas	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs
	▪ Effect on TRCA Valley and Stream Corridor Management Program, TRCA Terrestrial Natural Heritage System, other management plans and associated management objective as well as habitat rehabilitation and stewardship programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs	No additional effects to designated natural features, management plans, Programs and Protection/Enhancement Programs
Air Quality	▪ Potential effects on local air quality	No additional effects on local air quality	No additional effects on local air quality	No additional effects on local air quality	No additional effects on local air quality
Vegetation	▪ Effect on vegetation	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment
Agricultural Soils	▪ Impacts to prime agricultural soils (i.e. Class 1-3 soils)	No effect to agricultural soils	No effect to agricultural soils	No effect to agricultural soils	No effect to agricultural soils
Petroleum, Mineral, and Mineral Aggregate Resources	▪ Impacts to mineral, petroleum & mineral aggregate resources & operations	No effect to petroleum, mineral, and mineral aggregate resources	No effect to petroleum, mineral, and mineral aggregate resources	No effect to petroleum, mineral, and mineral aggregate resources	No effect to petroleum, mineral, and mineral aggregate resources
Property Waste & Contamination	▪ Effect on operating and closed waste disposal sites	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination
	▪ Impacts to other known contaminated sites	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination
	▪ Impacts to potentially contaminated sites	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination	No effect/impact to property waste and contamination
Technical Considerations					
Transportation	▪ Flexibility for future expansion/precluding or prejudging future expansion	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment	Potential change in effects. Carried forward for further assessment
	▪ Transportation operations & system performance	No effect to transportation operations	No effect to transportation operations	No effect to transportation operations	No effect to transportation operations
	▪ Network compatibility/connectivity	No effect to network compatibility/connectivity	No effect to network compatibility/connectivity	No effect to network compatibility/connectivity	No effect to network compatibility/connectivity
	▪ Emergency access	No effect to emergency access	No effect to emergency access	No effect to emergency access	No effect to emergency access
Engineering	▪ Constructability issues	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
	▪ Compliance with appropriate design criteria	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment
Cost	▪ Cost to construct	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment	Potential change in effect. Carried forward for further assessment

Tables 2A, 2B, 2C and 2D:

Net Environmental Effects Assessment and Determination of Significance

Table 2A: Net Environmental Effects Rain 3: Highway 427 crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD)PD Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance**
Surface Water	▪ Impacts to surface water ▪ Effect on watercourses that do not support direct fish habitat within the crossing location	▪ Does not increase the existing floodlines. ▪ The minimum freeboard is met for the Regulatory Flood. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ Impacts/changes to local channel hydraulics are limited. ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed.	▪ Does not increase the existing floodlines. ▪ The minimum freeboard is met for the Regulatory Flood. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ Impacts/changes to local channel hydraulics are limited. ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed.	▪ Floodlines are not affected by the PDPD and LINK427 DD for the Regulatory Flood. ▪ Minimum Freeboard is maintained in both instances for the Regulatory Flood.	▪ Negligible / No Difference. ▪ **Insignificant.**
Fish and Fish Habitat	▪ Effect on watercourses that are confirmed to support direct fish habitat/use within the crossing location	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features.	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features.	▪ No significant difference in fish passage or habitat. ▪ The NBL and SBL bridges more than span the bankfull channel and protect fluvial geomorphic functioning of the channel in both the PDPD and LINK427 DD. ▪ The increased fill in the valley associated with the LINK427 DD has no impact on fish and fish habitat as the limits of the fill are well set back from the bankfull channel. ▪ Under the DFO/MTO/OMNRF Protocol (version 3 - Pilot), the LINK427 DD adheres to the MTO BMP (Pilot) for Clear Span Bridge based on the following: – Bridges span the waterbody without altering the waterbody bed and bank; and, – Bridges are placed entirely above the high water level. ▪ As such, no serious harm to fish is anticipated and the mitigation measures outlined in the MTO BMP (Pilot) for Clear Span Bridge are implementable. An MTO Project Notification Form will be filled out.	▪ Negligible / No difference. ▪ **Insignificant.**
Wildlife Passage	▪ Effect of structures on wildlife passage as measured by bridge height and openness ratio	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and exceeds the minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). ▪ According to the EA: ○ For the ultimate 10 lane scenario, the OR = approx. 5.3 ○ Exceeds the minimum EA design criterion by 4.7 ○ Bridge height[6] = approx. 5 – 6 m	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and exceeds the minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). ○ For the ultimate 10 lane scenario the OR = approx. 3.6 [7] ○ Bridge height = approx. 5 – 6 m ○ The MTO Environmental Guide for Mitigating Road Impacts to Wildlife (March 2017) and various other current research was considered in developing the LINK427 DD. ○ The LINK427 crossing structures will also incorporate design elements to enhance the functionality of the wildlife passage.	▪ The LINK427 DD results in a reduction in span length of approximately 64 m compared to the PD, and a reduction from three spans to a single span. The effects of these structural differences on wildlife passage are reflected in the OR calculation discussed below. ▪ While the LINK427 DD (for the ultimate 10-lane scenario) reduces the OR relative to the PD by approximately 1.8, the OR of the LINK427 DD still far exceeds the required minimum design criteria provided in the 2010 EA (0.6) by 3 (for the ultimate 10-lane scenario). ▪ The LINK427 DD provides the same bridge height as the PD which exceeds the 2010 EA design criteria of 3 m height for wildlife passage by 2 -3 m . ▪ Since both designs far exceed the minimum OR and minimum height design criteria, both designs will maintain the function of movement of all animals through the valley, including large mammals (e.g. White-tailed Deer). ▪ No significant difference in wildlife movement opportunities from a height and OR perspective. ▪ No significant difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage. ▪ Furthermore, based on more recent research and the prevailing literature, the 2010 EA design criteria for wildlife passage should be viewed as 'targets' rather than 'minimums' – particularly in more urban/rural landscapes. Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the PD and LINK427 DD. The PD and LINK427 structures will not impede passage of wildlife in this landscape. This is not a landscape or habitat mosaic that supports major, critical movements of large or 'core' populations that are important to the regional landscape. There are no significant tableland nodes, and no critical habitat	▪ Minor difference. ▪ **Insignificant.**

[6] The bridge height of ~4-5 m provided in previous versions of Table 2 was extracted from Table 7-5 in the 2010 EA; however, we recognize that these heights were preliminary and a closer review of AECOM's GA for this crossing revealed the height to be ~5-6 m.
[7] Assumes the ultimate design does not incorporate any future design refinements that may be feasible to increase the OR.

Table 2A: Net Environmental Effects Rain 3: Highway 427 crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD)PD Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance**
				features that require more critical seasonal movement or support for large populations of animals. Therefore, designs that more than exceed the standard criteria are not warranted.	
	▪ Effect of fill (m3) in the valley on wildlife passage (due to throttling of valley form) [8]	▪ Estimated volume of fill in the valley for the PD is 13,000 m3. ▪ Implementation of wildlife fencing to funnel wildlife effectively to and through the crossing.	▪ Estimated volume of fill in the valley for the LINK427 DD is 27,000 m3 (using retaining walls to minimize fill). ▪ With the implementation of retaining walls and strategically placed wildlife fence, including tying fencing into the retaining walls where walls reach 3 m height (see Wildlife Fence Plan), wildlife will be funneled effectively to and through the crossing thereby mitigating the potential impact to wildlife passage as a result of the additional fill in the valley.	▪ The LINK427 DD requires an additional 14,000 m3 of fill in the valley. ▪ With the implementation of retaining walls and strategically placed wildlife fence to the LINK427DD, it will funnel wildlife effectively to and through the crossing in the same manner as the PD. Therefore, the LINK427 design will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor.	▪ Minor difference ▪ **Insignificant**
Species at Risk (SAR)	▪ Permanent and temporary impacts to SAR habitat	▪ 0.83 ha of SAR bat woodland habitat will be impacted	▪ 0.83 Ha *or less* of SAR bat woodland habitat will be impacted.	▪ Negligible / no significant difference in permanently impacted area. Temporary impacts are less than shown in the SAR Bat OBJ Report and 17(2)(c) Permit. ▪ No net change to SAR bat habitat impacts. ▪ Habitat restoration can be achieved as described in the SAR Bat OBJ Report and 17(2)(c) Permit.	▪ Negligible / No Difference. ▪ **Insignificant.**
Fluvial Geomorphology	▪ Impacts to channel geomorphology	▪ Piers are located within erosion limit and will therefore require channel offset protection. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained.	▪ Crossing abutments are located within erosion limit and will therefore require channel offset protection. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ No significant change in velocity through a range of events in the post-crossing condition.	▪ No change to fluvial geomorphology.	▪ Negligible / No Difference. ▪ **Insignificant.**
Vegetation	▪ Effect on vegetation	▪ Existing vegetation is FOD7-3 (EA 2010-2016): Fresh – Moist Willow Lowland Deciduous Forest (low quality, young forest with ground flora dominated by invasive Dog-Strangling Vine) ▪ This location has been identified as SAR Bat habitat by the 2017 Bat SAR OBJ Report.[9] ▪ Per the EA, make reasonable efforts to reduce vegetation impacts at detailed design. ▪ EA anticipates localized removal of riparian vegetation and removal of existing trees to construct bridge. ▪ The EA anticipates that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. Gaps between medians can be planted as required. ▪ Management of invasive species where feasible within valley. ▪ Edge management opportunities to be reviewed at detail design. ▪ Riparian and slope vegetation should be replaced within the ROW.[10] ▪ Restore and enhance vegetation and habitat conditions that have been generally disturbed through agricultural and other cultural activities.	▪ Existing vegetation is FOD7-3 (EA 2010-2016): Fresh – Moist Willow Lowland Deciduous Forest (low quality, young forest with ground flora dominated by invasive Dog-Strangling Vine). ▪ This location has been identified as SAR Bat habitat by the 2017 Bat SAR OBJ Report.[11] ▪ Per the EA, the LINK427 DD makes reasonable efforts to reduce vegetation impacts. ▪ EA anticipates localized removal of riparian vegetation and removal of existing trees to construct bridge. LINK427 DD results in less construction impacts in the valley to construct bridge. ▪ The EA anticipates that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. Gaps between medians can be planted as required. LINK427 DD assumes the same. ▪ Management of invasive species where feasible within valley can also be achieved with the LINK427 DD. ▪ Edge management opportunities have neem reviewing and is feasible with the LINK427 DD. ▪ Riparian and slope vegetation can be replaced and enhanced within the ROW as required by the EA.	▪ Permanent impacts to vegetation are equivalent. ▪ Temporary impacts from the LINK427 design to vegetation are less than shown in the SAR Bat OBJ Report and the Vegetation Restoration Plan Framework. ▪ The LINK427 DD has less overall impact to vegetation within the valley than the PD. ▪ For both designs, all vegetation areas outside designated construction routes can be fenced, minimizing the potential impacts to vegetation beyond the construction areas. ▪ For the LINK427 DD, crane access will be from the top of structure, minimizing vegetation impacts within the valley. Construction access has been refined and minimized. ▪ Embankment slopes for both designs can be enhanced with additional topsoil, amendments and stabilization to provide improved conditions for vegetative restoration. Restoration of woody vegetation will not occur on fill slopes. ▪ Replacement and enhancement of vegetation and riparian restoration can be achieved for the LINK427 DD as described in the EA as well as the Vegetation Restoration Plan Framework. ▪ Opportunities exist for enhancement of existing vegetation and mitigation of impacts.	▪ Minor difference. ▪ **Insignificant.**

[8] Criterion added at the request of the MNRF. This was not a design criterion from 2010 EA or subsequent TESRs.
[9] Highway 427 Expansion, Overall Benefit Justification Report: Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis and Tri-colored Bat (AECOM 2017).
[10] 2010 EA 7-83 Replace and enhance riparian vegetation removed or disturbed by the bridge construction. Clusters of native tree and shrub species as well as native grasses and herbaceous species could be planted to provide overhead cover to the ROW reach.
[11] Highway 427 Expansion, Overall Benefit Justification Report: Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis and Tri-colored Bat (AECOM 2017).

Table 2A: Net Environmental Effects Rain 3: Highway 427 crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD)PD Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance**
		▪ The mitigation, restoration and enhancement plans will be developed in consultation with the agencies. ▪ Documents subsequent to the EA such as the Vegetation Restoration Plan Framework include more specific guidelines for restoration and mitigation of vegetation.	▪ The mitigation, restoration and enhancement plans for the LINK427 DD are being developed in consultation with the agencies. ▪ The requirements for restoration shown in the Vegetation Restoration Plan framework can be met.	▪ It is noted that while there is an increased volume of fill in the valley required for the LINK427 DD vs. the PD (as noted under the Wildlife Passage Environmental Factor), the difference in the net effects to vegetation as a result of this additional volume of fill vs the PDPD is negligible and insignificant. The additional fill required for the LINK427 DD is in the area between the piers and abutments (i.e. under the structure) that would have been subject to shading influences (both light and moisture). LINK427 has done considerable work to demonstrate (via sun/shade computer modelling studies and site reconnaissance to review of vegetation survivorship under existing structures of similar height and orientation) that based on the absence of sunlight and moisture there will be little vegetation survival or growth potential under either structure. Furthermore, minor changes in structure height make almost no difference to the penetration of the shading impacts under the bridges. Therefore, the impact to vegetation in this area can be considered permanent for both the PD and LINK427 DD.	
Transportation	▪ Flexibility for future expansion/precluding or prejudging future expansion	▪ Expansion either to the inside or the outside of the structures can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments. ▪ The piers can be widened to either side by constructing access into the valley, installing shoring systems/coffer dams, and constructing the pier widenings. The access needed may require additional temporary lands depending on the extent of the widening. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ Expansion either to the inside or the outside of the structures can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments. The girders can be erected from the existing superstructure. ▪ Minimal to no access to the valley will be required.	▪ No intermediate piers to widen in the LINK427 DD. ▪ Minimal to no access to the valley floor required by the LINK427 DD.	▪ **Significant Benefit**
Engineering	▪ Constructability issues ▪ Compliance with appropriate design criteria	▪ Piers are located directly adjacent to the limits of the construction impact area which will complicate the H-pile installation, retapping, and subsequent driving of piles. ▪ Piers are located directly adjacent to limits of the construction impact area and will complicate the installation of the scaffolding and proprietary formwork for pier ▪ The erection of the center span girders and reinforcing steel will require the crane to be placed as close to the span as possible requiring crane pads and girder access roads within the valley. ▪ The erection of the center span formwork will require the zoom booms to be placed in the valley as close as possible ▪ The pouring of the deck across the center span requires the concrete pumps and concrete trucks to be placed in the valley. During a high volume pour multiple trucks are pouring into the pump to maintain the required pour rate and will require significant room to function.	▪ Abutments are in approximately the same location as the PD. ▪ Design allows for all bridge construction to be conducted from behind the abutments and Retaining Walls ▪ Single row of H-Piles does not require the pile driver to go around the element being piled for retaps and subsequent driving ▪ Cranes and girders can be placed behind the abutments to erect the girders ▪ The formwork for the deck can be installed from the abutment locations with zoom booms ▪ Concrete Pump and trucks can be placed behind the abutments to pour the deck ▪ NU Girders do not require intermediate cross bracing to be bolted/welded from underneath ▪ Abutment formwork is self-contained and supported off of the RSS walls and will not require scaffolding and proprietary formwork	▪ Improved constructability for the LINK427 DD. ▪ Both designs are compliant with the appropriate design criteria.	▪ **Significant Benefit.**
Cost	▪ Cost	▪ Base cost	▪ The LINK427 DD results in a cost reduction of approximately 45%.	▪ The LINK427 DD results in a cost reduction of approximately 45%.	▪ **Significant Benefit.**

Table 2B: Net Environmental Effects Rain 5: Langstaff Road crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
Surface Water	▪ Impacts to surface water ▪ Effect on watercourses that do not support direct fish habitat within the crossing location	▪ No increase to the existing floodlines. ▪ The minimum freeboard is met for the Regulatory Flood. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ Impacts/changes to local channel hydraulics are limited. ▪ Where there is potential for erosion, appropriate offset or bank protection will be proposed.	▪ Potential impact to surface water levels = decrease of 0.68 m compared with the Regional Event elevation ▪ No increase to the existing floodlines ▪ The minimum freeboard is met for the Regulatory Flood ▪ Bankfull channel maintained ▪ Existing channel planform maintained ▪ Sediment transport and other channel functions maintained ▪ Impacts/changes to local channel hydraulics are limited ▪ Where there is potential for erosion, appropriate offset or bank protection will be proposed.	▪ Floodlines are not significantly affected by PD or LINK427 DD. ▪ Minimum Freeboard is maintained in both instances for the Regulatory Flood.	▪ Minor difference. ▪ **Insignificant.**
Fish and Fish Habitat	▪ Effect on watercourses that are confirmed to support direct fish habitat/use within the crossing location	▪ The bridge structure avoids direct encroachment into the bankfull channel. The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintains fish movement and protect the underlying physical habitat features.	▪ The precast concrete modular bridge structure avoids direct encroachment into the bankfull channel. The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features. ▪ The reinstated reach will be designed to provide natural channel form and contain natural substrates to provide adequate fish passage.	▪ No significant difference in fish passage or habitat. ▪ The re-instatement of a properly functioning open section of channel following removal of the existing culvert can be accommodated within the 14.6 m span of the open footing precast concrete modular bridge structure; bankfull channel is approximately 6.1 m wide. ▪ The Pathways of Effects will be used to confirm the negative residual effects that will be assessed to determine likelihood of serious harm to fish under the DFO/MTO/OMNRF Protocol (version 3 – Pilot). The main permanent residual effect is incremental loss of riparian vegetation as a result of shading of the new structures (common to both LINK427 DD and PD). Temporary disturbance and associated risk of impacts is required for both the PD and LINK427 DD to remove the existing culvert and re-instate the new channel section. These impacts can be managed with proper implementation of OPSS 182. While it is not anticipated based on the impact assessment undertaken to date that the works will likely result in serious harm and authorization requirement, a conservative approach will be used in considering whether DFO review [Request for Review (RfR) submission] is advisable given the channel re-instatement work. ▪ Both the PD and LINK427 design will allow for the re-instatement of an open channel section that will accommodate natural fluvial geomorphic processes. ▪ Light and moisture is inadequate under both the LINK427 DD and PD to support good vegetation growth throughout the crossing. ▪ No known research that links air flow to fish habitat. ▪ The 14.6 m open bottom structure is a significant improvement over the existing culvert for fish and fish habitat.	▪ Negligible / No Difference. ▪ **Insignificant.**
Wildlife Passage	▪ Effect of structures on wildlife passage as measured by bridge height and openness ratio	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and a minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). ▪ According to the 2010 EA: o OR = approx. 6.5 (using only one 36 m span) o OR = approx. 13 (using both 36 m spans) o Bridge height = approx. 4.5 – 5 m ▪ In comparison to the existing condition (culvert), the PD would result in an increase in span length by 69 m, an increase in height of 1.5 m, and an increase in OR of 12.74.	▪ Meets the EA Design Criteria for the bridge for a minimum bridge height of 3 m and exceeds the minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). ▪ The LINK427 DD parameters: o OR = approx. 1.4 o Precast concrete modular bridge structure height = approx. 3 – 3.5 m (3 m over centre of wildlife passage area) ▪ The MTO Environmental Guide for Mitigating Road Impacts to Wildlife (March 2017) and various other current research was considered in developing the LINK427 DD. ▪ The LINK427 crossing structures will also incorporate design elements to enhance the functionality of the wildlife passage.	▪ Both designs meet or exceed the minimum OR and minimum height design criteria and both significantly improve the function of movement of all animals, including large mammals (e.g., White-tailed Deer) at this location compared to the existing conditions. ▪ The LINK427 DD results in a 57.4 m reduction in span length compared with the PD, and a reduction from a two span bridge to a precast concrete modular bridge. The effects of these structural differences on wildlife passage are reflected in the OR calculation provided below. ▪ While the LINK427 DD reduces the OR relative to the PD by approximately 11.6, the OR still exceeds the required minimum design criteria provided in the 2010 EA by 0.8 (133%). ▪ While the LINK427 design reduces the height relative to the PD by approximately 1.5 m, the height still meets the required minimum design criteria of 3 m provided in the 2010 EA. ▪ No significant difference in wildlife movement opportunities from a height and OR perspective.	▪ Minor difference. ▪ **Insignificant.**

Table 2B: Net Environmental Effects Rain 5: Langstaff Road crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
				▪ No significant difference in ability to incorporate design elements (e.g. use of brush piles, boulders) to enhance the functionality of the wildlife passage. ▪ In addition, relative to existing condition (3 m x 3 m culvert), the LINK427 DD changes are extremely positive: o increase in span width of 11.6 m (387%) o Open footing vs. culvert closed bottom o 0.5 m increase in height o Increase in OR of 1.14 o Substantial improvement to wildlife movement ▪ Furthermore, based on more recent research and the prevailing literature, the 2010 EA design criteria should be viewed as 'targets' rather than 'minimums' – particularly in more urban/rural landscapes. Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the LINK427 design. The LINK427 structures will not impede passage of wildlife in this landscape. This is not a landscape or habitat mosaic that supports major, critical movements of large or 'core' populations that are important to the regional landscape. There are no significant tableland nodes, and no critical habitat features that require more critical seasonal movement or support for large populations of animals. Therefore, designs that more than exceed the standard criteria are not warranted.	
	▪ Effect of fill (m3) in the valley on wildlife passage (due to throttling of valley form)	▪ Estimated volume of fill in the valley for the PD is 3,000 m^3. ▪ Implementation of wildlife fencing to funnel wildlife effectively to and through the crossing.	▪ Estimated volume of fill in the valley for the LINK427 DD is 8,000 m^3. ▪ The location of the wildlife fencing was shifted to the toe of valley / fill slope based on the input of MNRF to better funnel animals to and under the structure. With the implementation of the Wildlife Fence Plan, wildlife will be funneled effectively to and through the crossing thereby minimizing the impact to wildlife passage as a result of fill in the valley.	▪ LINK427 design requires an additional 5,000 m^3 of fill in the valley compared to the PD. ▪ With the implementation of strategically placed wildlife fence, the LINK427 DD will funnel wildlife effectively to and through the crossing. Therefore, the LINK427 DD will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor. ▪ The removal of the existing 3 m x 3 m culvert and replacement with a 14.6 m precast concrete modular bridge structure at this location will reinstate the valley linkage and will provide a substantial improvement to wildlife movement opportunities through the Rainbow Creek Valley system as a whole.	▪ Minor difference ▪ **Insignificant**
Fluvial Geomorphology	▪ Impacts to channel geomorphology	▪ Channel design required where existing culvert is to be removed. ▪ Channel bank stabilization required for newly constructed channel. ▪ Sediment transport and other channel functions maintained.	▪ Channel design required where existing culvert is to be removed. ▪ Channel bank stabilization required for newly constructed channel. ▪ Sediment transport and other channel functions maintained. ▪ No significant change in velocity through a range of events in the post-crossing condition.	▪ No change to fluvial geomorphology. ▪ The erosion allowance for RAIN-5 was determined based on a review of the existing planimetric form and local meander amplitudes - a slight departure from the geomorphological recommendations outlined within the EA, which assessed the 100-year erosion limit for channel reaches situated well upstream and downstream of the subject reach. ▪ The subject reach is relatively straight with limited evidence of adjustment, and local meander amplitudes up to 10 m were observed. ▪ The local meander amplitude was suggested to be applied as a surrogate for sizing the crossing, given the lack of channel sinuosity. ▪ The local meander amplitude was contained within the proposed 14.6 m structure.	▪ Negligible / No Difference. ▪ **Insignificant.**
Vegetation	▪ Effect on vegetation	▪ Existing vegetation is CUM1-1: Dry-Moist Old Field Meadow (Cultural Meadow). Apple trees and Manitoba maple were found in the 2010 fieldwork. ▪ Make reasonable efforts to reduce vegetation impacts at detailed design. ▪ Localized removal of riparian vegetation to remove the culvert will be required for the PD. ▪ Removal of existing trees to construct the PD bridge.	▪ Existing vegetation is CUM1-1: Dry-Moist Old Field Meadow (Cultural Meadow). Apple trees and Manitoba maple were found in the 2010 fieldwork. ▪ LINK427 DD makes reasonable efforts to reduce vegetation impacts through tightening up slopes and minimizing construction impacts. ▪ Localized removal of riparian vegetation to remove the culvert will be required for LINK427 DD. ▪ Removal of existing trees to construct LINK427 DD.	▪ Permanent impacts of the LINK427 DD are slightly more than shown in the PD due to the effects associated with fill embankments. ▪ Temporary impacts are less than shown in the PD and Vegetation Restoration Plan Framework. ▪ Replacement and enhancement of vegetation and riparian restoration can be achieved for both designs as described in the 2010 EA and Vegetation Restoration Plan Framework. ▪ Opportunities exist for enhancement of existing vegetation and mitigation of impacts for both designs.	▪ Minor difference. ▪ **Insignificant.**

Table 2B: Net Environmental Effects Rain 5: Langstaff Road crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
		▪ Some light penetration may be possible beneath the bridge. Riparian and slope vegetation should be replaced within the ROW.[12] ▪ Additional Tree and Shrub Plantings upstream of crossing where valley is open (2010 EA 7-41) ▪ Restore and enhance vegetation and habitat conditions that have been generally disturbed through agricultural and other cultural activities. ▪ The mitigation, restoration and enhancement plans will be developed in consultation with the agencies. ▪ Documents subsequent to the EA such as the Vegetation Restoration Plan Framework include more specific guidelines for restoration and mitigation of vegetation.	▪ Limited light penetration will be possible beneath the LINK427 arch structure. Riparian and slope vegetation will be replaced within the ROW.[13] ▪ Additional Tree and Shrub Plantings upstream of crossing where valley is open (2010 EA 7-41) is still feasible with LINK427 design. ▪ Restore and enhance vegetation and habitat conditions that have been generally disturbed through agricultural and other cultural activities still feasible with LINK427 DD. ▪ The mitigation, restoration and enhancement plans for the LINK427 DD are being developed in consultation with the agencies. ▪ The requirements for restoration shown in the Vegetation Restoration Plan Framework can be met. ▪ All vegetation areas outside designated construction routes will be fenced, minimizing the impacts to vegetation. ▪ Crane access will be from the top of structure, minimizing vegetation impacts. ▪ Embankment slopes can be enhanced with additional topsoil, amendments and stabilization to provide improved conditions for vegetative restoration. Restoration of woody vegetation will not occur on fill slopes. ▪ Riparian and slope vegetation can be replaced and enhanced within the ROW as required by the EA, with the exception of the area directly below the structure. Because the area below the structure would experience shading and moisture deprivation, restoration outside the structure is more likely to be successful.	▪ Replacement and enhancement of removed vegetation would not be possible directly below the structure, but can be achieved in adjacent areas within the ROW. ▪ It is noted that while there is an increased volume of fill in the valley required for the LINK427 DD vs. the PD (as noted under the Wildlife Passage Environmental Factor), the difference in the net effects to vegetation as a result of this additional volume of fill vs the PD is negligible and insignificant. The additional fill required for the LINK427 design is in the area between the piers and abutments in the LINK427 DD (i.e. under the structure) that would have been subject to shading influences. LINK427 has done considerable work to demonstrate (via sun/shade computer modelling studies and site reconnaissance to review of vegetation survivorship under existing structures of similar height and orientation) that based on the absence of sunlight and moisture there will be little vegetation survival or growth potential under either structure. Furthermore, minor changes in structure height make almost no difference to the penetration of the shading impacts under the bridges. Therefore, the impact to vegetation in this area can be considered permanent for both the PD and LINK427 DD. ▪ The conclusion of a 'minor difference' in net effect to vegetation is further supported by the quality of vegetation that is impacted at this location (i.e. cultural meadow, a very common, tolerant vegetation community).	
Transportation	▪ Flexibility for future expansion/precluding or prejudging future expansion	▪ Expansion to either side of the structure can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments ▪ The piers can be widened to either side by constructing access into the valley, installing shoring systems/coffer dams, and constructing the pier widenings. The access needed may require additional temporary lands depending on the extent of the widening. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ Expansion to either side of the structure can be accomplished by using conventional methods. ▪ The footings can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments ▪ The precast arch superstructure can be widened by placing the equipment behind the abutments. The arch components can be erected from the existing superstructure.	▪ Reduced time for construction with LINK427 DD. ▪ No access to the valley in front of the footings is required. ▪ No intermediate piers.	▪ **Significant Benefit.**
Engineering	▪ Constructability issues ▪ Compliance with appropriate design criteria	▪ The erection of the girders will require cranes to be placed in the valley area, impacting existing vegetation. There will be disturbance on the south side for the access road down to construct the piers in the second stage. ▪ The removal of the headwalls on the south side will require intrusion into the areas outside of the construction impact area.	▪ Construction of the Structure can be completed from behind the abutments. ▪ The Cranes and vehicles delivering the concrete arch components can be placed behind the abutments. ▪ The piling can be constructed without interfering with the vegetation outside of the limits of the construction impact areas.	▪ Improved constructability for the LINK427 DD. ▪ Both designs are compliant with the appropriate design criteria.	▪ **Significant Benefit.**

[12] 2010 EA 7.1.2.2 Potential Impacts and 7.1.2.3 Mitigation Measures: "Replace and enhance riparian vegetation removed on the valley slope by the bridge construction by planting clusters of native tree and shrub species along this bank and within the ROW with native tree and shrub species. This requirement is fully attainable with the LINK design, with the exception of planting directly below the structure.

[13] 2010 EA 7.1.2.2 Potential Impacts and 7.1.2.3 Mitigation Measures: "Replace and enhance riparian vegetation removed on the valley slope by the bridge construction by planting clusters of native tree and shrub species along this bank and within the ROW with native tree and shrub species. This requirement is fully attainable with the LINK design, with the exception of planting directly below the structure.

Table 2B: Net Environmental Effects Rain 5: Langstaff Road crossing of Rainbow Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
			▪ The removal of the existing culvert headwalls on the south side will require intrusion into the vegetation outside of the limits of the construction impact areas on the south side.		
Cost	▪ Cost	▪ Base cost	▪ The LINK427 DD results in an approximate cost reduction of 65%.	▪ The LINK427 DD results in an approximate cost reduction of 65%.	▪ **Significant Benefit.**

Table 2C: Net Environmental Effects Rob 5: Highway 427 crossing of West Robinson Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
Surface Water	▪ Impacts to surface water ▪ Effect on watercourses that do not support direct fish habitat within the crossing location	▪ Increase of the floodline but remains within the MTO ROW ▪ Minimum freeboard criteria is met for the Regulatory Flood. ▪ Bankfull channel maintained ▪ Existing channel planform maintained ▪ Sediment transport and other channel functions maintained ▪ Impacts/changes to local channel hydraulics are limited ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed	▪ Potential localized impact to surface water levels = 0.25 m compared with the Regional Event elevation. However, the surface water levels would return to existing levels within 55 m upstream of the proposed southbound structure and would be contained within the MTO lands. ▪ Minimum freeboard criteria is met for the Regulatory Flood ▪ Bankfull channel maintained ▪ Existing channel planform maintained ▪ Sediment transport and other channel functions maintained ▪ impacts/changes to local channel hydraulics are limited ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed.	▪ LINK427 DD = 0.05 m higher surface water level than the PD. ▪ There is no substantial difference between the PD and the LINK427 DD.	▪ Minor difference. ▪ **Insignificant.**
Fish and Fish Habitat	▪ Effect on watercourses that are confirmed to support direct fish habitat/use within the crossing location	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintains fish movement and protect the underlying physical habitat features.	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintains fish movement and protect the underlying physical habitat features.	▪ No significant difference in fish passage or habitat. ▪ The impact assessment and Pathways of Effects analysis confirm that negative residual effects are nominal and the likelihood of serious harm is low. Unlike the PD, the LINK427 DD will require localized bank protection along the NBL pier. This bank protection has been designed as a vegetated rock buttress that will be sculpted into the existing channel bank. Construction-related effects will be managed with proper implementation of OPSS182. The bed of the watercourse will not be altered and the existing bank profile will be maintained avoiding changes to the bankfull channel cross section. Therefore, the works and effects are localized in extent and temporary in nature. Otherwise, the new structures will fully span bankfull channel and natural fluvial geomorphic functioning of the channel will be maintained. The primary residual effect under both PD and LINK427 DD is localized reduction of riparian vegetation as a result of shading effects. Therefore, the overall effects are localized and serious harm is unlikely. As such, an MTO Project Notification Form will be filled out as per the DFO/MTO/OMNRF Protocol (version 3 – Pilot). ▪ The fill for the LINK427 DD is well beyond the bankfull channel as such does not affect fish habitat.	▪ Negligible / No Difference. ▪ **Insignificant.**
Wildlife Passage	▪ Effect of structures on wildlife passage as measured by bridge height and openness ratio	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and a minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer) ▪ According to the 2010 EA: o For the ultimate 10 lane scenario the OR = approx. 5 o Bridge height = approx. 4.5 m o OR exceeds the minimum EA criterion by 9.4 o Note: The OR assessment during the 2010 EA assumed a closed median as worst case scenario and is based on using only one of the 60 m spans. Much greater OR values are provided for the NBL and SBL separately, but most conservative value was selected for comparison with LINK design. The OR for both 60 m spans was not provided but can be calculated to be 2x, or an OR of approx. 10.	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and a minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). o For the ultimate 10 lane scenario the OR = ~6.2 o Bridge height ranges from ~4 m to ~8 m o Note: This assessment is based on the full span so is not directly comparable to the OR calculated during the 2010 EA. Regardless, it shows the LINK427 design far exceeds the minimum OR criterion by 5.6. ▪ The MTO Environmental Guide for Mitigating Road Impacts to Wildlife (March, 2017) and various other current research was considered in developing the LINK427 DD. ▪ The LINK427 crossing structures will also incorporate design elements to enhance the functionality of the wildlife passage.	▪ The LINK427 DD results in approximately a 33.4 m reduction in span length, relative to the PD, and retains a two span design. The effects of these structural differences on wildlife passage are reflected in the OR calculation provided below. ▪ While the LINK427 DD (for the ultimate 10-lane scenario) reduces the OR relative to the PD by approximately 3.8, the OR still exceeds the required minimum design criteria provided in the 2010 EA by 5.6 (for the ultimate 10-lane scenario). ▪ The LINK427 DD results in a change to the bridge height relative to the PD. The change ranges from a 0.5 m decrease to a 3.5 m increase. The height exceeds the 2010 EA design criteria of 3 m minimum height for wildlife passage by 1 m – 5 m. ▪ Since both designs far exceed the minimum OR and minimum height design criteria, both designs will maintain the function of movement of all animals, including large mammals (e.g. White-tailed Deer). ▪ No significant difference in wildlife movement opportunities from a height and OR perspective. ▪ No significant difference in ability to incorporate design elements (e.g. brush piles, boulders) to enhance the functionality of the wildlife passage.	▪ Minor difference. ▪ **Insignificant**.

Table 2C: Net Environmental Effects Rob 5: Highway 427 crossing of West Robinson Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
				▪ Furthermore, based on more recent research and the prevailing literature, the 2010 EA design criteria should be viewed as 'targets' rather than 'minimums' – particularly in more urban/rural landscapes. Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the LINK427 DD. The LINK427 structures will not impede passage of wildlife in this landscape. This is not a landscape or habitat mosaic that supports major, critical movements of large or 'core' populations that are important to the regional landscape. There are no significant tableland nodes, and no critical habitat features that require more critical seasonal movement or support large populations of animals. Therefore, designs that more than exceed the standard criteria are not warranted. ▪ The changes do not result in a significant adverse environmental effect on the valley as a wildlife movement corridor.	
	▪ Effect of fill (m3) in the valley on wildlife passage (due to throttling of valley form)	▪ Estimated volume of fill in the valley for the PD is 6,000 m^3. ▪ Implementation of wildlife fencing to funnel wildlife effectively to and through the crossing.	▪ Estimated volume of fill in the valley for the LINK427 DD is 20,000 m^3. ▪ The location of the wildlife fencing was shifted to the toe of valley / fill slope based on the input of MNRF to better funnel animals to and under the structure. With the implementation of the Wildlife Fence Plan, wildlife will be funneled effectively to and through the crossing thereby mitigating the potential impact to wildlife passage as a result of fill in the valley.	▪ LINK427 DD requires an additional 14,000 m^3 of fill in the valley relative to the PD. This large increase in fill is a result of raising the height of the bridge and is offset by the benefits of a higher structure. ▪ With the implementation of strategically placed wildlife fence, both designs will funnel wildlife effectively to and through the crossing. Therefore, the LINK427 DD will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor.	▪ Minor difference ▪ **Insignificant**
Fluvial Geomorphology	▪ Impacts to channel geomorphology	▪ Piers are located within erosion limit and will therefore require channel offset protection. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained.	▪ Piers are located within erosion limit and will therefore require channel offset protection. ▪ Channel bank protection required in vicinity of a crossing pier. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ No significant change in velocity through a range of events in the post-crossing condition.	▪ LINK427 DD incorporates bank treatment measures along a section of channel ~10 m in length adjacent to the pier of the NBL structure. This bank treatment has been designed by the fluvial geomorphologists so that it is sculpted into/to match the existing profile of the channel bank. The existing bankfull channel profile will be maintained. Therefore, the associated instream work is temporary and localized to the ~10 m length. ▪ The treatment will not reduce the channel bankfull width or alter the existing channel planimetric form.	▪ Minor difference. ▪ **Insignificant**
Vegetation	▪ Effect on vegetation	▪ Existing vegetation is FO-11 (CUW1/CUM1-1) – Dry – Moist Old Field Meadow (Cultural Meadow)/ Mineral Cultural Thicket ▪ Several mature bur oak trees exist in the valley and were recommended for retention, where feasible. ▪ Make reasonable efforts to reduce vegetation impacts at detailed design. ▪ Localized removal of riparian vegetation expected for PD. ▪ Removal of existing trees to construct bridge where necessary. ▪ The highway crossing of West Robinson Creek where the landscape was pastured and very open at the time of the EA. It was noted that this area would benefit substantially from the restriction of cattle access to the creek and riparian and floodplain areas, and subsequent planting/naturalization to improve cover and habitat opportunities, and enhance diversity and connectivity. (2010 EA) ▪ The EA anticipates that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. Gaps between medians can be planted as required. ▪ Riparian and slope vegetation should be replaced within the ROW.[14]	▪ Existing vegetation is FO-11 (CUW1/CUM1-1) – Dry – Moist Old Field Meadow (Cultural Meadow)/ Mineral Cultural Thicket ▪ Several mature bur oak trees exist in the valley and 3 of the 4 trees can be retained under the LINK427 DD. ▪ LINK427 has made reasonable efforts to reduce vegetation impacts at detailed design through tightening up of fill slopes and minimizing construction impacts in the valley. ▪ Localized removal of riparian vegetation expected for LINK427 DD. ▪ The highway crossing of West Robinson Creek is no longer pastured and has regenerated to early successional cultural meadow and cultural thicket. ▪ The LINK427 DD includes the same EA assumption that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. Gaps between medians can be planted as required. ▪ Riparian and slope vegetation can be replaced and enhanced within the ROW as required by the EA, with the exception of the area directly below the structure. Because the area below the structure would experience	▪ Permanent impacts are slightly more than shown in the PD due to fill embankments. ▪ Temporary impacts are less than shown in the Vegetation Restoration Plan Framework. ▪ Replacement and enhancement of vegetation and riparian restoration can be achieved as described in the EA as well as the Vegetation Restoration Plan Framework. ▪ Opportunities exist for enhancement of existing vegetation and mitigation of impacts. ▪ Replacement and enhancement of removed vegetation would not be possible directly below the structure, but can be achieved in adjacent areas within the ROW. ▪ Replacement and enhancement of vegetation and riparian restoration can be achieved as described in the EA. ▪ It is noted that while there is an increased volume of fill in the valley required for the LINK427 DD vs. the PD (as noted under the Wildlife Passage Environmental Factor), the difference in the net effects to vegetation as a result of this additional volume of fill vs the PD is	▪ Minor difference. ▪ **Insignificant.**

[14] 2010 EA 7.1.2.2 Potential Impacts and 7.1.2.3 Mitigation Measures: "Replace and enhance riparian vegetation removed on the valley slope by the bridge construction by planting clusters of native tree and shrub species along this bank and within the ROW with native tree and shrub species. This requirement is fully attainable with the shortened span, with the exception of planting directly below the structure. Re-stabilize and restore the banks that have eroded and slumped using bioengineering techniques.

Table 2C: Net Environmental Effects Rob 5: Highway 427 crossing of West Robinson Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
		▪ Documents subsequent to the EA such as the Vegetation Restoration Plan Framework include more specific guidelines for restoration and mitigation of vegetation. The Framework recommends the planting of Graminoid Meadow in this valley to enhance barn swallow habitat.	shading and moisture deprivation, restoration outside the structure is more likely to be successful, as would have been the case with the PD as well. ▪ Documents subsequent to the EA such as the Vegetation Restoration Plan Framework include more specific guidelines for restoration and mitigation of vegetation. The Framework recommends the planting of Graminoid Meadow in this valley to enhance barn swallow habitat. This can be achieved with the LINK427 DD. ▪ All vegetation areas outside designated construction routes will be fenced, minimizing the impacts to vegetation. ▪ Embankment slopes can be enhanced with additional topsoil, amendments and stabilization to provide improved conditions for vegetative restoration. Restoration of woody vegetation will not occur on fill slopes. ▪ Construction access has been reduced from that described in the Vegetation Restoration Plan Framework due to refinements at detailed design.	negligible and insignificant. The additional fill required for the LINK427 DD is in the area between the piers and abutments in the LINK427 DD (i.e. under the structure) that would have been subject to shading influences. LINK427 has done considerable work to demonstrate (via sun/shade computer modelling studies and site reconnaissance to review of vegetation survivorship under existing structures of similar height and orientation) that based on the absence of sunlight and moisture there will be little vegetation survival or growth potential under either structure. Furthermore, minor changes in structure height make almost no difference to the penetration of the shading impacts under the bridges. Therefore, the impact to vegetation in this area can be considered permanent for both the PD and LINK427 DD. ▪ It is noted that while there is an increased volume of fill in the valley required for the LINK427 design vs. the PD, this fill is not below the structure and therefore the ability to restore this impacted area is somewhat reduced relative to the PD. The conclusion of a 'minor difference' in net effect to vegetation is further supported by the quality of vegetation that is impacted at this location (i.e. early successional cultural meadow, a very common, tolerant vegetation community), and the fact that this community type can be easily restored on fill slopes and other areas of the Lands.	
Transportation	▪ Flexibility for future expansion/precluding or prejudging future expansion	▪ Expansion either to the inside or the outside of the structures can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments ▪ The piers can be widened to either side by constructing access into the valley, installing shoring systems/coffer dams, and constructing the pier widenings. The access needed may require additional temporary lands depending on the extent of the widening. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ Expansion either to the inside or the outside of the structures can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments ▪ The piers can be widened to either side by constructing access into the valley, installing shoring systems/coffer dams, and constructing the pier widenings. The access needed may require additional temporary lands depending on the extent of the widening. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ No difference.	▪ Negligible / No Difference. ▪ **Insignificant.**
Engineering	▪ Constructability issues ▪ Compliance with appropriate design criteria	▪ Access Roads into the valley will require intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The construction of the west pier will require intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The piling design includes 3 rows of piles, 2 of which are battered. Access around the entire pier to facilitate piling and the required re-tapping will require intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The scaffolding and engineered formwork systems to construct the pier will require room to assemble, erect and modify. Intrusions into the vegetation outside of the limits of the construction impact areas will be necessary ▪ The superstructure is comprised of Steel I beams spanning a t total of 120 m. This configuration usually requires the girders to be continuous over the pier and be constructed with intermediate cross bracing spaced at regular intervals. Due to transportation restrictions, the first section of each girder will probably be around 80 m long (matching the end point of stress reversal in the girder). The access roads and cranes will need to be able to handle girders of this length. In addition, the installation of the cross bracing will require direct access underneath the majority of the structure. This will	▪ Access Roads into the valley will require intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The construction of the west pier will require intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The LINK427 DD does not include for piling in the pier footing and as such less intrusion into the vegetation outside of the limits of the construction impact areas past the pier is necessary ▪ The scaffolding and engineered formwork systems to construct the pier will require room to assemble, erect and modify. Intrusions into the vegetation outside of the limits of the construction impact areas will be necessary ▪ The superstructure is comprised of NU Girders. Installation of overhang formwork will require some intrusion into the vegetation outside of the limits of the construction impact areas. ▪ The deck will require concrete pumps to setup in the valley with room to allow for multiple concrete trucks. This will take up considerable room in the bottom of the valley.	▪ Improved constructability for the LINK427 DD. ▪ Both designs are compliant with the appropriate design criteria.	▪ **Significant Benefit.**

Table 2C: Net Environmental Effects Rob 5: Highway 427 crossing of West Robinson Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
		require intrusion in the vegetation outside of the limits of the construction impact areas. ▪ The overhang formwork installation will require some intrusion into the vegetation outside of the construction impact areas. The deck will require concrete pumps to setup in the valley with room to allow for multiple concrete trucks. This will take up considerable room in the bottom of the valley.			
Cost	▪ Cost	▪ Base cost	▪ The LINK427 DD results in an approximate cost reduction of 40%.	▪ The LINK427 DD results in an approximate cost reduction of 40%.	▪ **Significant Benefit.**

Table 2D: Net Environmental Effects Rob 6: Major Mackenzie Drive crossing of West Robinson Creek					
Environmental Factor	**Criteria**	**Preliminary Design (PD) Net Effect**	**LINK427 Detail Design (DD) Net Effect**	**Comparison / Difference**	**Significance of Change**
Surface Water	▪ Impacts to surface water ▪ Effect on watercourses that do not support direct fish habitat within the crossing location	▪ Does not increase the existing floodlines. ▪ The minimum freeboard is met for the Regulatory Flood. ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ Impacts/changes to local channel hydraulics are limited. ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed.	▪ Potential impact to water levels = decrease of 0.04 m compared with the Regional Event elevation. ▪ Does not increase the existing floodlines. ▪ The minimum freeboard is met for the Regulatory Flood ▪ Bankfull channel maintained. ▪ Existing channel planform maintained. ▪ Sediment transport and other channel functions maintained. ▪ impacts/changes to local channel hydraulics are limited. ▪ Where there is potential for erosion appropriate offset or bank protection will be proposed.	▪ Floodlines are not affected by the PD and LINK427 DD. ▪ Minimum Freeboard is maintained in both instances	▪ Minor difference. ▪ **Insignificant.**
Fish and Fish Habitat	▪ Effect on watercourses that are confirmed to support direct fish habitat/use within the crossing location	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features.	▪ The bridge structure avoids direct encroachment into the bankfull channel. ▪ The structure maintains the fluvial geomorphic and hydrotechnical functioning of the channel, which minimizes potential indirect effects to the watercourse, and will in turn, maintain fish movement and protect the underlying physical habitat features. ▪ The reinstated reach will be designed to provide natural channel form and contain natural substrates to provide adequate fish passage.	▪ No significant difference in fish passage or habitat. ▪ The re-instatement of a properly functioning open section of channel following removal of the existing culvert can be accommodated within the 41.2 m clear span bridge. ▪ The Pathways of Effects (PoE's) will be used to confirm the negative residual effects that will be assessed to determine likelihood of serious harm to fish under the DFO/MTO/OMNRF Protocol (version 3 – Pilot). The main permanent residual effect is incremental loss of riparian vegetation as a result of shading of the new structures (common to both LINK427 DD and PD). Temporary disturbance and associated risk of impacts is required for both the PD and LINK427 DD to remove the existing culvert and re-instate the new channel section. These impacts can be managed with proper implementation of OPSS 182. While it is not anticipated based on the impact assessment undertaken to date that the works will likely result in serious harm and authorization requirement, a conservative approach will be used in considering whether DFO review [Request for Review (RfR) submission] is advisable given the channel re-instatement work. ▪ Both the PD and LINK427 DD will allow for the re-instatement of an open channel section that will accommodate natural fluvial geomorphic processes.	▪ Negligible / No Difference. ▪ **Insignificant.**
Wildlife Passage	▪ Effect of structures on wildlife passage as measured by bridge height and openness ratio	▪ Exceeds the EA Design Criteria for the bridge for a minimum bridge height of 3 m and a minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer) ▪ According to the 2010 EA: o OR = approx. 3 (using only one of the 34 m spans) o OR = approx. 6 (using both 34 m spans) o Bridge height = approx. 3 – 4 m ▪ In comparison to the existing condition, the PD has an increase in span length of 63 m, an increase in height of 0 - 1 m, and an increase in OR of approx. 4.	▪ Meets the EA Design Criteria for the bridge for a minimum bridge height of 3 m and exceeds the minimum openness ratio (OR) of 0.6 to facilitate movement of the full range of animals using this landscape, including large mammals (e.g. White-tailed Deer). o OR = approx. 3.6 o Bridge height = approx. 3 – 4 m ▪ The MTO Environmental Guide for Mitigating Road Impacts to Wildlife (March, 2017) and various other current research was considered in developing the LINK427 design. ▪ The LINK427 crossing structures will also incorporate design elements to enhance the functionality of the wildlife passage.	▪ Both designs meet or exceed the minimum OR and minimum height design criteria and both significantly improve the function of movement of all animals, including large mammals (e.g. White-tailed Deer) at this location compared to the existing conditions. ▪ The LINK427 DD results in a reduction in span length of 28 m (41%) compared to the PD, and a change from a two span to a single span structure. The effects of these structural differences on wildlife passage are reflected in the OR calculation as provided below. ▪ While the LINK427 DD reduces the OR relative to the PD by approximately 2.4 (40%), the OR still exceeds the required minimum design criteria provided in the 2010 EA by 3 (500%). ▪ The LINK427 DD provides the same bridge height as the PD, which exceeds the 2010 EA design criteria of 3 m height for wildlife passage by 0 m – 1 m. ▪ No significant difference in wildlife movement opportunities from a height and OR perspective. ▪ No significant difference in ability to incorporate design elements (e.g., brush piles, boulders) to enhance the functionality of the wildlife passage. ▪ In addition, relative to existing condition (5 x 3 m culvert), the changes from the LINK427 DD are extremely positive:	▪ Minor difference. ▪ **Insignificant.**

				○ 35 m (700%) increase in span length ○ Culvert replaced with a bridge ○ 0 – 1 m increase in height ○ Increase in OR of 2.6 ▪ Furthermore, based on more recent research and the prevailing literature, these criteria should be viewed as 'targets' rather than 'minimums' – particularly in more urban/rural landscapes. Wildlife common to this landscape, and White-tailed Deer in particular, will use much smaller structures than those provided by the LINK427 DD. The LINK427 structures will not impede passage of wildlife in this landscape. This is not a landscape or habitat mosaic that supports major, critical movements of large or 'core' populations that are important to the regional landscape. There are no significant tableland nodes, and no critical habitat features that require more critical seasonal movement or support large populations of animals. Therefore, designs that exceed standard criteria are not warranted.	
	▪ Effect of fill (m3) in the valley on wildlife passage (due to throttling of valley form)	▪ Estimated volume of fill in the valley for the PD is 5,000 m^3. ▪ Implementation of wildlife fencing to funnel wildlife effectively to and through the crossing.	▪ Estimated volume of fill in the valley for the LINK427 DD is 8,000 m^3. ▪ The location of the wildlife fencing was shifted to the toe of valley / fill slope based on the input of MNRF to better funnel animals to and under the structure. With the implementation of the Wildlife Fence Plan, wildlife will be funneled effectively to and through the crossing thereby mitigating the impact to wildlife passage as a result of fill in the valley.	▪ LINK427 DD requires an additional 3,000 m^3 (60%) of fill in the valley. ▪ With the implementation of strategically placed wildlife fence, both designs will funnel wildlife effectively to and through the crossing. Therefore, the LINK427 DD will not have any significant adverse effects on wildlife movement along the valley or associated stream corridor. ▪ The removal of the existing 5 m x 3 m culvert and replacement with a 40 m bridge span at this location will reinstate the valley linkage and will have a substantial improvement to wildlife movement opportunities through the West Robinson Creek Valley system as a whole.	▪ Minor difference ▪ **Insignificant**
Fluvial Geomorphology	▪ Impacts to channel geomorphology	▪ Channel design required, where existing culvert is to be removed. ▪ Channel bank stabilization required for newly constructed channel. ▪ Sediment transport and other channel functions maintained.	▪ Channel design required, where existing culvert is to be removed. ▪ Channel bank stabilization required for newly constructed channel. ▪ Sediment transport and other channel functions maintained. ▪ No significant change in velocity through a range of events in the post-crossing condition.	▪ No change to fluvial geomorphology.	▪ Negligible / No Difference. ▪ **Insignificant.**
Vegetation	▪ Effect on vegetation	▪ Existing vegetation is FO-7: Fresh-Moist Willow Lowland Deciduous Forest ▪ Construction will require removal of woody vegetation and reasonable efforts to reduce vegetation impacts at detailed design. Localized removal of riparian vegetation. (2010 EA 7-67). ▪ The EA anticipates that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. ▪ Repair and enhance vegetation by planting clusters of tree and shrub species within the ROW (2010 EA 7-83) ▪ Edge management opportunities to be reviewed. ▪ Riparian and slope vegetation should be replaced within the ROW.[15] ▪ Documents subsequent to the EA such as the Vegetation Restoration Plan Framework include more specific guidelines for restoration and mitigation of vegetation.	▪ Existing vegetation is FO-7: Fresh-Moist Willow Lowland Deciduous Forest ▪ Construction will require removal of woody vegetation, but reasonable efforts to reduce vegetation impacts have been made by LINK427 through engineering considerations (e.g., steeper slopes). Localized removal of riparian vegetation will occur. (2010 EA 7-67). ▪ The EA anticipates that the majority of structures within the study area will not have riparian or slope restoration below the structures due to shading impacts. LINK427 DD assumes the same. ▪ Edge management is feasible with the LINK427 DD. ▪ Riparian and slope vegetation can be replaced and enhanced within the ROW as required by the 2010 EA, with the exception of the area directly below the structure. Because the area below the structure would experience shading and moisture deprivation, restoration outside the structure is more likely to be successful. ▪ All vegetation areas outside designated construction routes will be fenced, minimizing the impacts to vegetation. ▪ Embankment slopes can be enhanced with additional topsoil, amendments and stabilization to provide improved conditions for vegetative restoration. Restoration of woody vegetation will not occur on fill slopes.	▪ Permanent impacts are slightly more than shown in the PD due to fill embankments. ▪ Temporary impacts associated with the LINK427 DD are less than shown in the Vegetation Restoration Plan Framework. ▪ Replacement and enhancement of vegetation and riparian restoration can be achieved as described in the 2010 EA and the Vegetation Restoration Plan Framework. ▪ Opportunities exist for both designs for enhancement of existing vegetation and mitigation of impacts. ▪ Replacement and enhancement of removed vegetation would not be possible directly below the structure in the LINK427 DD, but can be achieved in adjacent areas within the ROW. ▪ It is noted that while there is an increased volume of fill in the valley required for the LINK427 DD vs. the PD (as noted under the Wildlife Passage Environmental Factor), the difference in the net effects to vegetation as a result of this additional volume of fill vs the PD is negligible and insignificant. The additional fill required for the LINK427 DD is in the area between the piers and abutments in the LINK427 DD (i.e. under the structure) that would have been subject to shading influences. LINK427 has done considerable work to demonstrate (via sun/shade computer modelling studies and site reconnaissance to review of vegetation survivorship under existing structures of similar height and orientation) that based on the absence of sunlight and	▪ Minor difference. ▪ **Insignificant.**

[15] 2010 EA 7.1.2.2 Potential Impacts and 7.1.2.3 Mitigation Measures: "Replace and enhance riparian vegetation removed on the valley slope by the bridge construction by planting clusters of native tree and shrub species along this bank and within the ROW with native tree and shrub species. This requirement is fully attainable with the shortened span, with the exception of planting directly below the structure. Re-stabilize and restore the banks that have eroded and slumped using bioengineering techniques.

			▪ Construction access has been reduced from that described in the Vegetation Restoration Plan Framework due to refinements at detailed design. ▪ Riparian and slope vegetation can be replaced and enhanced within the ROW as required by the EA.	moisture there will be little vegetation survival or growth potential under either structure. Furthermore, minor changes in structure height make almost no difference to the penetration of the shading impacts under the bridges. Therefore, the impact to vegetation in this area can be considered permanent for both the PD and LINK427 DD. ▪ The conclusion of a 'minor difference' in net effect to vegetation is further supported by the quality of vegetation that is impacted at this location (i.e. willow lowland deciduous forest, a common, vegetation community that is comprised of many non-native species and is already impacted by the adjacent road).	
Transportation	▪ Flexibility for future expansion/precluding or prejudging future expansion	▪ Expansion to either side of the structure can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments. ▪ The piers can be widened to either side by constructing access into the valley, installing shoring systems/coffer dams, and constructing the pier widenings. The access needed may require additional temporary lands depending on the extent of the widening. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ Expansion to either side of the structure can be accomplished by using conventional methods. ▪ The abutments can be widened by installing shoring systems on either side of the structure allowing for the extension of the abutments. ▪ The girders and superstructure can be widened by placing the equipment behind the abutments and in the valley. The girders can be erected from the existing superstructure.	▪ No intermediate pier. ▪ Reduced requirement to access the valley.	▪ **Significant Benefit.**
Engineering	▪ Constructability issues ▪ Compliance with appropriate design criteria	▪ The access roads to construct the center pier will enter into the valley, Stage1 will require an access road that extends into the vegetation outside of the construction impact areas. ▪ The erection of the girders will require the placement of crane pads within the valley and will require some intrusion into the vegetation outside of the construction impact areas. ▪ The placement of concrete pumps and concrete trucks to facilitate the pour will require access to the valley and as such require intrusion into the vegetation outside of the construction impact areas. ▪ The center pier, north half is located inside the vegetation outside of the construction impact areas.	▪ The substructure has been placed entirely outside of the vegetation outside of the construction impact areas. ▪ The construction of the bridge can take place from behind the abutments limiting intrusions into the valley. ▪ The erection of the single span girders can be accomplished by placing the cranes behind the abutment and not entering the valley. ▪ The concrete pours can be conducted from behind the abutments as the pumps can reach the entire length of the superstructure.	▪ Improved constructability for the LINK427 DD. ▪ Both designs are compliant with the appropriate design criteria.	▪ **Significant Benefit.**
Cost	▪ Cost	▪ Base cost	▪ The LINK427 DD results in a cost reduction of approximately 30%.	▪ The LINK427 DD results in a cost reduction of approximately 30%.	▪ **Significant Benefit.**

Appendix E: Drawings

Bound under separate cover

Appendix F: Groundwater Dewatering Assessment Summary Table

Groundwater Dewatering Assessment Summary Table

Updated: May 31, 2018

Reference Area	Site Name, ID and Drawing (DWG) Number	Station (STA) IDs	Field Status	Engineering Drawing **Reference Drawings: January 12, 2018 (90% complete)**	Hydrogeological Assessment Conditions	Dewatering Evaluation (LPD-Litres per day)	Final Comments
Highway 7 to Major Mackenzie Drive					Chainage starts at 10+000 from Highway 7 for northern portion of Highway 427		
15	Highway 427 Northbound and Southbound Lanes bridge over Rainbow Creek (DWG-133, 134)	STA.11+600	Static water levels,single well response test, water quality (WQ) sampling completed. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	Construction on piles. Pile caps above ground surface.	Less than 50,000 LPD	The structure will be founded on H piles as designed and the pile cap will be above GW level.
16	Langstaff Road Underpass (DWG-136, 137)	STA. 12+100	Static water level and single well response test completed.	90% available and reviewed.	Foundation of the centre pier will be founded at 181.0 masl in till below groundwater table of 182.8 masl encountered in till.	Less than 50,000 LPD	There is potential for gravity flow from shallow sand seams and as a result some amount of water may accumulate in the excavated trench. Sump pumping would be adequate to address this issue.
20	Highway 427 Northbound and Southbound Lanes over West Robinson Creek (DWG-142, 143)	STA. 15+525	Static water levels and water quality sampling completed. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	The structures of north and south abutments and centre pier will be founded on piles. The deepest excavation for pilecap will be for the centre pier underside of which will extend to approximnately 192 masl in to the till. The groundwater level in the till is at 192.7 masl.	Less than 50,000 LPD	Till is not conductive to transport and flow of groundwater however since this site is close to a creek there is potential for connected channel deposit that could become preferential pathway and may cause issues of groundwater seepage in the trench for pile cap for the centre pier. However sump pumping would be adequate to address this issue.
21	Highway 427 Overpass at CPR / McGillivray Road (DWG-145, 146, 147, 148)	STA. 15+990	Static water levls,single well response test, water quality sampling complete. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	Deepest excavation for the piers will extend to an elevation of 199.0 masl, well above water levels (191.2, CPR17-04) measured in nearby MW.	Dewatering not anticipated.	All of the excavations as designed will be above GW table, so dewatering at this site will not be required.
22	Highway 427 Overpass at Major Mackenzie Drive (DWG-149, 150)	STA. 16+550	Static water levels and water quality sampling completed. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	The overpass structure will be founded on piles (209.00 masl) and as designed the pile cap is above the exiting ground.	Dewatering not anticipated.	This structure will be constructed above ground. So dewatering is not expected.
Off Highway 427 alignment Locations (from North to South direction)							
23	Major Mackenzie Drive over West Robinson Creek (DWG-151, 152)	STA. 17+300	Static water levels,single well response test, water quality sampling complete. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	Bridge abutments on piles with underside of pile cap approximately at 198.3 masl in Till. Groundwater level in the monitoring wells nearby is between 199 and 200 masl.	Less than 50,000 LPD	Some form of dewatering will be required because of its proximity to the Robinson Creek and potential for presence of channel deposits.
25	Langstaff Road culvert over Rainbow Creek (DWG-135)	STA. 9+507	Static water levels,single well response test, water quality sampling complete. No issues of exceedance compared to PWQO guidelines.	90% available and reviewed.	Groundwater elevations are 180.4 to 179.7 masl and excavation for pile cap to extend to 176.7 as the open foot culvert structure will be on piles.	Less than 50,000 LPD	There is potential for minor volume dewatering as the excavation will extend below water table in till and has artesian pressure at the site. Active watercourse so there is potential for dewatering if channel deposits are encountered which may be in hydraulic connection with the area outside of construction footprint.

PWQO = Provincial Water Quality Objective, masl = metres above sea level, mgs = metres below ground surface

Appendix G: ESA Permit

Ontario

PERMIT UNDER clause 17(2)(c) of
THE ENDANGERED SPECIES ACT, 2007

Permit #: AU-C-011-16

Issued to: Her Majesty the Queen in Right of Ontario as Represented by the
Minister of Transportation
Major Projects Office
159 Sir William Hearst Avenue, 7th Floor
Toronto, Ontario M3M 0B7

ATTN: Teepu Khawja –Regional Director – Central Region
Email: teepu.khawja@ontario.ca
Phone: 416- 235-5400

Term: This permit comes into force on the date it is issued (the "Effective Date") and expires on January 31, 2024.

Location: Highway 427 Expansion Project from Albion Road to Major Mackenzie Drive in the City of Vaughan, Regional Municipality of York and in the areas identified in Appendix B (the "Site").

1. **Authority.** This permit is issued to Her Majesty the Queen in Right of Ontario as represented by the Minister of Transportation ("the Proponent") under clause 17(2)(c) of the Endangered Species Act, 2007 (ESA, 2007).

2. **Application to Species.** This permit applies to Little Brown Myotis, Northern Myotis, and Eastern and Small-footed Myotis which are species listed as endangered on the Species at Risk in Ontario list, and their habitats, which is protected under the ESA, 2007.

3. **Authorization.** This permit authorizes the Proponent to engage in the activities specified in condition 4 that would otherwise be prohibited by subsections 9(1) and 10(1) of the ESA, 2007, for the purpose of expanding Highway 427 from Albion Road to Major Mackenzie Drive which will involve vegetation disturbance and removal, site grading and excavation, demolition of building structures, extending lanes on Highway 427, widening existing highway lanes, improving drainage and illumination facilities, and associated Site restoration works (the "Project").

4. **Application of Authorization.** The authorization provided in section 3 applies to the Proponent as is necessary to:

   (a) cause temporary damage to **0.45 hectares** (ha) **(Fig 2c and 2e)** and destroy **2.18** ha **(Fig 2c, 2d and 2e)** of the habitat of Little Brown Myotis, Northern Myotis, and Eastern Small-footed Myotis at the Site in order to carry out the Project and fulfill the conditions of the permit;
   (b) damage and destroy 1 building structure (**Fig 2a**) used by Little Brown Myotis, Northern Myotis, and Eastern Small-footed Myotis at the Site in order to carry out the Project and fulfill the conditions of the permit (Barn 1 shown in Fig 2b was used by Little Brown Myotis, Northern Myotis, and Eastern Small-footed Myotis);
   (c) capture, harm, harass, possess and transport Little Brown Myotis, Northern Myotis, Eastern and Small-footed Myotis at the Site in order to carry out the Project and fulfill the conditions of the permit.

5. **Conditions:** The activities authorized by this permit are subject to all of the conditions specified herein.

6. **Appendices:** The following appendices form part of this permit:

   - Appendix A: Conditions
   - Appendix B: Project Location (the Site) (Works and Overall Benefit Activities)
   - Appendix C: Monitoring Report Specifications
   - Appendix D: Notification / Contact Schedule

Failure to comply with conditions in this permit may result in a contravention of the ESA, 2007.

Pursuant to clause 17(2)(c) of the ESA, 2007, I hereby issue this permit authorizing the activities described above, subject to the conditions set out herein.

Nathalie Des Rosiers
Minister of Natural Resources and Forestry

Date of Issuance: March 28 / 2018
(dd/mm/yy)

APPENDIX A: CONDITIONS

Definitions

1. In the permit, the following words shall have the following meanings:

   a) **"Bat Species"** means Little Brown Myotis, Northern Myotis and Eastern Small-footed Myotis;

   b) **"Building Structures"** means existing human-made barns, sheds and houses at the Site;
   c)
   d) **"Design Drawing"** means a drawing or figure identified in Appendix C;

   e) **"MNRF"** means the Aurora District Office of the Ministry of Natural Resources and Forestry;

   f) **"Notification/Contact Schedule"** means the document in Appendix E, that outlines the protocol to be followed to communicate with the MNRF as it may be amended from time to time;

   g) **"Overall Benefit Activities"** means the activities described in condition 5 of this Appendix that shall be undertaken in order to create an overall benefit for Bat Species;

   h) **"Qualified Professional"** means a person with particular expertise who is trained or qualified in a specific area;

   i) **"Works"** means activities including vegetation disturbance and removal, site grading and excavation, building demolition, extending lanes, widening existing highway lanes, improving drainage and illumination facilities, and associated Site restoration, needed to expand Highway 427 from Albion Road to Major Mackenzie Drive and associated Site restoration works at the Site.

General

2. A copy of this permit must be maintained on the Site at all times when activities are being conducted under the authority of the permit.

3. The Proponent shall retain a Qualified Professional to supervise and assist with the implementation of conditions 4 through 10 inclusive.

4. The Proponent shall carry out the Works and Overall Benefit Activities in accordance with the following:

   a) The Proponent shall carry out the Works in accordance with the Design Drawings;

   b) Works within the Bat Species habitat shall be conducted between **October 1** and **March 31**, of any year this permit is in effect, unless as otherwise directed by MNRF;

   c) Overall Benefit Activities related to planting of trees and shrubs described in conditions 5(a) through to 5(c) shall be conducted between **March 31** and **May 30th**, of any year this permit is in effect, unless as otherwise directed by MNRF;

   d) Overall Benefit Activities related to installation of habitat structures listed in condition 5(d) shall be conducted between **October 1** and **March 31**, of any year this permit is in effect, unless as otherwise directed by MNRF;

Overall Benefit Activities

5. The Proponent shall carry out the following activities for the purpose of providing an overall benefit to Bat Species:

a) Habitat Enhancement: Restoration Area 4

To create habitat conditions preferred by the Bat Species, a total 3.20 ha of the existing Cultural Thicket (CUT1) community and agricultural field will be planted and restored to a deciduous forest in Restoration Area 4 in accordance with Figure 3b in Appendix B. The restoration activities to be undertaken for this area are divided into three (3) components:

I. Woodland Restoration of the former Agricultural Field

This area will be reforested using an estimated total of 865 trees including:

- 10 trees that are approximately 2.4 m in height;
- 340 trees that are approximately 1.8 m in height;
- 20 trees that are approximately 1.5 m in height;
- 375 trees that are approximately 50 mm caliper;
- 70 trees that are approximately 40 mm caliper; and,
- 50 whip size (i.e., potted stock).

- 250 of the 1.8 m trees will be used to create an additional coniferous buffer (using White Spruce (*Picea glauca*) between the edge management area and the woodland restoration area. This buffer will help to block light and sound from the prosed highway extension.
- The 10 trees that are approximately 2.4 m high will be used to plant a cluster of White Pine (*Pinus strobus*) which will provide maternity roosting habitat for the Tri-coloured Bat.
- The remaining 605 trees of various sizes will be used restore the existing agricultural field to a deciduous forest community. Species planted will include: White Pine, Bur Oak (*Quercus macrocarpa*), Basswood (*Tilia americana*), Shagbark Hickory (*Carya ovata*), Red Maple (*Acer rubrum*), Eastern Cottonwood (*Populus deltoides*), Sugar Maple (*Acer saccharum*), Choke Cherry (*Prunus virginiana*) and Trembling Aspen (*Populus tremuloides*).

II. Woodland Restoration of Existing CUT1:

Portions of Proposed Restoration Area 4 currently represented by CUT1 will be managed to reduce invasive species such as common buckthorn which is prevalent throughout the CUT1 community. Native woody species including White Elm and Hawthorns shall be preserved where possible.

- The number of trees which can be planted in the Proposed Restoration Area 4 currently represented by CUT1 will be dependent on the amount of invasive species removed. Based on the size of this area, an estimated maximum of 282 trees could be planted. This includes a maximum of:

  - 62 trees that are approximately 1.8 m in height;
  - 15 trees that are approximately 1.5 m in height;
  - 103 trees that are approximately 50 mm caliper;
  - 52 trees that are approximately 40 mm caliper; and,

- 50 whip size (i.e., potted stock).
- Species planted will include: White Pine, Bur Oak, Sugar Maple, Choke Cherry, Basswood, Shagbark Hickory, Red Maple, Eastern Cottonwood and Trembling Aspen.

III. Edge Management Areas

A total of 3,409 shrubs of either a 1 or 2 gal pot sizes will be planted along the edge of the woodland restoration area to provide edge management. Species planted will include: Red Osier Dogwood (*Cornus sericea*), Grey Dogwood (*Cornus racemosa*), Smooth Serviceberry (*Amelanchier laevis*), Fragrant Sumac (*Rhus aromatica*), Staghorn Sumac (*Rhus typhina*) and Red Elderberry (*Sambucus racemosa*).

A seed mix will also be applied to the edge management area (Ontario Seed Company [OSC] – Woodland Seed Mix 8275).

b) Habitat Enhancement: Restoration Area 6

Restoration Area 6 in Figure 3-c of Appendix B, consisting of 0.13 ha, will be restored by planting native shrubs. An estimated total of 737 shrubs of either a 1 or 2 gal pot sizes will be planted along the edge of the woodland restoration area to provide edge management in accordance with Figure 3-c in Appendix B. Species planted will include: Red Osier Dogwood, Grey Dogwood, Smooth Serviceberry, Fragrant Sumac, Staghorn Sumac and Red Elderberry.

c) Habitat Enhancement: Restoration Area 8

Restoration Area 8, consisting of 0.17 ha will be restored by planting native trees and shrubs in accordance with Figure 3d in Appendix B. This area will be reforested using an estimated total of 49 trees including

- 10 trees that are approximately 1.8 m in height;
- three (3) trees that are approximately 1.5 m in height;
- 24 trees that are approximately 50mm caliper;
- nine (9) trees that are approximately 40mm caliper; and,
- three (3) whip size (i.e., potted stock).

Species planted will include: White Pine, Bur Oak, Sugar Maple, Choke Cherry, Peachleaf Willow (*Salix amygdaloides*), Red Maple, Balsam Poplar (*Populus balsamifera*) and Trembling Aspen.

d) Habitat Structures

A total of 12 bat boxes and five (5) Branden Bark™ structures will be installed within Restoration Areas 3 and 4 in a clustered pattern in accordance with Figures 3-a, 3-b, 3-c and 3-d in Appendix B. Locations are based on specific habitat types that were selected to target species specific foraging and roosting preferences.

Bat boxes and BrandenBark™ structures will be strategically placed near the foraging habitat of the four (4) Bat Species found in the lands. Northern Myotis prefer a more natural roosting site and peeling bark, therefore the installation of five (5) BrandenBark™ structures will also be utilized in Proposed Restoration Area 4 to compensate for the cavity trees being removed as part of the proposed works and provide an overall benefit to Bat Species.

Locations of structures are as follows:

Box ID	Location	Approximate Easting	Approximate Northing
BB-1	Restoration Area 3	4852567.122	608491.2325
BB-2	Restoration Area 3	4852567.958	608498.7148
BB-3	Restoration Area 3	4852560.271	608495.2971
BB-4	Restoration Area 3	4852554.408	608501.2776
BB-5	Restoration Area 4	4852334.687	608398.0381
BB-6	Restoration Area 4	4852333.279	608407.8087
BB-7	Restoration Area 4	4852325.259	608399.8238
BB-8	Restoration Area 4	4852322.949	608409.0106
BB-9	Restoration Area 4	4852244.706	608481.6627
BB-10	Restoration Area 4	4852248.335	608489.2491
BB-11	Restoration Area 4	4852037.049	608500.3271
BB-12	Restoration Area 4	4852040.849	608507.9707
BrB-1	Restoration Area 4	4852236.001	608481.3442
BrB-2	Restoration Area 4	4852238.749	608489.2363
BrB-3	Restoration Area 4	4852026.625	608507.527
BrB-4	Restoration Area 4	4852034.478	608511.6036
BrB-5	Restoration Area 4	4852027.448	608515.4563

6. The following Overall Benefit Activities (as described in condition 5 above) shall be completed prior to **December 31, 2018:**
   - 5.d) - Habitat Structures

   The following Overall Benefit Activities (as described in condition 5 above) shall be completed prior to **May 30, 2020:**
   - 5.a) 1 - Habitat Enhancement: Restoration Area 4 - Woodland Restoration of the former Agricultural Field
   - 5.a) 2 - Habitat Enhancement: Restoration Area 4 - Woodland Restoration of Existing CUT1

   The following Overall Benefit Activities (as described in condition 5 above) shall be completed prior to **May 30, 2021**:
   - 5.a) 3 - Habitat Enhancement: Restoration Area 4 – Edge Management
   - 5. b) Habitat Enhancement: Restoration Area 6
   - 5. c) Habitat Enhancement: Restoration Area 8

Corrective Actions

7. On an ongoing basis from the start of the Works or Overall Benefit Activities until the expiry of the permit, the Proponent shall take corrective actions such as replacing vegetation that does not survive, or other actions specified by MNRF, and the Proponent shall report to MNRF immediately after taking such corrective actions.

Bat Species Handling

8. The following conditions apply in relation to the handling of Bat Species, in the event that these species are captured or collected during the implementation of the Works and Overall Benefit Activities being carried out under the authority of this permit:

   a) The Proponent shall notify MNRF as per the Notification/Contact Schedule twenty-four (24) hours in advance of undertaking any wildlife rescue activities authorized under this permit;

b) Prior to handling any Bat Species under the authority of this permit, a person shall be trained in proper bat handling procedures;

c) Prior to using capture equipment under the authority of this permit, a person shall be trained in the use of that equipment;

d) If a member of a species protected by the ESA, 2007 other than Bat Species is incidentally captured, the capture must be reported by e-mail to MNRF as per the Notification/Contact Schedule within twenty-four (24) hours; and

9. If an injured Bat Species is found the Proponent shall:

(a) ensure that the individual is collected by the Qualified Biologist and protected from further harm;

(b) obtain veterinary advice and/or care for the individual from a member of the College of Veterinarians of Ontario with appropriate experience;

(c) after obtaining appropriate veterinary care or advice in accordance with sub-condition (b) immediately above, the Proponent shall transfer the member of the Bat Species to an authorized Wildlife Custodian experienced in caring for the Bat Species; and

(d) report the Bat Species encounter to MNRF before the next business day or as soon as possible thereafter, including the location where the individual member of the Bat Species was found and the circumstances under which it was found injured.

10. If an individual member of a Bat Species is killed or found dead on the Site, during monitoring or actions to achieve and overall benefit, the Proponent shall:

(a) collect the individual and store it in a safe and refrigerated place;

(b) document the circumstances under which the individual was killed or found dead;

(c) document the location where the individual was found;

(d) contact MNRF before the end of the next business day or as soon as possible thereafter; and,

(e) comply with any instructions provided by MNRF regarding the handling and transfer of the dead individual.

<u>Reporting</u>

11. The Proponent shall conduct monitoring and report on all the activities undertaken in accordance with the permit from a period beginning with the issuance of the permit and concluding on January 31, 2024. The monitoring must be sufficient to result in the collection or development of the information specified in Appendix D.

12. The Proponent shall submit annual reports to the attention of MNRF as per the Notification/Contact Schedule prior to the following dates:

a. January 31, 2019
b. January 31, 2020
c. January 31, 2021
d. January 31, 2022
e. January 31, 2023
f. January 31, 2024

13. The reports specified in condition 12 shall include all of the information described in Appendix D related to the Site, Works, and Overall Benefit Activities for the previous calendar year;

14. The Proponent shall submit a final report to the attention of the of MNRF as per the Notification/Contact Schedule prior to January 31, 2024 that:

i. Includes all of the information described in Appendix D related to the Site(s), Works, and Overall Benefit Activities for the previous twelve (12) months;
ii. Summarizes all of the information submitted in the reports in accordance with condition 12;
iii. Includes a final analysis of the effectiveness of the Overall Benefit Activities.

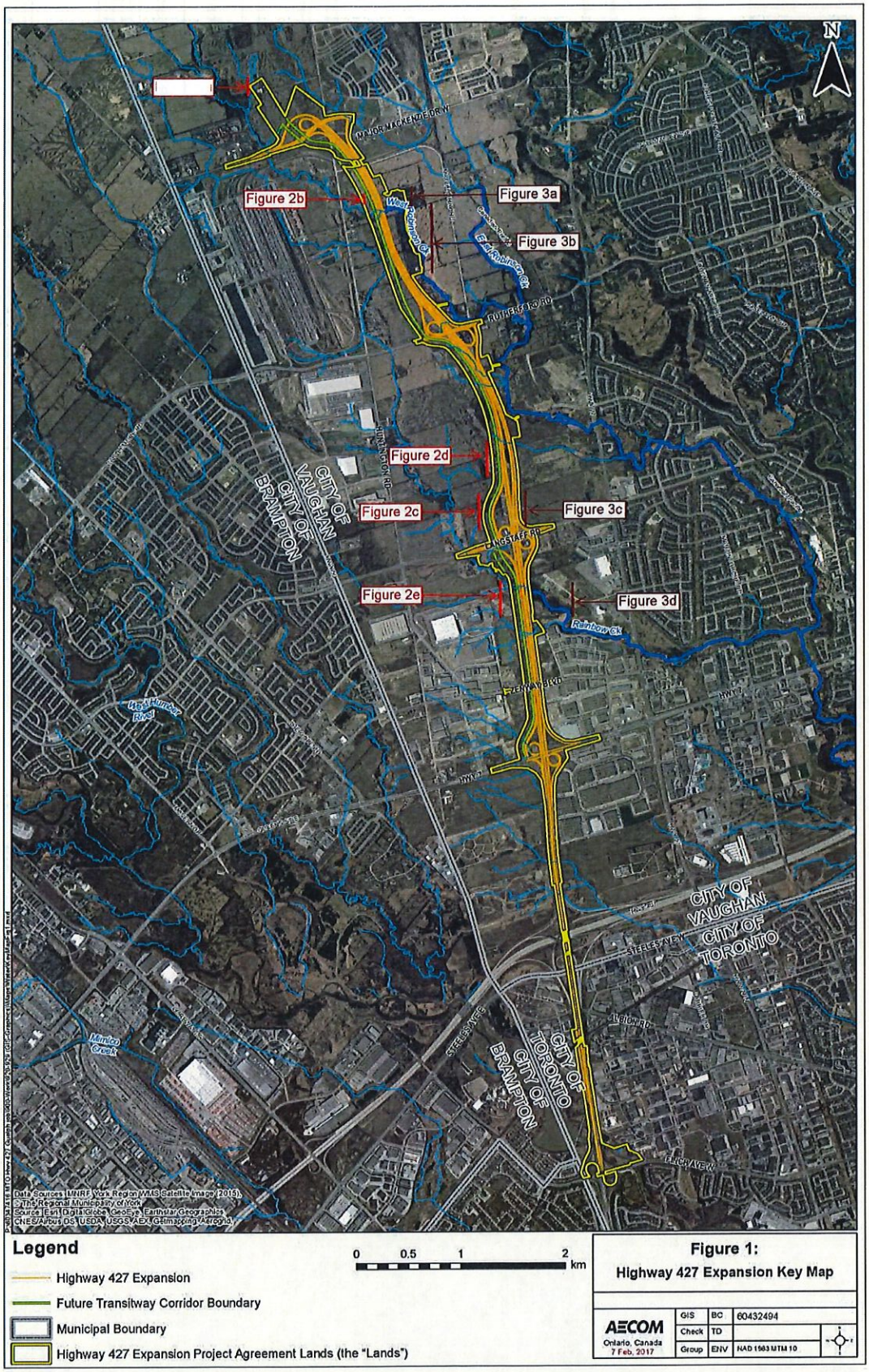
Observation

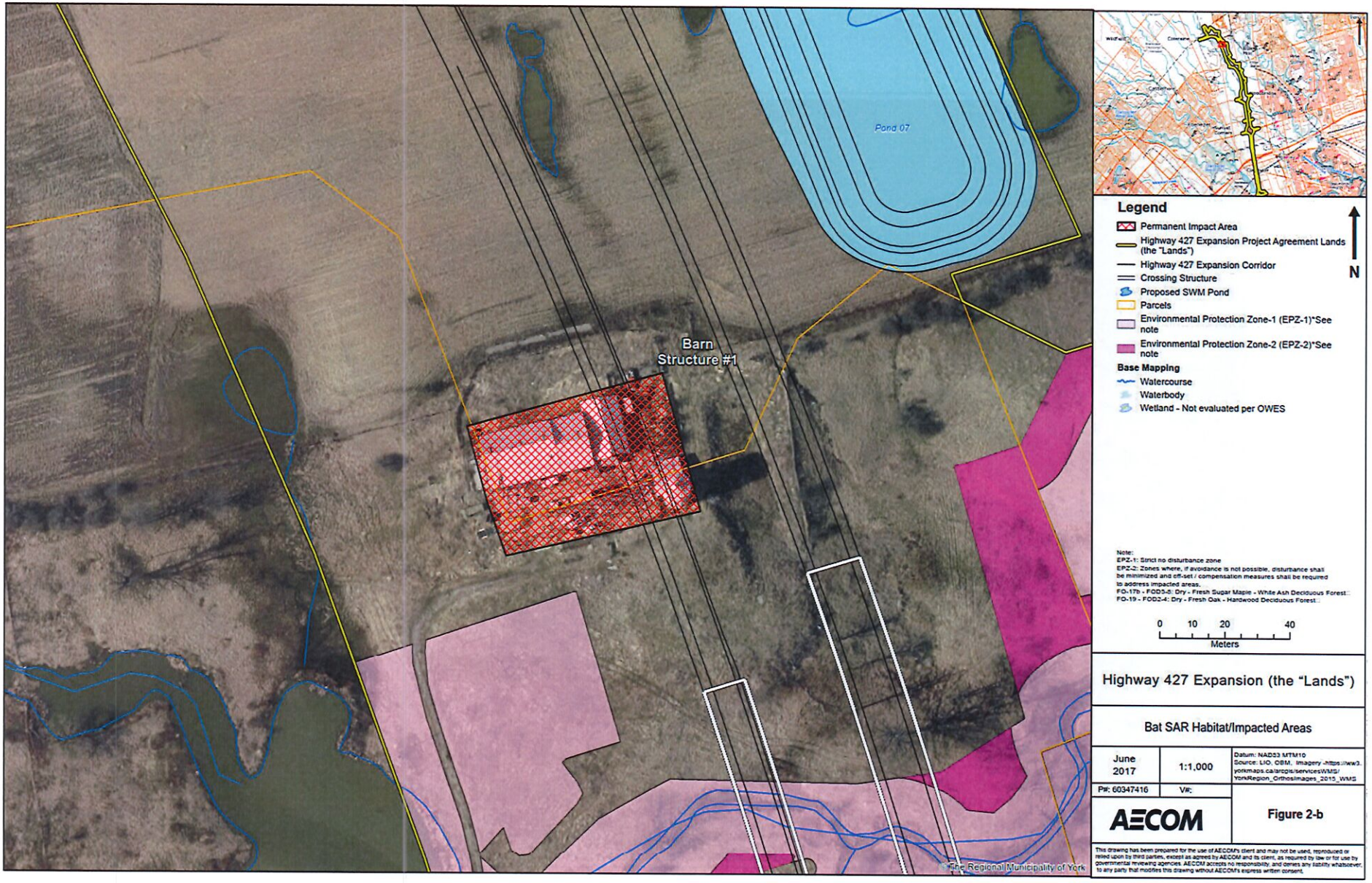
15. On reasonable notice, the Proponent shall allow MNRF staff and others accompanying them to access the Site and other areas for the purpose of observing the Site, Works, Overall Benefit Activities, or monitoring activities. For areas located on property not owned by the Proponent, the Proponent shall undertake reasonable steps to obtain permission for MNRF staff and others accompanying them to enter the Site for the purpose of observation.

Conflict

16. Where any conflict exists between the conditions of this permit and the Detailed Design Drawings, the conditions of this permit shall prevail.

APPENDIX B: PROJECT LOCATION (the Site) - *Works and Overall Benefit Activities*





Legend

- Permanent Impact Area
- Highway 427 Expansion Project Agreement Lands (the "Lands")
- Highway 427 Expansion Corridor
- Crossing Structure
- Proposed SWM Pond
- Parcels
- Environmental Protection Zone-1 (EPZ-1)*See note
- Environmental Protection Zone-2 (EPZ-2)*See note

Base Mapping

- Watercourse
- Waterbody
- Wetland - Not evaluated per OWES

N

Note:
EPZ-1: Strict no disturbance zone
EPZ-2: Zones where, if avoidance is not possible, disturbance shall be minimized and off-set / compensation measures shall be required to address impacted areas.
FO-17b - FOD5-5: Dry - Fresh Sugar Maple - White Ash Deciduous Forest::
FO-19 - FOD2-4: Dry - Fresh Oak - Hardwood Deciduous Forest::

0 10 20 40
Meters

Highway 427 Expansion (the "Lands")

Bat SAR Habitat/Impacted Areas

June 2017	1:1,000	Datum: NAD83 MTM10 Source: LIO, OBM, Imagery -https://ww3.yorkmaps.ca/arcgis/services/WMS/YorkRegion_OrthoImages_2015_WMS
P#: 60347416	V#:	

AECOM

Figure 2-b

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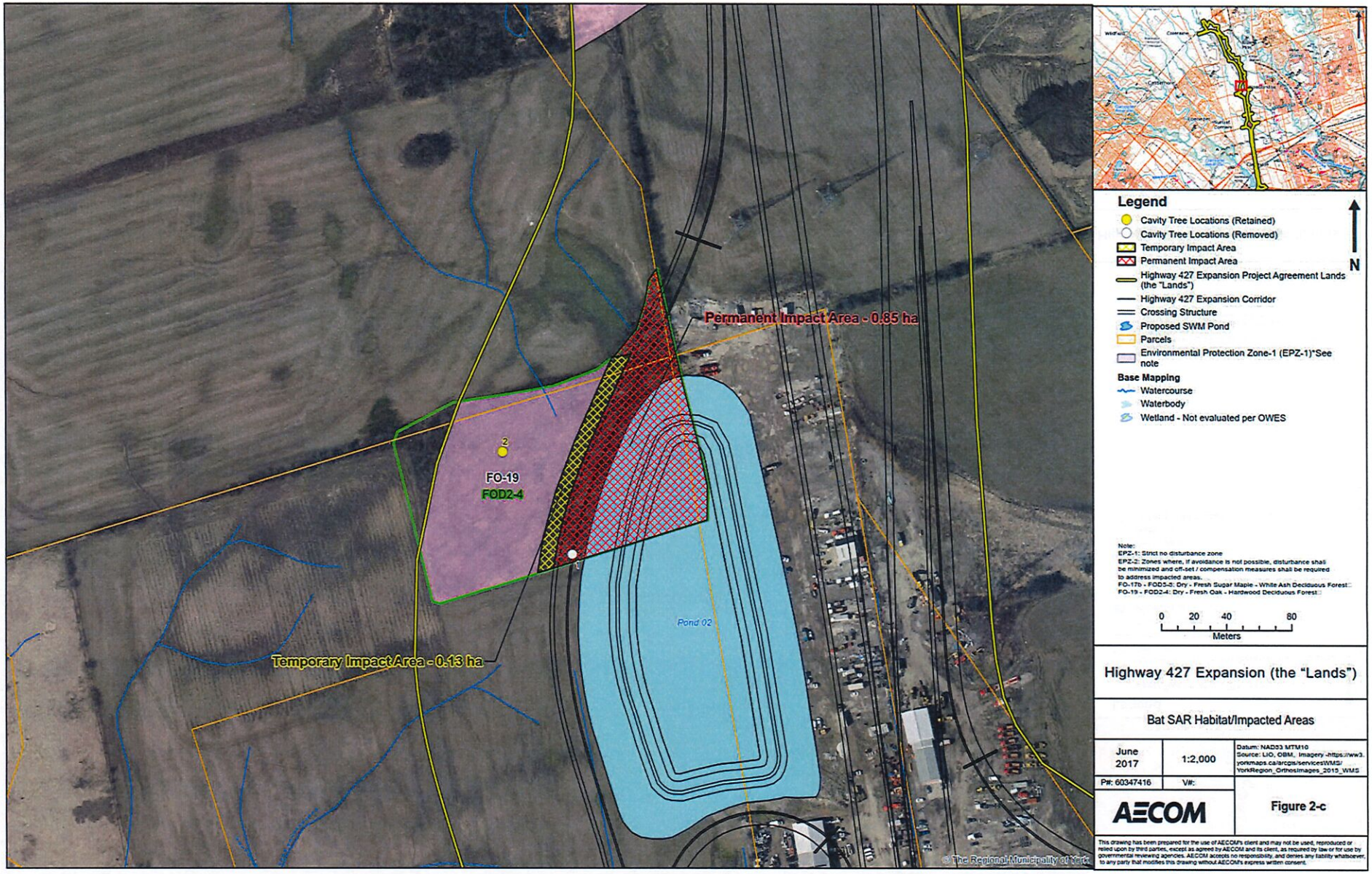

Legend

- Cavity Tree Locations (Retained)
- Cavity Tree Locations (Removed)
- Temporary Impact Area
- Permanent Impact Area
- Highway 427 Expansion Project Agreement Lands (the "Lands")
- Highway 427 Expansion Corridor
- Crossing Structure
- Proposed SWM Pond
- Parcels
- Environmental Protection Zone-1 (EPZ-1)*See note

Base Mapping

- Watercourse
- Waterbody
- Wetland - Not evaluated per OWES

N

Note:
EPZ-1: Strict no disturbance zone
EPZ-2: Zones where, if avoidance is not possible, disturbance shall be minimized and off-set / compensation measures shall be required to address impacted areas.
FO-17b - FOD3-3: Dry - Fresh Sugar Maple - White Ash Deciduous Forest
FO-19 - FOD2-4: Dry - Fresh Oak - Hardwood Deciduous Forest

0 20 40 80
Meters

Highway 427 Expansion (the "Lands")

Bat SAR Habitat/Impacted Areas

June 2017	1:2,000	Datum: NAD83 MTM10 Source: LIO, OBM, Imagery -https://ww3.yorkmaps.ca/arcgis/services/MSI/YorkRegion_OrthoImages_2015_WMS
P#: 60347416	V#:	

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Figure 2-c

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Legend

- Cavity Tree Locations (Removed)
- Permanent Impact Area
- Highway 427 Expansion Project Agreement Lands (the "Lands")
- Highway 427 Expansion Corridor
- Crossing Structure
- Proposed SWM Pond
- Parcels
- Environmental Protection Zone-1 (EPZ-1)*See note

Base Mapping

- Watercourse
- Waterbody
- Wetland - Not evaluated per OWES

N

Note:
EPZ-1: Strict no disturbance zone
EPZ-2: Zones where, if avoidance is not possible, disturbance shall be minimized and off-set / compensation measures shall be required to address impacted areas.
FO-17b - FOD5-8: Dry - Fresh Sugar Maple - White Ash Deciduous Forest::
FO-19 - FOD2-4: Dry - Fresh Oak - Hardwood Deciduous Forest::

0 20 40 80
Meters

Highway 427 Expansion (the "Lands")

Bat SAR Habitat/Impacted Areas

June 2017	1:2,000	Datum: NAD83 MTM10 Source: LIO, OBM, Imagery :https://ww3.yorkmaps.ca/arcgis/services/WMS/YorkRegion_OrthoImages_2015_WMS
P#: 60347416	V#:	

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Figure 2-d

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Legend

- Cavity Tree Locations (Retained)
- Cavity Tree Locations (Removed)
- Temporary Impact Area
- Permanent Impact Area
- Highway 427 Expansion Project Agreement Lands (the "Lands")
- Highway 427 Expansion Corridor
- Crossing Structure
- Proposed SWM Pond
- Parcels
- Environmental Protection Zone-1 (EPZ-1)*See note
- Environmental Protection Zone-2 (EPZ-2)*See note

Base Mapping

- Watercourse
- Waterbody
- Wetland - Not evaluated per OWES

N

Note:
EPZ-1: Strict no disturbance zone
EPZ-2: Zones where, if avoidance is not possible, disturbance shall be minimized and off-set / compensation measures shall be required to address impacted areas.
FO-17b - FOD5-5: Dry - Fresh Sugar Maple - White Ash Deciduous Forest::
FO-19 - FOD2-4: Dry - Fresh Oak - Hardwood Deciduous Forest::

0 20 40 80
Meters

Highway 427 Expansion (the "Lands")

Bat SAR Habitat/Impacted Areas

June 2017	1:2,000	Datum: NAD83 MTM10 Source: LIO, OBM, Imagery -https://ww3.yorkmaps.ca/arcgis/services/WMS/YorkRegion_Orthoimages_2015_WMS
P#: 60347416	V#:	

AECOM

Figure 2-e

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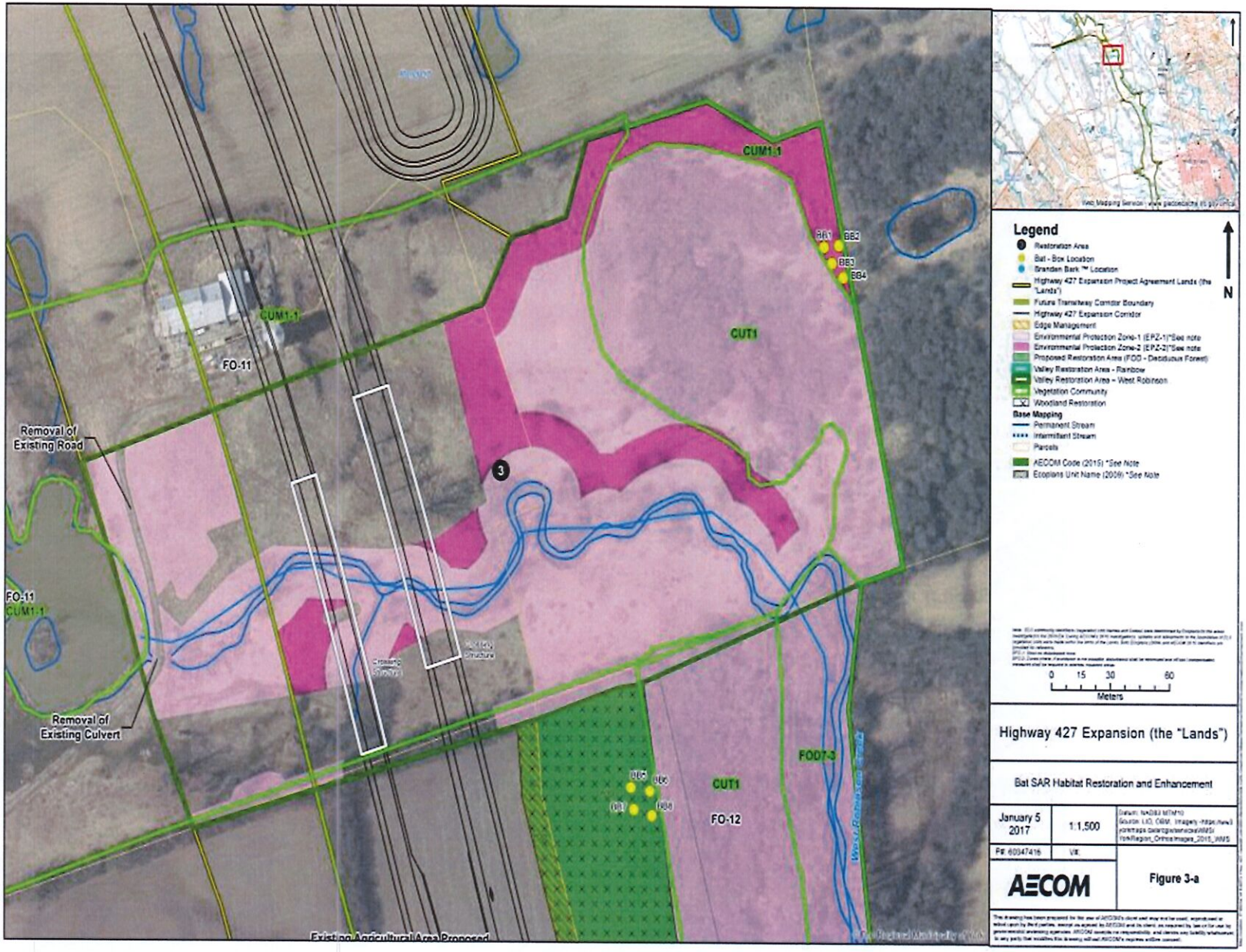
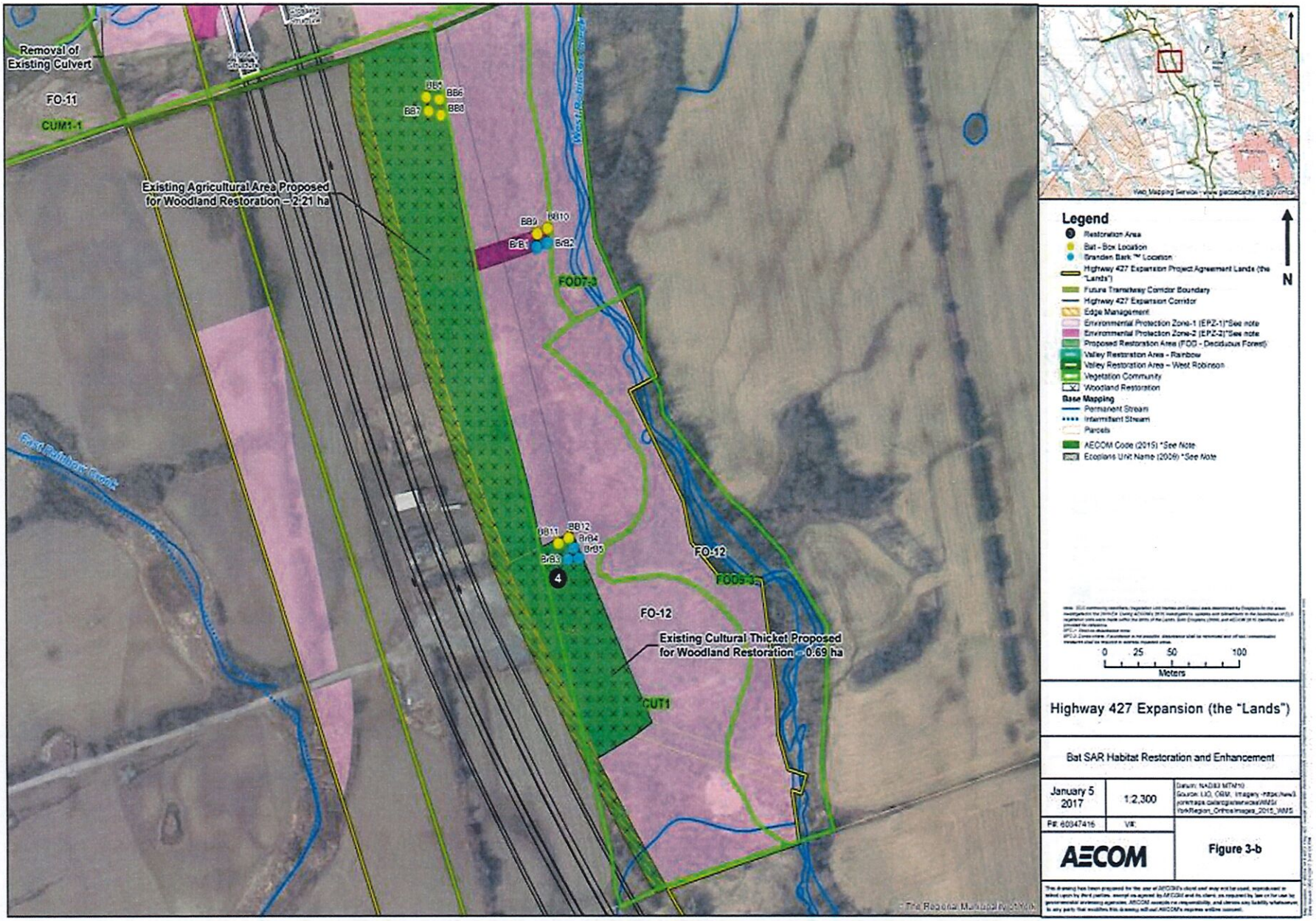
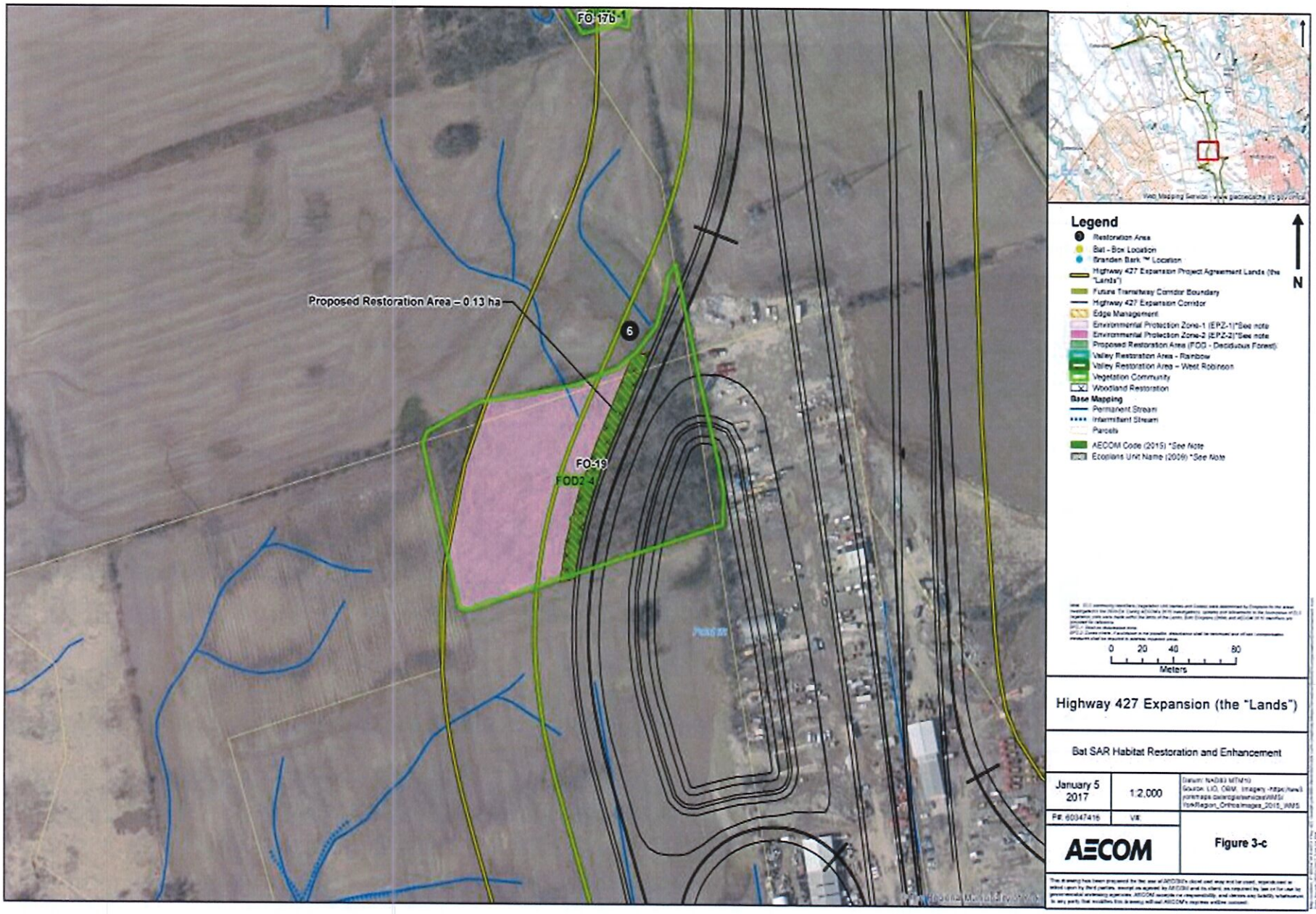
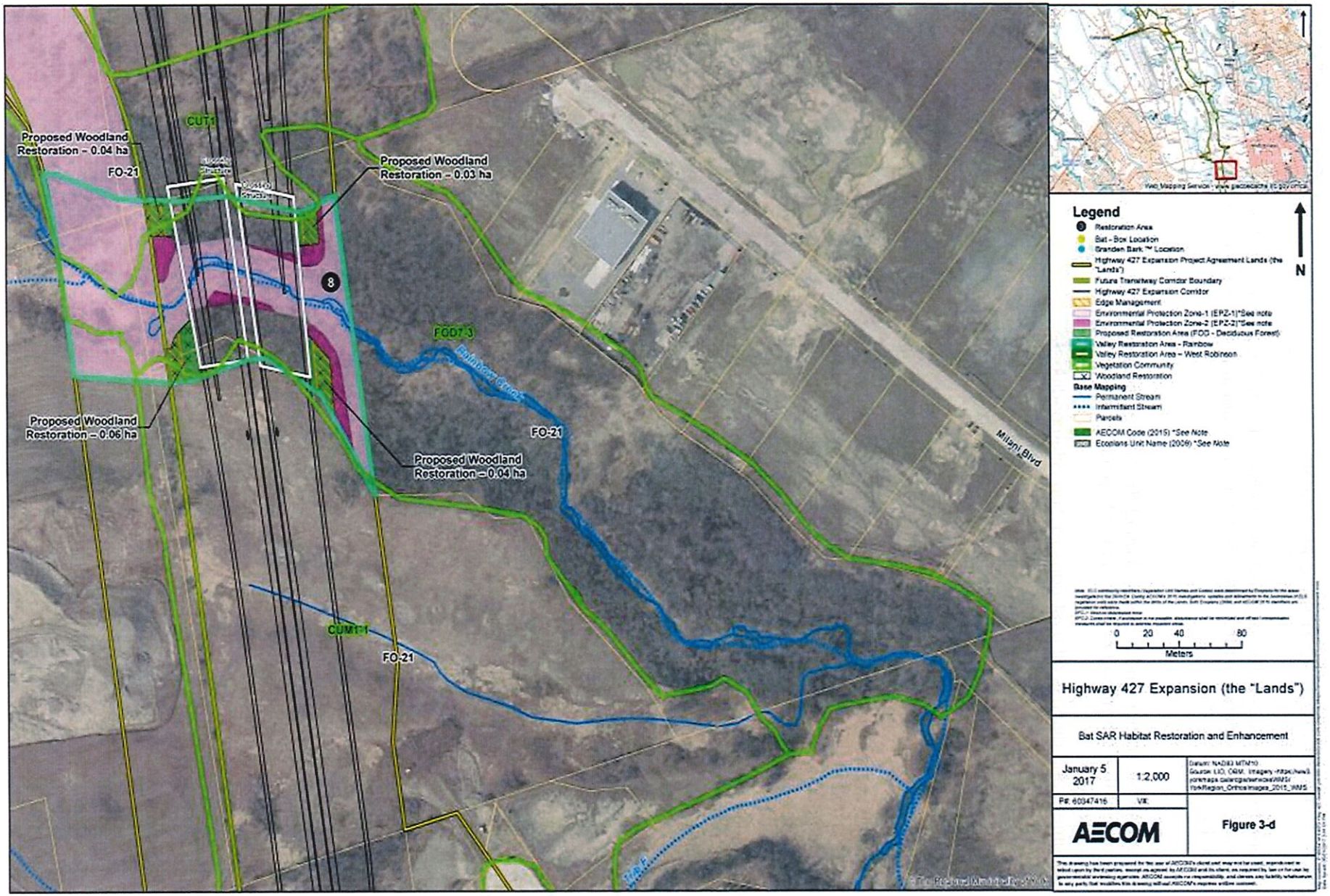

CUM1-1
CUT1
FO-11
Removal of Existing Road
3
FO-11
CUM1-1
Removal of Existing Culvert
FOD7-3
CUT1
FO-12
BB1
BB2
BB3
BB4
Legend
Restoration Area
Bat - Box Location
Brandon Bark ™ Location
Highway 427 Expansion Project Agreement Lands (the "Lands")
Future Transitway Corridor Boundary
Highway 427 Expansion Corridor
Edge Management
Environmental Protection Zone-1 (EPZ-1)(*See note
Environmental Protection Zone-2 (EPZ-2)(*See note
Proposed Restoration Area (FOD - Deciduous Forest)
Valley Restoration Area - Rainbow
Valley Restoration Area - West Robinson
Vegetation Community
Woodland Restoration
Base Mapping
Permanent Stream
Intermittent Stream
Parcels
AECOM Code (2015) *See Note
Ecoplans Unit Name (2009) *See Note
N
0 15 30 60
Meters
Highway 427 Expansion (the "Lands")
Bat SAR Habitat Restoration and Enhancement
January 5 2017
1:1,500
P#: 60047416
AECOM
Figure 3-a


Removal of Existing Culvert
FO-11
CUM1-1
Existing Agricultural Area Proposed for Woodland Restoration – 2.21 ha
BB5
BB6
BB7
BB8
BB9
BB10
BrB1
BrB2
FOD7-2
BB11
BB12
BrB4
BrB5
BrB3
4
FO-12
FOD9-3
FO-12
Existing Cultural Thicket Proposed for Woodland Restoration – 0.69 ha
CUT1
Legend
Restoration Area
Bat - Box Location
Branden Bark ™ Location
Highway 427 Expansion Project Agreement Lands (the "Lands")
Future Transitway Corridor Boundary
Highway 427 Expansion Corridor
Edge Management
Environmental Protection Zone-1 (EPZ-1)*See note
Environmental Protection Zone-2 (EPZ-2)*See note
Proposed Restoration Area (FOD - Deciduous Forest)
Valley Restoration Area - Rainbow
Valley Restoration Area – West Robinson
Vegetation Community
Woodland Restoration
Base Mapping
Permanent Stream
Intermittent Stream
Parcels
AECOM Code (2015) *See Note
Ecoplans Unit Name (2009) *See Note
N
0 25 50 100
Meters
Highway 427 Expansion (the "Lands")
Bat SAR Habitat Restoration and Enhancement
January 5 2017
1:2,300
Ref: 60047416
AECOM
Figure 3-b


FO-17b-1
Proposed Restoration Area – 0.13 ha
6
FO-19
FOD2-4
Legend
Restoration Area
Bat - Box Location
Brandon Bark ™ Location
Highway 427 Expansion Project Agreement Lands (the "Lands")
Future Transitway Corridor Boundary
Highway 427 Expansion Corridor
Edge Management
Environmental Protection Zone-1 (EPZ-1)(*See note
Environmental Protection Zone-2 (EPZ-2)(*See note
Proposed Restoration Area (FOD - Deciduous Forest)
Valley Restoration Area - Rainbow
Valley Restoration Area – West Robinson
Vegetation Community
Woodland Restoration
Base Mapping
Permanent Stream
Intermittent Stream
Parcels
AECOM Code (2015) *See Note
Ecoplans Unit Name (2009) *See Note
N
0 20 40 80
Meters
Highway 427 Expansion (the "Lands")
Bat SAR Habitat Restoration and Enhancement
January 5 2017
1:2,000
P#: 60347416
VR
AECOM
Figure 3-c


Proposed Woodland Restoration – 0.04 ha
FO-21
CUT1
Proposed Woodland Restoration – 0.03 ha
8
FOD7-3
Rainbow Creek
Proposed Woodland Restoration – 0.06 ha
Proposed Woodland Restoration – 0.04 ha
FO-21
Milani Blvd
CUM1-1
FO-21
Legend
Restoration Area
Bat - Box Location
Brandon Bark ™ Location
Highway 427 Expansion Project Agreement Lands (the "Lands")
Future Transitway Corridor Boundary
Highway 427 Expansion Corridor
Edge Management
Environmental Protection Zone-1 (EPZ-1)*See note
Environmental Protection Zone-2 (EPZ-2)*See note
Proposed Restoration Area (FOD - Deciduous Forest)
Valley Restoration Area - Rainbow
Valley Restoration Area – West Robinson
Vegetation Community
Woodland Restoration
Base Mapping
Permanent Stream
Intermittent Stream
Parcels
AECOM Code (2015) *See Note
Ecosites Unit Name (2009) *See Note
N
0 20 40 80
Meters
Highway 427 Expansion (the "Lands")
Bat SAR Habitat Restoration and Enhancement
January 5 2017
1:2,000
P#: 60347416
VR:
AECOM
Figure 3-d

APPENDIX C: MONITORING REPORT SPECIFICATIONS

At a minimum, the annual reports required by condition 12 shall contain all details as described under the headings below. Additional information in relation to monitoring may be outlined in Appendix A, or requested by MNRF.

Site Conditions

- Include photographs and a description of the Site prior to construction
- Document the extent and condition of bat species habitat present at the Site for the relevant reporting year
- Document and discuss all post-construction Site conditions,
- Discuss whether or not the Project that was authorized has been undertaken in accordance with the specifications of this permit and Design Drawings
- Justify and explain any deviations from the authorization provided and describe any corrective actions taken
- Include the results of any and all monitoring conducted, including viability / survival rates of any planted vegetation and stability, integrity, and condition of all constructed and / or natural features
- Describe the current condition of all habitat impacted by the permit and identify any issues or other problems that may be resulting in negative impacts to the habitat
- Provide documentation detailing any occurrences of species at risk that were encountered during the reporting year.

Mitigation Measures

- Document how successful (or unsuccessful) the actions taken during construction were in meeting the conditions of this permit in regards to mitigating impacts to the Bat Species and / or their habitats
- If applicable, discuss any modifications to the actions that were implemented during the current reporting year, as well as a rationale for the modifications
- Provide a summary of any incidents that occurred during the current reporting year and provide a description of the actions that were taken to remediate the issues
- Include a summary and rationale describing any requested amendments or extensions that resulted in a change to the permit
- If applicable, identify any significant problems encountered and remedial actions taken or proposed to correct those problems.

Overall Benefit

- Document the Overall Benefit Activities that were implemented during the current reporting year and describe how they were completed / constructed as per this permit, including documentation of installations and any maintenance / replacement of plants that died, and photographs where relevant
- If applicable, describe any modifications and / or changes made to the Overall Benefit Activities in this permit, as well as a rationale for the modifications
- Document and discuss if the Overall Benefit Activities are functioning as intended.
- Monitor effectiveness of all bat boxes and BrandenBark™ structure installations shall be carried out under the direction of a Qualified Biologist between June and September, in years three (3), four (4) and five (5) following installation of the structures. Objectives of the monitoring will include:

    - Determining the condition of the structures;
    - Determining whether the structures have been utilized by bats; and,
    - Determining whether any of the three (3) bat SAR identified in the Lands are using the boxes.

- Data collected will determine which species are selecting the various structures within the context of the three (3) different adjacent foraging habitat treatments (i.e., will determine which species prefer the bat boxes in woodland habitat, BrandenBark™ structures in woodland habitat, bat boxes near pond habitat, bat boxes in riparian habitat or BrandenBark™ structures in riparian habitat).

- In year two (2) following installation and during each monitoring year thereafter, a site visit to assess the condition of the structures will determine if maintenance of the structures is required. Bat boxes and BrandenBark™ structures will be visually inspected during monitoring visits for any defects and will be replaced as soon as possible, should a defect be observed. This could include gaps or cracks, leaking boxes, or damage from wind etc. Bat boxes BrandenBark™ structures should also be inspected to check for the presence of wasps/and or bees. If present, nests should carefully be removed. In years three (3), four (4) and five (5), this monitoring can be conducted with other regularly scheduled site visits.

- In years, three (3), four (4) and five (5) following installation, in order to determine whether any of the three (3) Bat Species identified in the Lands are using the boxes, the monitoring activities will include DNA analyses. This will require guano collection using a guano collecting device, which is a removable fine wire mesh installed 0.6 m below each of the structures. Design and placement of guano collection devises will be based on methods cited in similar academic studies. The guano collecting device will be installed 30 days prior to the first guano collection. The guano samples will be collected from the guano collecting devices approximately every thirty (30) days for a minimum of three (3) collections beginning in the month of June in each monitoring year. The presence of guano in the collecting device will confirm the presence of Bat Species using the structures; while results of the genetic analysis will confirm which species are using the structures.

- Monitoring of the Woodland Restoration Areas will be carried out by a Qualified Biologist annually between May 15 and September 15 following the completion of installation up until September 15, 2023. Objectives of the monitoring will include:

    - Determining the percentage of invasive species and non-woody vegetation; and,
    - Determining the health and survival rate of the planted trees and shrubs.

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APPENDIX D: NOTIFICATION/CONTACT SCHEDULE

NOTE: The preferred method of contact with the MNRF is by email and all communications should reference the permit #: AU-C-011-16

Telephone/Email:
All contact by telephone for notification/reporting/inquiries regarding the Works, Overall Benefit Activities or Species at Risk encounters relating to this permit should be directed to:

Primary Contact: (905) 713 - 7400, esa.aurora@ontario.ca

Secondary Contact: Mark Heaton, Management Biologist, (905) 713 – 7406, mark.heaton@ontario.ca

Mailing Address:
All mailed notification/reporting/inquiries regarding the Works, Overall Benefit Activities or Species at Risk encounters relating to this permit should be directed to:

Ministry of Natural Resources and Forestry, Aurora District
50 Bloomington Road
Aurora, Ontario L4G 3G8

This Schedule may be updated or replaced from time to time by the MNRF. Any updates or replacements shall be attached to and form part of the permit.

NOTE: The preferred method of contact with the MNRF is by email and all communications should reference the permit #: AU-C-011-16.