AECOM

Appendix A

A.1 Notice of Commencement / Project Restart

The City of London
Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment

NOTICE OF STUDY RESTART

August 16, 2021 **PUBLIC NOTICE**

Project Restart

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

In 2016, the project was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). As it is related to this project, the northern routes for RT have been deferred and the City has decided to restart this project.

Background

Western Road between Huron College and Platts Lane is part of a primary transportation corridor that services Western University and other local institutions in addition to some residential and commercial uses. Within this corridor, the Western Road and Sarnia Road/Philip Aziz Avenue intersection supports a large volume of vehicle traffic making turning movements, high pedestrian/ cycling traffic and frequent transit services. This type of traffic is expected to increase in the future.

The City of London Transportation Master Plan suggests the Western Road and Sarnia Road/Philip Aziz Avenue intersection be improved to accommodate increased traffic, address safety, and improve road width constraints along Philip Aziz Avenue.

Planning for the Future

This study will be completed in accordance with the Ontario Environmental Assessment Act and will follow the MCEA (Schedule C) process. The project team will examine a full range of alternatives and improvements. Future university expansion plans, recent and or planned municipal infrastructure (e.g. watermains and stormwater management), walking and cycling features, effective movement of traffic and environmental impacts will be considered.

Your Involvement is Important

You will be consulted throughout this study and asked to help shape the future of the community. A PIC will be held in the fall of 2021 to present the updated problem/opportunity statement, a review of the study progress, the evaluation of the alternative solutions and project timeline. Another PIC will be held in the spring of 2022 to present the evaluation of alternative design concepts for the preferred solution, in addition to proposed mitigation measures and next steps. Advanced notification of the PICs will be advertised on the City of London website and in the Londoner newspaper, in addition to regular mail. Comments from review agencies and members of the public are encouraged now and throughout the study. To learn more, visit the project website: https://london.ca/projects/western-road-sarnia-road-philip-aziz-avenue-environmental-assessment.

To provide comments, receive additional information or be added to the study mailing list, contact either of the following team members below:

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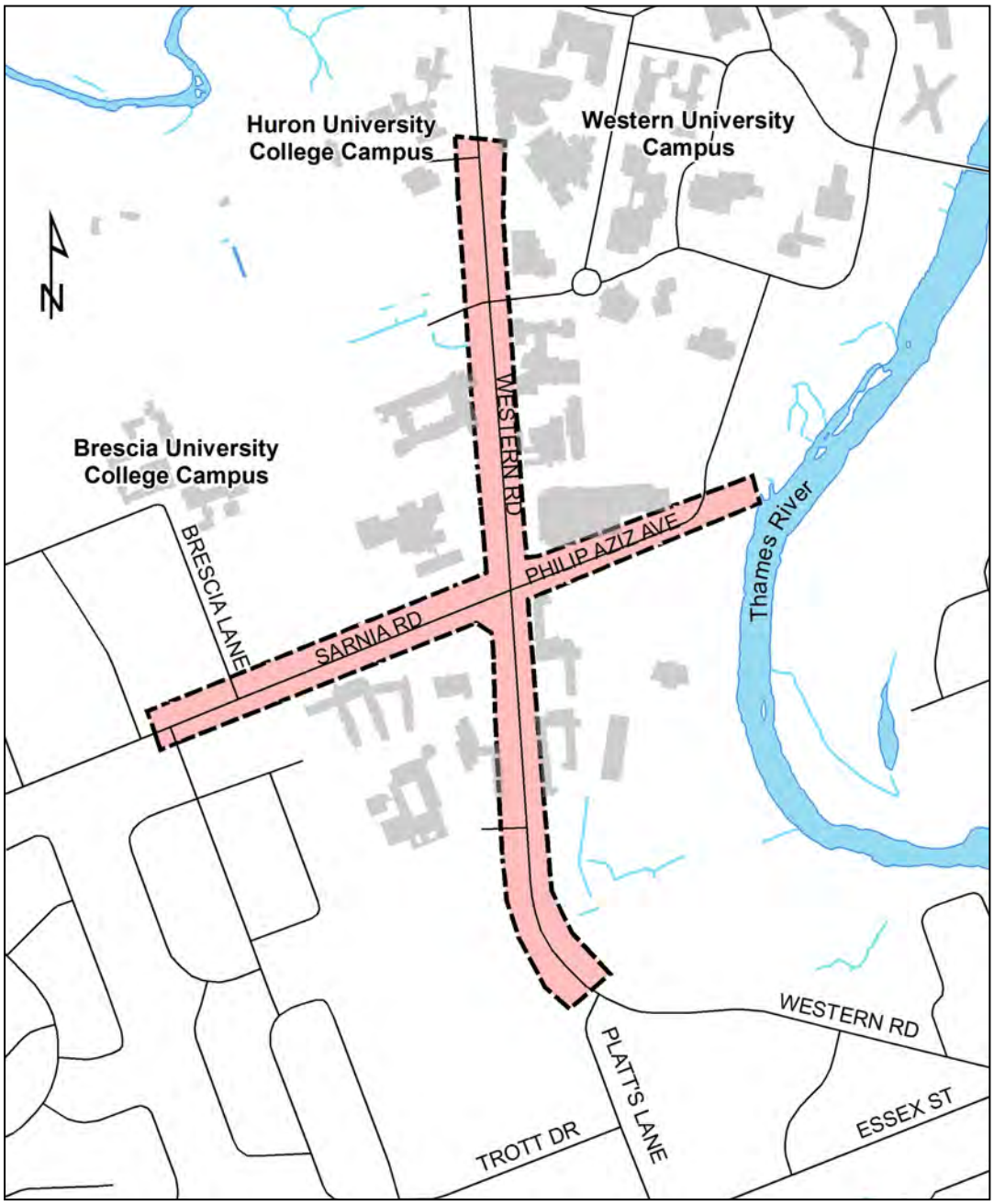


With the exception of personal information, all comments will become part of the public record of the study. The study is being conducted according to the requirements of the Municipal Class Environmental Assessment, which is a planning process approved under Ontario's Environmental Assessment Act.

Issued on August 16, 2021

AECOM

Appendix A

A.2 Public Information Centre #1

Notice of Public Meeting

November 16, 2021

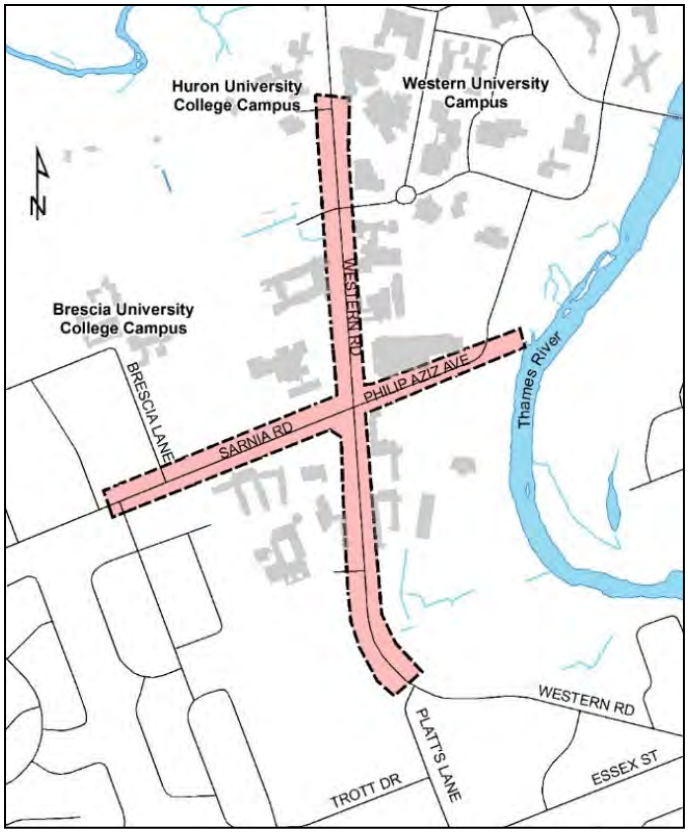
Western Road and Sarnia Road / Phillip Aziz Avenue Environmental Assessment

In January 2015, the City of London, in partnership with its consultant, AECOM, started the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment to identify improvements to accommodate increasing traffic, address pedestrian, cyclist, vehicular safety concerns and improve road width constraints along Philip Aziz Avenue.

In 2016, the project was put on hold while alternatives for rapid transit routes through the area were being considered. Now that the north leg of rapid transit has been deferred by Council, the City is restarting this Environmental Assessment and invites you to participate in the process.

Study Area

The study area includes Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River.



London
CANADA

Project Updates

Visit the study webpage (getinvolved.london.ca/westernsarnia) to view the status of the study, submit comments, share feedback or sign up for project updates.

Upcoming Public Information Session

When: Wednesday, December 1, 2021, from 6-8 p.m. (up to two hours)

Format: Virtual (Zoom webinar)

Registration required: Yes - visit getinvolved.london.ca/westernsarnia to register

Recording: Yes - the webinar will be available on getinvolved.london.ca/westernsarnia

Purpose: Provide progress update, share potential solutions for the area, present recommendation, collect feedback and discuss next steps.

About Environmental Assessments

A Municipal Class Environmental Assessment (MCEA) is a process designed to predict environmental effects of proposed initiatives before they are carried out to protect the natural, cultural, social and economic environment. This project is being completed as a Schedule “C” project which includes the construction of new facilities and major expansions to existing facilities. Consultation with people impacted by the project is mandatory. Following the Public Information Session, feedback will be collected and reviewed by the project team. After that, another Public Information Session, scheduled for April 2022, will be held to review design alternatives.

Contact Information

The City wants to hear from you now and throughout the process. If you would like to ask a question, give input, or add your name to the contact list to receive updates, please reach out to the City Project Manager.

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

London
CANADA

Western Road and Sarnia Road / Philip Aziz Avenue Intersection Improvements

Public Information Centre #1

December 1, 2021 from 6-8 p.m.

aecom.com

Engagement Guidelines

- Please use the Q&A button to ask a question at any time.
- All questions will be answered after the presentation, during the Q&A Session.
- This meeting is being recorded and will be posted online at **getinvolved.london.ca/westernsarnia**

Project Team

Karl Grabowski
City of London
Transportation Design Engineer / Project Manager

Jane Fullick
City of London
Senior Transportation Technologist
Transportation Planning and Design

John Pucchio
AECOM
Senior Engineer, Project Manager

Karl Grueneis
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Environmental Assessment Planning Lead

Paul Adams
AECOM
Environmental Assessment Planner

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Agenda

- Introductions and purpose
- Presentation (approximately 30 minutes)
- Questions and answer period

Public Information Centre (PIC) Purpose

1. Introduce the Project;
2. Provide an overview of the Municipal Class Environmental Assessment (MCEA) process;
3. Explain why the project was put on hold in 2016;
4. Provide a summary of previous work completed;
5. Describe the updated Problem and Opportunity Statement;
6. Describe the existing conditions in the area including:
   a) Current traffic and intersection operating conditions;
   b) Existing Natural Heritage Conditions;
   c) Current Water/Wasterwater/Stormwater servicing;
   d) Existing Archaeological and Cultural Heritage conditions;
7. Present the alternative planning solutions, evaluation and preliminary recommendations; and
8. Meet the project team and get your feedback.

Municipal Class EA Study Process

The Class EA study will be completed in accordance with the **Ontario Environmental Assessment Act** and will fulfill the requirements of the Municipal Class EA process for **Schedule C** projects. At the end of the EA process, an **Environmental Study Report** will be prepared for public review and comment to document the planning process followed.

Phase 1: Problem and Opportunity
Review background planning and policy documents, identify study area needs, problems and opportunities.

Phase 2: Alternative Solutions
Review existing environment, identify and evaluate feasible alternative solutions and select Recommended Alternative Solution.

We are here

Phase 3: Alternative Design Concepts
Develop and evaluate alternative designs, identify environmental impacts and required mitigation measures, and select the Recommended Design Alternative.

Phase 4: Environmental Study Report
Document the decision-making process in an Environmental Study Report and publish Notice of Study Completion for 30-day comment period.

Phase 5: Implementation
Complete the detailed design, tender and construction following the completion of the EA study and review period.

Continuous Consultation & Engagement

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Project Summary / Study Area

- In 2015, the City of London initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class EA (MCEA).
- In 2016, the MCEA was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT).
- Now that the north leg of rapid transit has been deferred by Council, the City is restarting the MCEA and invites you to participate in the process.
- The primary Study Area is the Western Road and Sarnia Road/Philip Aziz Intersection, including the roadways leading up to it.
- The Study Area may also include adjacent lands and/or roadways.

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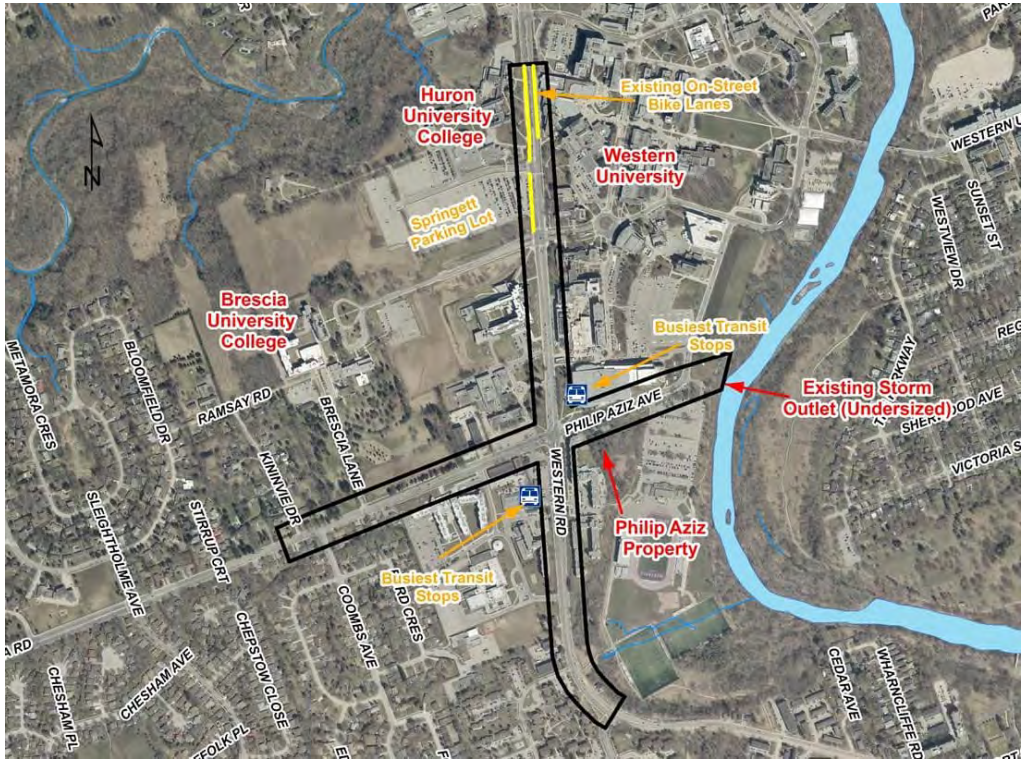
Project Background / Study Area Features

The City of London 2030 Transportation Master Plan identified necessary improvements to the study area these include:

- Intersection improvements to accommodate forecasted increase in traffic;
- Signal improvements to support transit signal priority;
- Address safety; and
- Improve road width constraints along Philip Aziz Avenue.



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Existing Conditions – Transportation

Primary trip generating/destination areas:

- Springett parking lot
- Huron University College parking lot

Pedestrian Traffic:

- High Mid Block pedestrian crossing volumes
- Mid-block pedestrian crossing volume is equal to the amount of pedestrian crossing at the Western Road/Sarnia Road intersection

Intersection Level of Service:

- Intersection is operating over capacity at a level of service (LOS) 'D' in the AM and LOS 'F' in the PM.
- Acceptable operations are generally considered LOS 'A' to 'C'. Critical failure of a system occurs at LOS 'E' & 'F'.

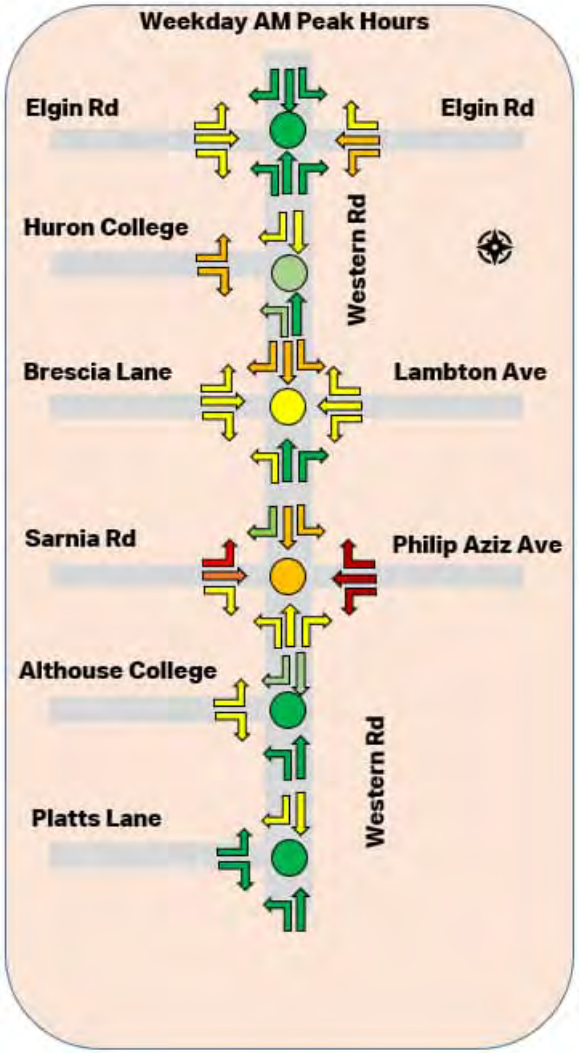
Average Daily Traffic

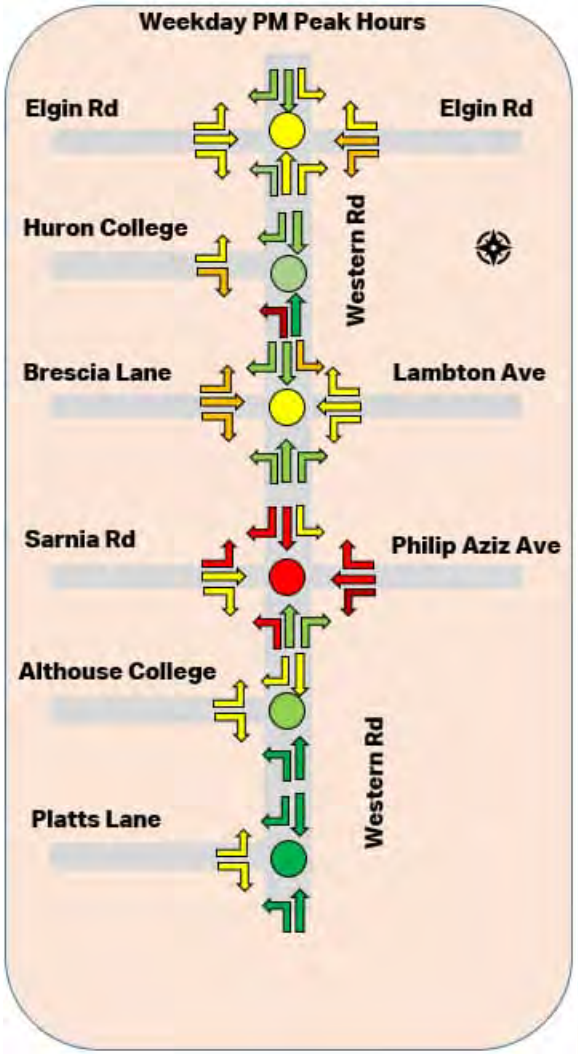
- Western Road – 28,500 vehicles per day
- Sarnia Road – 24,000 vehicles per day

Study Area Collisions (2015 to 2021)

- 219 mid-block collisions
- 217 intersection collisions
- 10 pedestrian/vehicle collisions

Existing Conditions – Transportation



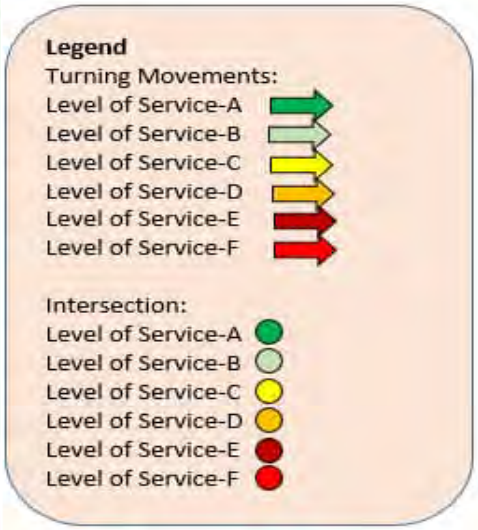


Traffic Analysis:

The Level of Service (LOS) at an intersection is determined by the amount of traffic delay.

LOS A – Little or no delays
LOS B – Short traffic delays
LOS C – Average delays
LOS D – Long traffic delays
LOS E – Very long delays
LOS F – Extreme delays causing congestion.

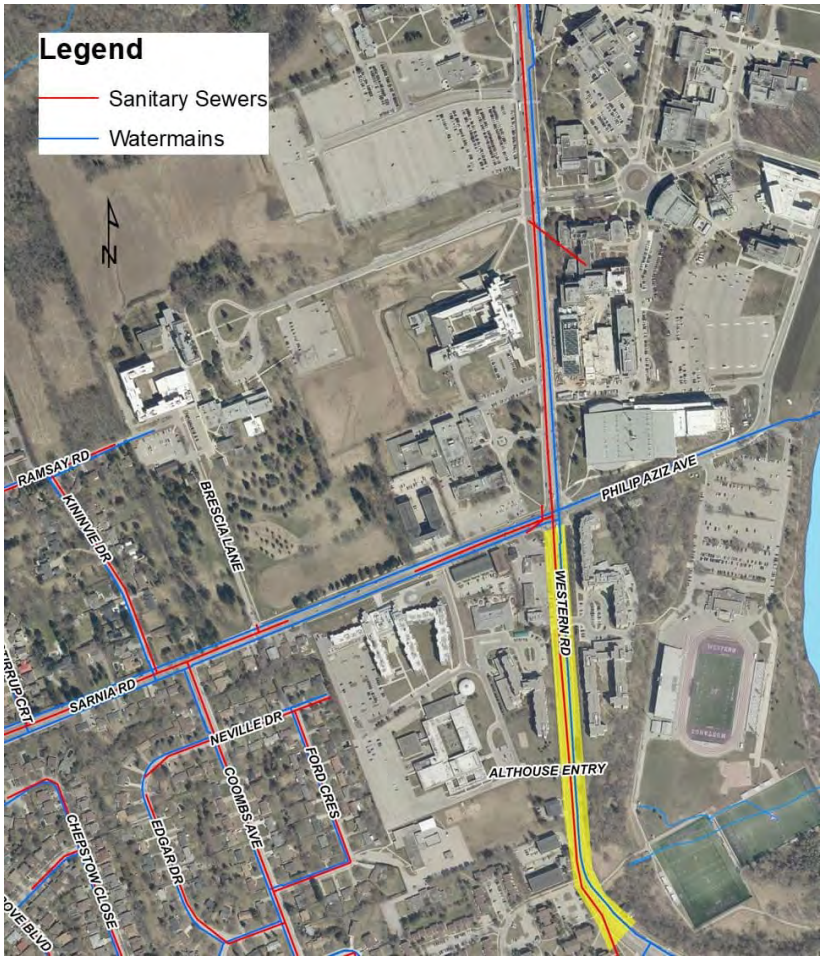
The current LOS along the study corridor is illustrated in these figures for the peak travel times: morning (AM) and evening (PM).



Existing Conditions – Water and Wastewater

Water Infrastructure

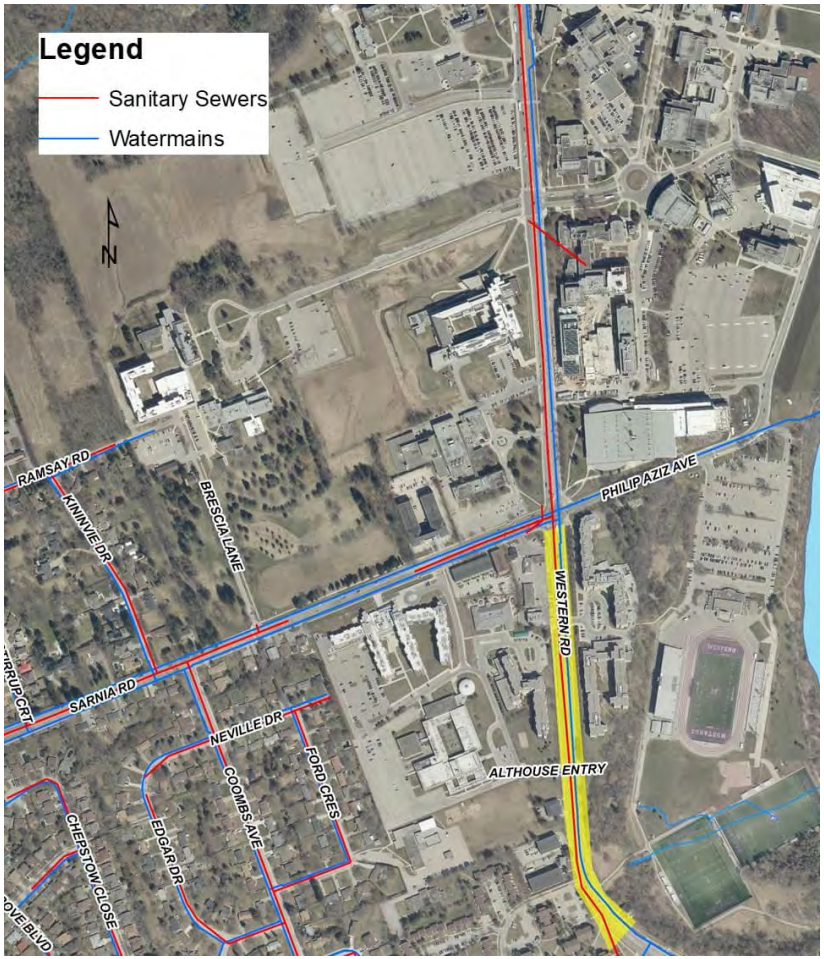
- Existing 400 mm diameter watermain along Western Rd
- Watermain size decreases to 250 mm diameter just south of Western Rd/Sarnia Rd intersection
- Several studies identified the need to upsize the 250 mm diameter section of watermain (between Sarnia Rd and Platts Ln) to accommodate growth within the service area
- Extent of previously recommended watermain upsizing needed shown in yellow



Existing Conditions – Water and Wastewater

Sanitary Infrastructure

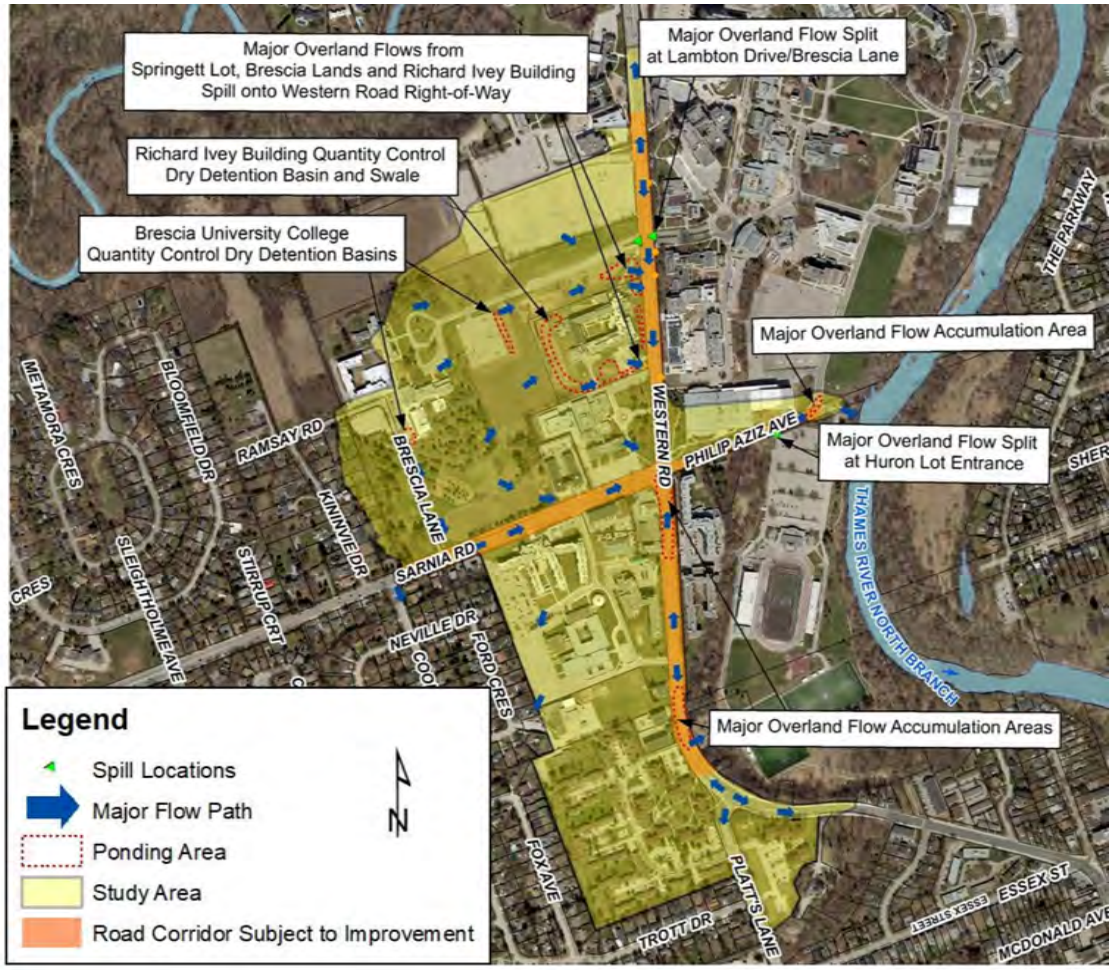
- Existing 825 mm diameter sewer along Western Rd that conveys sewage to Greenway PCP
- Western University Master Servicing Study (AECOM, 2019) recommended upsizing sanitary trunk sewer between Sarnia Rd and Platts Ln to 975 mm diameter to accommodate growth expected within Western University campus
- Extent of previously recommended sanitary trunk sewer upsizing shown in yellow
- The need to upsize may be negated depending on City's Wastewater Treatment Operations strategic focus on "swing stations" and providing ability to send sanitary flow to a different PCP



Existing Conditions – Stormwater Infrastructure and Drainage

Philip Aziz Avenue:

- Under sized storm sewers on Philip Aziz Avenue and Sarnia Road;
- Some storm sewers with diameters decreasing in the downstream direction;
- Lack of storm sewers, curb and gutter, and overflow of road drainage from Western Road flow onto private lands between Brescia Lane/Lambton Drive to Sarnia Road/Philip Aziz Avenue;
- Significant ponding at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue; and
- No stormwater quality control currently in place within the corridor.
- Minor drainage system does not meet current City standards



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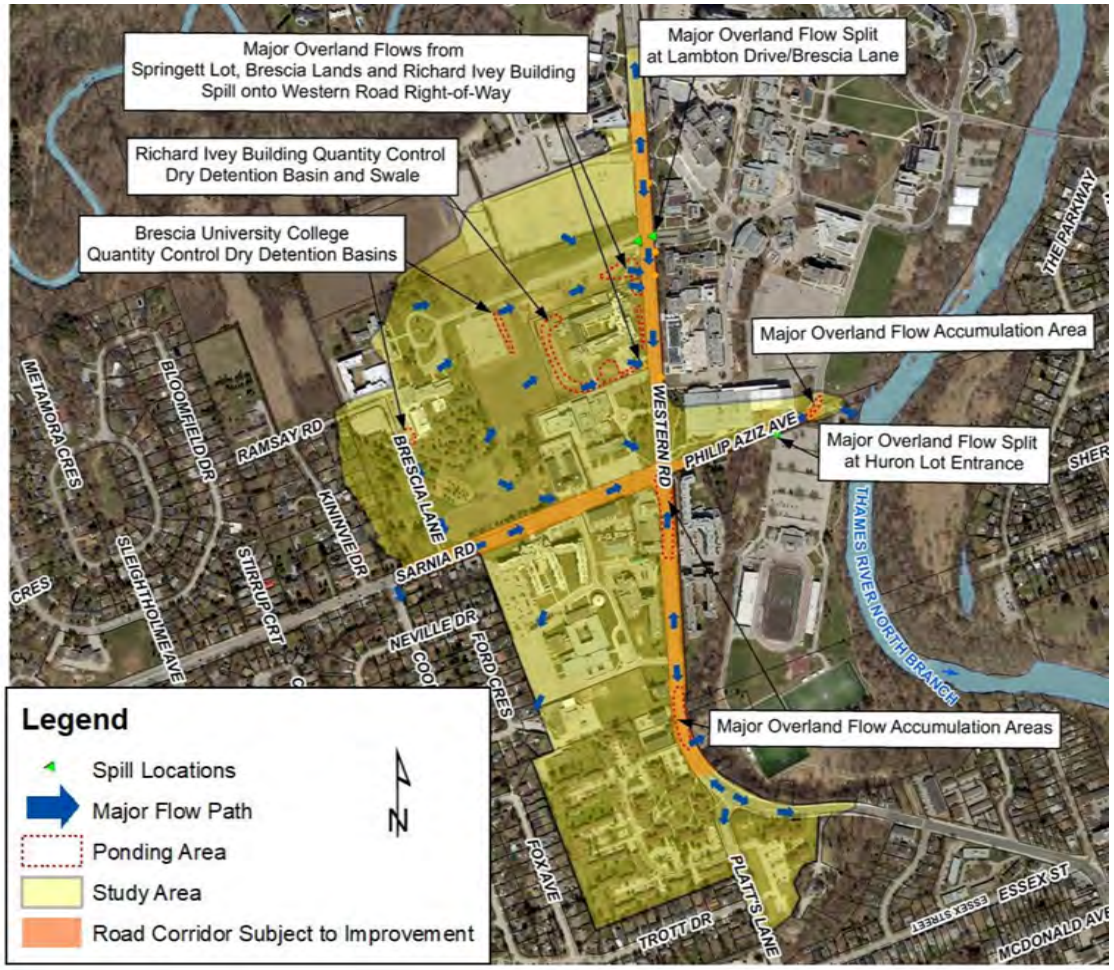
Existing Conditions – Stormwater Infrastructure and Drainage

Western Road:

- Limited storm infrastructure is present along this section of Western Road.
- There are no storm sewers servicing the west side of Western Road within study area



Existing Conditions – Stormwater Infrastructure and Drainage Continued

Sarnia Road

- Ontario Hall to Western Road: Existing 675 mm diameter sewer along Sarnia Road conveys flows to a 450 mm sewer on Sarnia Road at Western Road.
- Flows are directed to an existing 375 mm diameter sewer on Philip Aziz Avenue at Western Road.

Storm Sewer Outlet

- The conditions of the two existing storm sewer outlets at the west bank of the Thames River along the Philip Aziz Avenue and Huron Drive alignments were experiencing severe erosion and undermining of the headwall base slabs.
- A section of the study area (the intersection of Philip Aziz Avenue and Huron Drive) is situated within UTRCA's Regulatory Floodplain.
- Low topographic relief results in poor drainage throughout the Western Road Corridor from Platts Lane heading north to the Sarnia Road / Philip Aziz Avenue intersection.
- Ponding occurs within the ROW at three locations.
- There is limited quantity control on adjacent University lands, with stormwater spilling onto the Western Road at several locations.

Existing Stormwater Outlet

Existing Conditions – Stormwater Infrastructure Opportunities and Constraints

- Improve storm sewer network and drainage. The new storm sewers would be designed to meet current City Standards.

- Treatment of stormwater runoff quality may be considered – by means of an Oil Grit Separator (OGS) and/or other Best Management Practices (BMPs) (e.g. grassed swales, vegetated filter strips, pervious pipe systems, infiltration basins) to provide removal of at least 70% of Total Suspended Solids (TSS).

- Existing outlet to the Thames River requires replacement. A new outlet complete with scour protection and energy dissipation can be provided.

OGS Unit

Existing Conditions – Stormwater Infrastructure Opportunities and Constraints

- Implementation of innovative Low Impact Developments (LID) measures could potentially be used to enhance aesthetic of the road corridor, improve the stormwater level of service and provide research/educational opportunities to students of the adjacent University

- Existing utilities and native soil conditions may limit the application of certain types of LID stormwater controls

LID Example: Subsurface Exfiltration System

LID Example: Supported Soil Filtration System

LID Example: Bioswale

Existing Conditions – Natural Environment

An analysis was conducted to determine potential Species at Risk (SAR) within 1 km of the study area. The following species may occur within the study area:

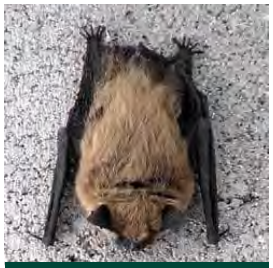
Terrestrial Species*

- 9 breeding birds (including Bank Swallow, Barn Swallow and Bobolink)
- 14 reptiles (including Spotted Turtle, Queensnake and Blanding's Turtle)
- 8 bats (including Little Brown Myotis and Northern Long-eared Myotis)

Aquatic Conditions*

- 10 fish species (including Gravel Chub, Eastern Sand Darter and Black Redhorse);
- 10 mussel species (including Fawnsfoot, Kidneyshell and Rainbow Mussel).

* Majority of these species are associated with the Thames River corridor.



Little Brown Myotis

Barn Swallow

Eastern Sand Darter

Existing Conditions – Natural Environment

Woodland Area:

The woodland located southeast of the Western Road/Sarnia Road intersection contains the following vegetation:

- Manitoba Maple. Black Walnut, Wild Mustard, Common Buckthorn, Hackberry
- A small cattail wetland also occurs

Wild Mustard

Common Buckthorn

Tree Assessment:

- A boulevard tree inventory and assessment was conducted and evaluated 130 trees along the study corridor
- Most trees were found to be in fair to good condition

Existing Conditions – Cultural Heritage

Stage 1 archaeological assessment:

- High potential for the recovery of Indigenous and Euro-Canadian archaeological resources within parts of the study area.
- Stage 2 study will be required for lands outside of the disturbed road allowance where impacts are proposed in areas determined to retain archaeological potential.

The study area contains the following cultural & built heritage resources:

One property designated under Part IV of the Ontario Heritage Act:

- BHR 1: 150 Philip Aziz Avenue

Three listed properties:

- CHL 1: 1285 Western Road/271 Ramsay Road
- CHL 2: 1151 Richmond Street
- CHL 3: 1125-1131 Western Road/230 Sarnia Road

Brescia University College

Entrance to Philip Aziz Property

Problem and Opportunity Statement

The Problem and Opportunity Statement is the principal starting point of a MCEA and becomes the central theme and integrating element of the project. It also assists in setting the scope of the project.

The Problem:

- The City of London Transportation Master Plan (2030 TMP) identified the need to improve the Western Road and Sarnia Road/Philip Aziz Avenue intersection in the next 5 years.
- This intersection accommodates approximately 20,000 pedestrians, hundreds of cyclists, eight transit routes carrying thousands of passengers and 41,000 vehicles.
- The intersection experiences traffic congestion, safety concerns, increased delays and decreasing levels of service for all users and this will continue if left untreated.
- The existing storm drainage in the area does not meet current design standards and requires upgrades.

Problem and Opportunity Statement

The Opportunity:

- Develop a range of planning and design alternatives that can improve pedestrian and cyclist facilities and safety, improve intersection operations, and provide additional capacity by removing constraints.
- Improve continuity with Western Road north and south of the study area, address stormwater drainage and enhance streetscape conditions.
- Consult the public and agencies and solicit feedback to select the best plan for the future
- Follow the City of London's 'Complete Streets' guidelines, 'Urban Design' guidelines, and Western University's Master Plan Vision, to potentially create a gateway to the campus.
- Create a street/intersection that is as functional and comfortable as possible for all users (students, children, seniors, cyclists, motorists, transit users and pedestrians)

Alternative Planning Solutions

Planning solutions are alternatives that can implement the problems/opportunities identified on Slide 18 & 19**.** The Planning Solutions for this project are identified below:

1. **Do Nothing –** this alternative provides a basis to which other alternative planning solutions can be compared.

2. **Expand Pedestrian, Bicycle, Transit Use -** This alternative would involve diverting current traffic within the corridor from vehicles to pedestrian, bicycle and transit use.

3. **Operational Improvements -** This alternative would consider operational improvements to the intersection and study corridor (improved turning lanes, intersection signalization optimization).

4. **Improvements to Parallel Roads -** This alternative considers improvements to Wonderland Road, Platts Lane and Richmond Street to increase corridor capacity.

5. **Improvements to Local Roads -** This alternative would involve utilizing local roads to improve destination access.

6. **Improvements along Philip Aziz Avenue -** This alternative would involve widening Philip Aziz Avenue to provide improved traffic operations, sight distances, to build cycling facilities and adequately support pedestrian usage.

Alternative Solutions Evaluation Criteria

Factor	Criteria	Description
Socio-Economic	• Property Impacts	• Potential Impact to private property • Impacts to local businesses
Cultural Environment	• Archaeological Resources • Cultural Heritage landscapes and built heritage resources	• Disturbance to archaeological sites, cultural heritage landscapes and built cultural heritage resources
Natural Heritage	• Aquatic environment • Terrestrial environment • Species at Risk • Source water protection	• Impacts/enhancements to aquatic and terrestrial species and habitat • Effects of the project on source water
Technical	• Design and constructability • Safety • Servicing • Transportation / Traffic	• Complexity of design and ease of construction • Ease of construction • Improvements to vehicular/pedestrian and cyclist safety • Impacts to municipal servicing • Improvements to intersection level of service • Impacts/enhancements to municipal infrastructure and servicing • Complies with the 2030 TMP
Economic and Financial	• Capital costs • Ongoing maintenance and operating costs	• Design and construction costs • Costs to maintain intersection/road improvements • Potential for land acquisition costs

Summary of Planning Alternatives Evaluation

Planning Alternative	Screening Result	Alternatives for Further Study
1. **Do Nothing** • Does not address the problem opportunity statement • Does not comply with 2030 TMP	Not Carried Forward	Screened from additional study.
2. **Expand Pedestrian, Bicycle, Transit Use** • Not possible for sufficient diversion to these modes of transportation to solely address the problem.	Carried Forward	To be studied further in Phase 3 Design Concepts
3. **Operational Improvements** • Does not provide sufficient improvement to address the current rated capacity when carried forward as a sole solution. • Does not prevent continued service degradation when carried forward as a sole solution.	Carried forward	To be studied further in Phase 3 Design Concepts
4. **Improvements to parallel roads** • Will not provide necessary capacity relief within the north/south corridor. • Wonderland Road/Richmond Street are outside of an acceptable proximity. Platts Lane would require widening of the CP Railway Bridge. • Does not solve the local turning movement issue.	Not Carried Forward	Screened form additional study.
5. **Improvements to Local Roads** • Supports the Western University Master Plan with a secondary collector • Diverts traffic away from Sarnia Road and Western Road.	Carried Forward	To be studied further in Phase 3 Design Concepts
6. **Improvements along Philip Aziz Avenue** • Addresses the problem statement • Complies with the 2030 TMP • Will prevent continued service degradation.	Carried Forward	To be studied further in Phase 3 Design Concepts

Summary of Planning Alternatives Evaluation - Recommended

The Recommended Planning Solution is a combination of:

- **Alternative 2: Expand Pedestrian, Bicycle, Rapid Transit Use**
- **Alternative 3: Operational Improvements**
- **Alternative 5: Improvements to Local Roads**
- **Alternative 6: Improvements along Philip Aziz Avenue**

These alternatives will be the basis upon which alternative design concepts are developed and evaluated in Phase 3.

Next Steps

Fall 2021
Collect input from PIC #1

Receive and consider input from the public, agencies and stakeholders to confirm the preferred planning alternatives

Winter/Spring 2022
Alternative Design Concepts

Determine Alternative Design concepts that can implement the preferred planning alternative.

April 2022 Hold PIC #2 and present the evaluation of alternative design concepts and the preliminary recommended solution

Receive and considered input from the public, agencies, and stakeholders to confirm the preferred planning alternatives

June 2022
Environmental Study Report

Prepare Environmental Study Report

Report will be available for Public Review for 30-Days.

If no issues are raised within the 30-day review period and subject to MECP acceptance, the City can proceed to detailed design

Stay Connected

Visit our Get Involved website, **getinvolved.london.ca/westernsarnia** where you can:

- Ask questions and leave comments for the project team
- View the latest project materials
- Access a recording of this meeting

You can also reach us any time with comments or questions, using the contact information below. This presentation can be made available in alternative formats upon request.

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AECOM

Appendix A

A.3 Public Information Centre #2

Western Road / Sarnia Road / Philip Aziz Avenue Environmental Assessment

Public Information Centre #2

June 23, 2022

aecom.com

Engagement Guidelines

- Please use the Q&A button to ask a question at any time.
- All questions will be answered after the presentation, during the Q&A Session.
- This meeting is being recorded and will be posted online at **getinvolved.london.ca/westernsarnia**

Project Team

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Jane Fullick
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John Pucchio
AECOM
Senior Engineer, Project Manager

Karl Grueneis
AECOM
Environmental Assessment Planning Lead

Paul Adams
AECOM
Environmental Assessment Planner

aecom.com

Agenda

- Introductions and purpose
- Presentation (approximately 45 minutes)
- Questions and answer period

Public Information Centre (PIC) Purpose

1. Introduce the Project;
2. Provide an overview of the Municipal Class Environmental Assessment (MCEA) process;
3. Provide a summary of PIC1;
4. Describe the updated Problem and Opportunity Statement;
5. Present the design alternatives, evaluation and preliminary recommendations; and
6. Meet the project team and get your feedback.

Municipal Class EA Study Process

The Class EA study will be completed in accordance with the **Ontario Environmental Assessment Act** and will fulfill the requirements of the Municipal Class EA process for **Schedule C** projects. At the end of the EA process, an **Environmental Study Report** will be prepared for public review and comment to document the planning process followed.

Phase 1: Problem and Opportunity
Review background planning and policy documents, identify study area needs, problems and opportunities.

Phase 2: Alternative Solutions
Review existing environment, identify and evaluate feasible alternative solutions and select Recommended Alternative Solution.

Phase 3: Alternative Design Concepts
Develop and evaluate alternative designs, identify environmental impacts and required mitigation measures, and select the Recommended Design Alternative.

We are here

Phase 4: Environmental Study Report
Document the decision-making process in an Environmental Study Report and publish Notice of Study Completion for 30-day comment period.

Phase 5: Implementation
Complete the detailed design, tender and construction following the completion of the EA study and review period.

Continuous Consultation & Engagement

aecom.com

PIC #1 Summary

- PIC#1 was held on December 1, 2021
- Existing conditions and project background were presented:
  - In 2015, the City of London initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class EA (MCEA).
  - In 2016, the MCEA was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT).
  - Now that the north leg of rapid transit is not proceeding, the City is restarting the MCEA and invites you to participate in the process.

PIC #1 Summary - Problem/Opportunity Statement

Problem

- The City of London Transportation Master Plan (2030 TMP) identified the need to improve the Western Rd and Sarnia Rd/Philip Aziz Ave intersection in the next 5 years.
- This intersection accommodates pedestrians, cyclists, significant transit routes and numerous vehicles (per day).
- The intersection experiences traffic congestion, safety concerns, increased delays and decreasing levels of service for all users and this will continue if left untreated.
- The existing storm drainage in the area does not meet current design standards and requires upgrades.

Opportunity Statement

- Develop a range of planning and design alternatives that can improve pedestrian and cyclist facilities and safety, improve intersection operations, and provide additional capacity by removing constraints.
- Improve continuity with Western Road north and south of the study area, address stormwater drainage and enhance streetscape conditions.
- Consult the public and agencies and solicit feedback to select the best plan for the future.
- Follow the City of London's 'Complete Streets' guidelines, 'Urban Design' guidelines, and Western University's Master Plan Vision, to potentially create a gateway to the campus.
- Create a street/intersection that is as functional and comfortable as possible for all users (students, children, seniors, cyclists, motorists, transit users and pedestrians)

PIC #1 Summary
Recommended Planning Solutions

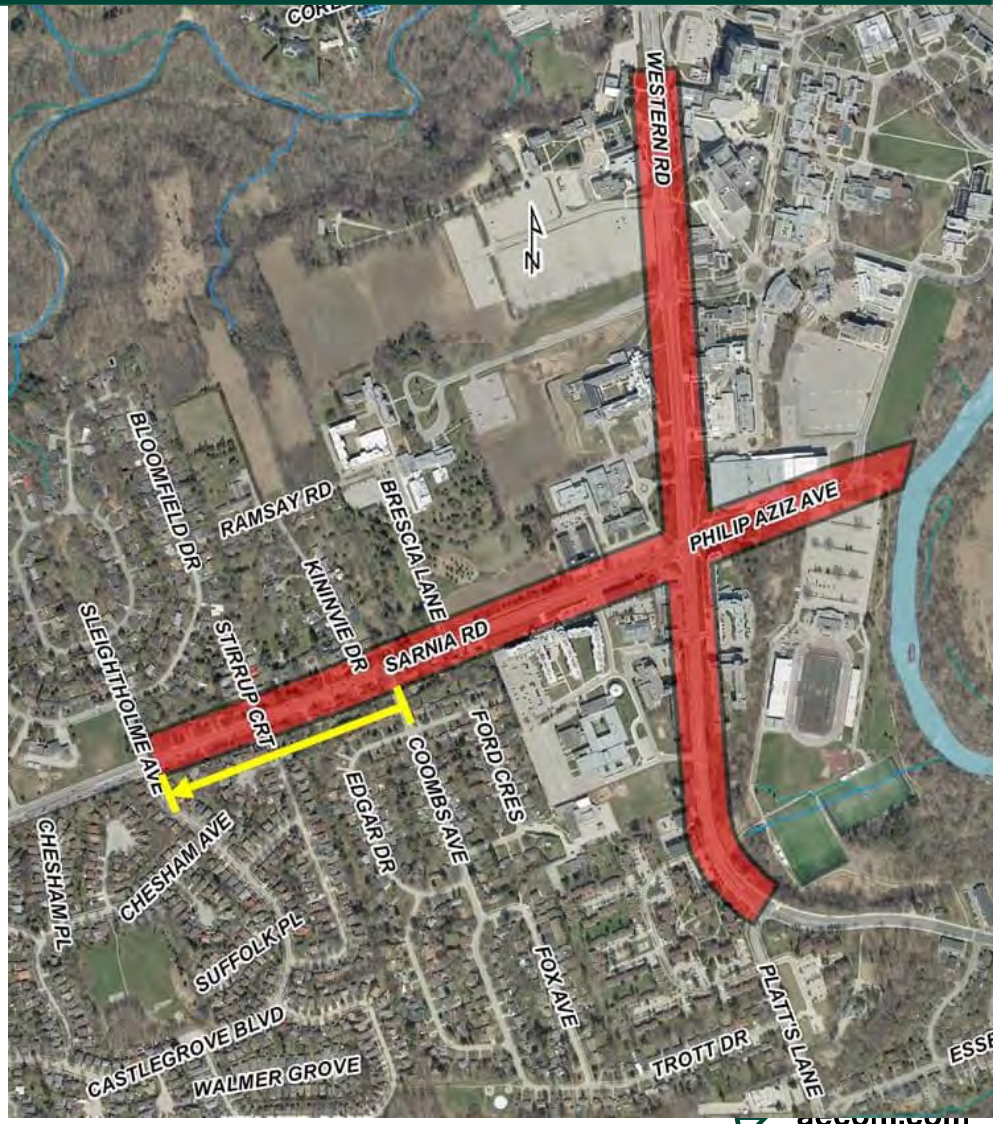
The Recommended Planning Solution is a combination of:

- **Expand Pedestrian, Bicycle, Transit Use**
- **Operational Improvements**
- **Improvements to Access Management**
- **Improvements along Philip Aziz Avenue**

Additional Study Area Limits

Project Extents

- Western Rd from Huron College entry (north) to Platts Ln (south)
- Sarnia Rd / Philip Aziz Ave corridor from Sleightholme Ave (west) to the Thames River (east)
  - Coombs Ave to Sleightholme Ave was added after PIC#1
  - This additional piece of Study area allows for the existing cycling lanes to the west to be extended all the way to the East Limits of the Study Area
- Coombs Ave (previous west limits)



Design Alternatives

Sarnia Rd

1. Maintain existing road section with sidewalks (no dedicated bicycle lanes)

2. Full Urban Cross Section with bicycle lanes extended to Sleightholme Recommended

Western Rd

1. Extended South bound right turn lane Recommended
2. Added bus bays Recommended
3. Active transportation improvements: Recommended
4. Active Transportation in Right of Way. Recommended

Philip Aziz Ave

1. Full Urban Cross Section with reconstructed entrance to Philip Aziz property.

2. Full Urban Cross Section with relocated entrance to Philip Aziz property. Recommended

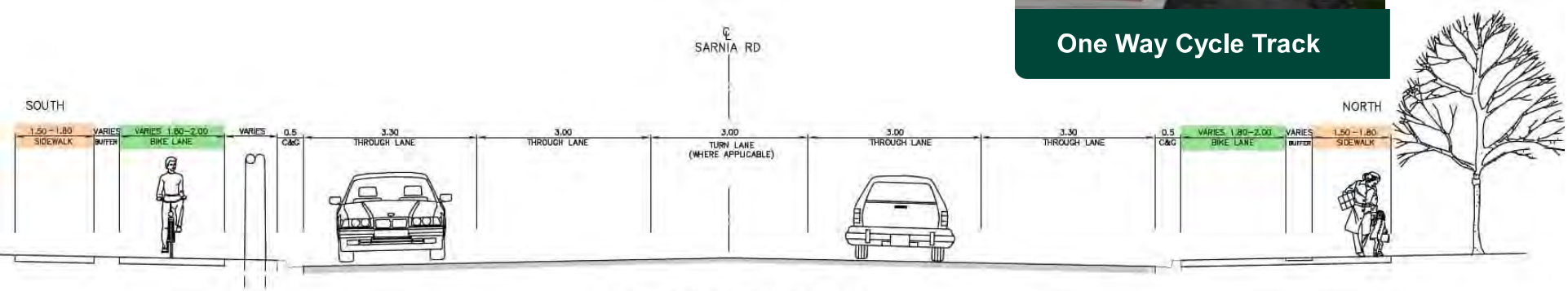
Intersection

1. Roundabout
2. Pedestrian Tunnel
3. Double left turn lane vs Single left turn lane (Recommended)
4. Typical Pedestrian Crossway with protected intersection design features (Recommended) vs Scramble

Sarnia Rd – Design Summary

- Maintain the current 4 lane configuration.
- Extend bicycle lanes to Sleightholme Ave to connect to the existing lanes.
- Bicycle lanes will be raised.
- Utilizes existing generous ROW for improving active transportation.
- No utility relocation, except for minor work involving relocation of guy poles.
- Minor regrading adjacent to existing retaining wall on north side.
- Some (minor) loss of trees along the corridor.
- Small property taking area on north side.
- Reconstruction of bus stops (with bus pads).

One Way Cycle Track



TYPICAL SECTION SARNIA ROAD

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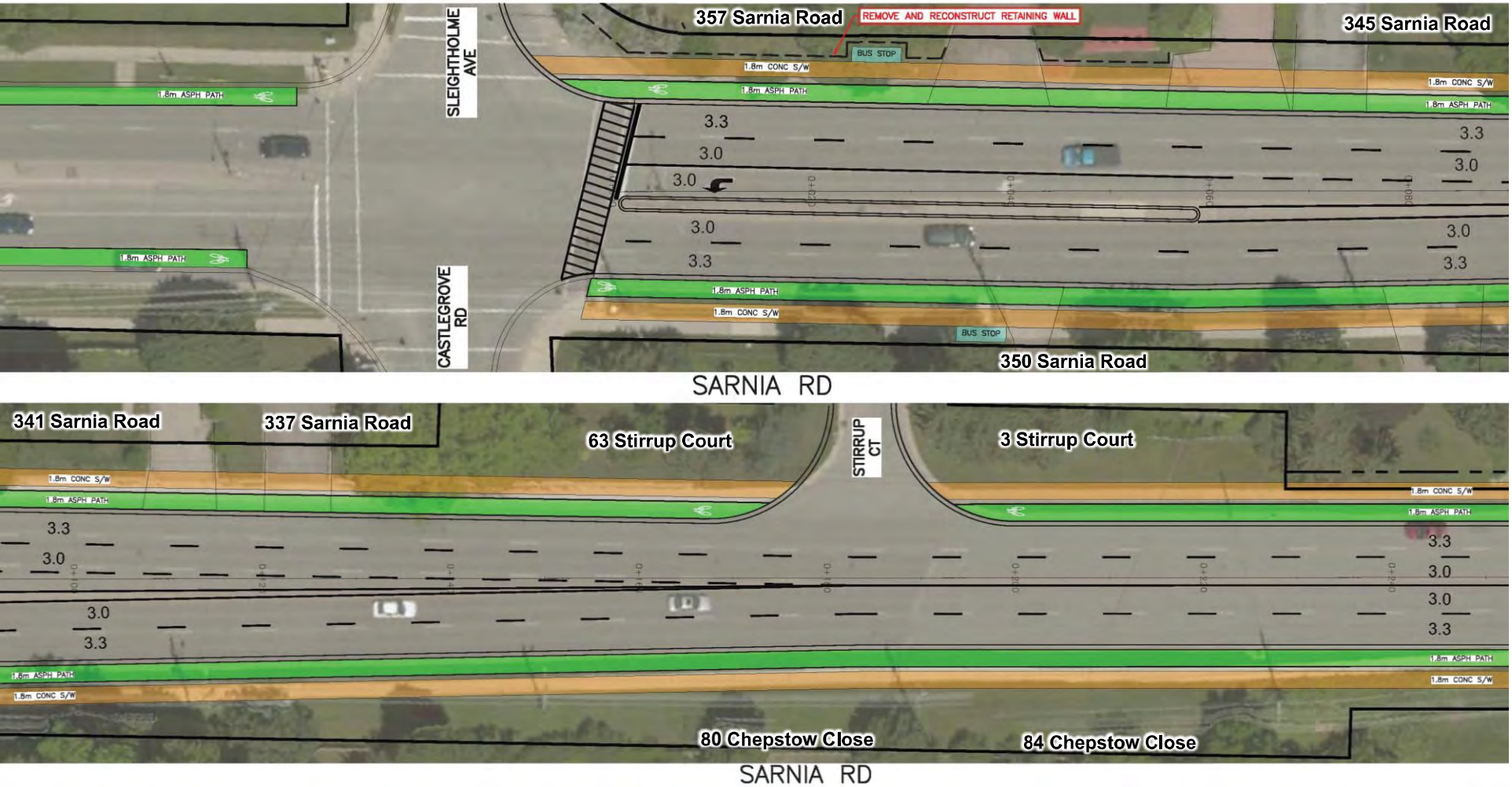
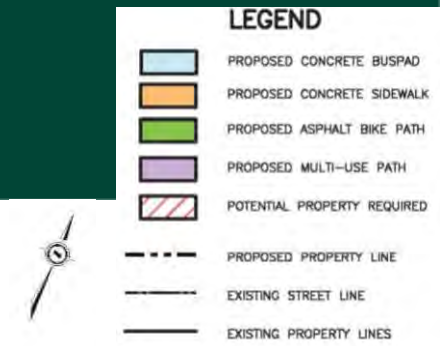
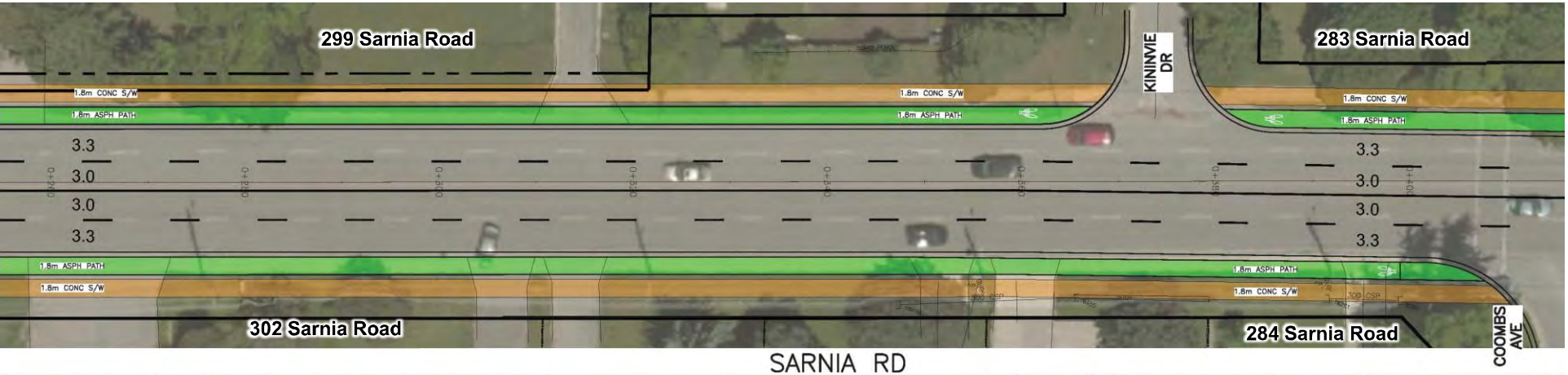
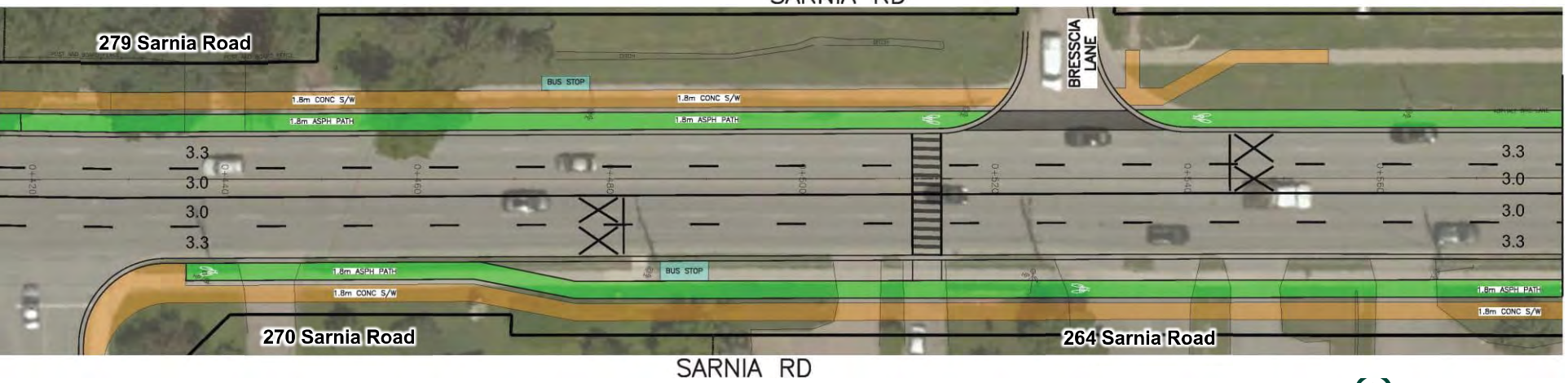
Sarnia Rd – Concept Layouts



Sarnia Rd – Concept Layouts







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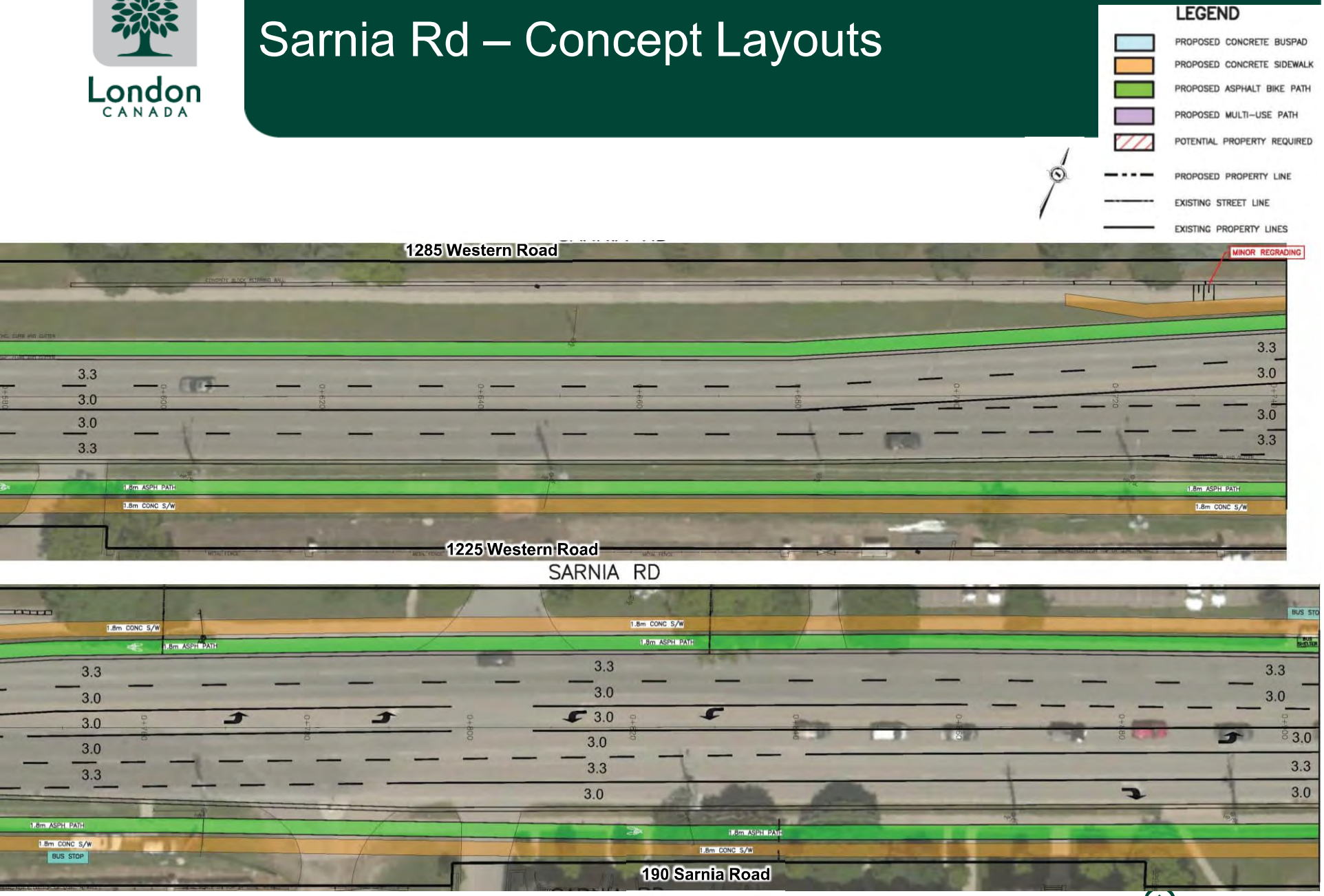
Sarnia Rd – Concept Layouts



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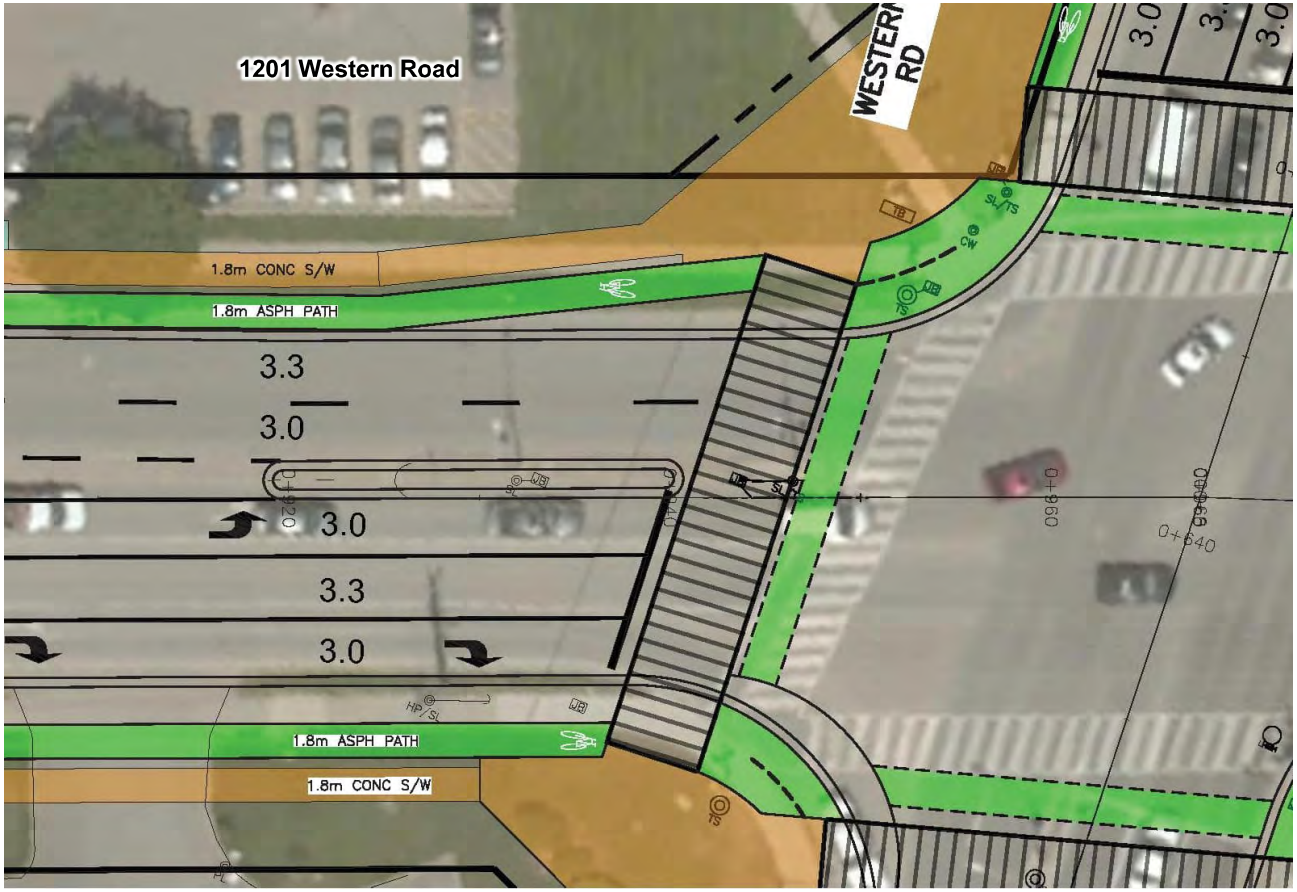
Sarnia Rd – Concept Layouts

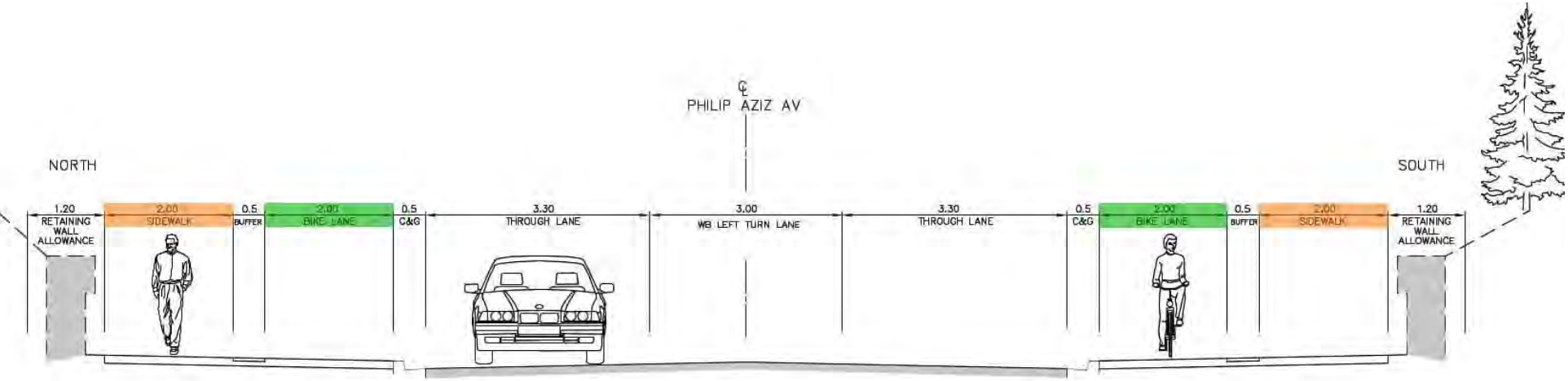


Philip Aziz Ave - Existing

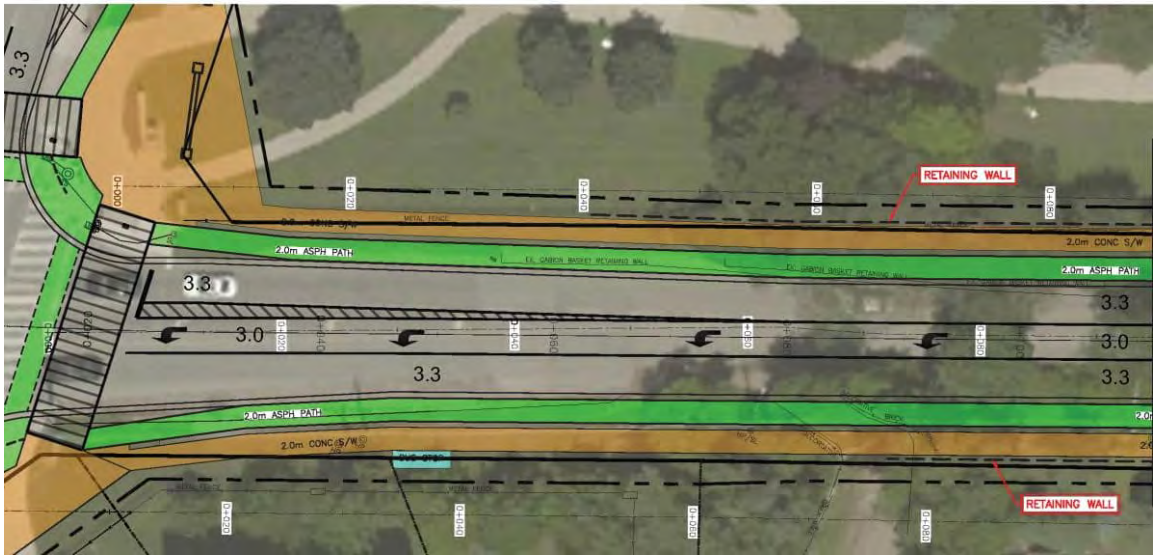
- Two lanes, short left turn lane to Western Rd, no sidewalks, no bike lanes.
- Gabion wall, heritage property entrance, overhead hydro, undersized storm sewer.

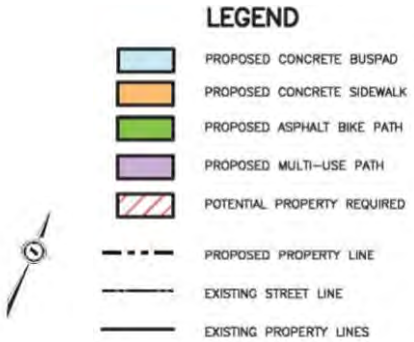
Philip Aziz Avenue – Design Summary

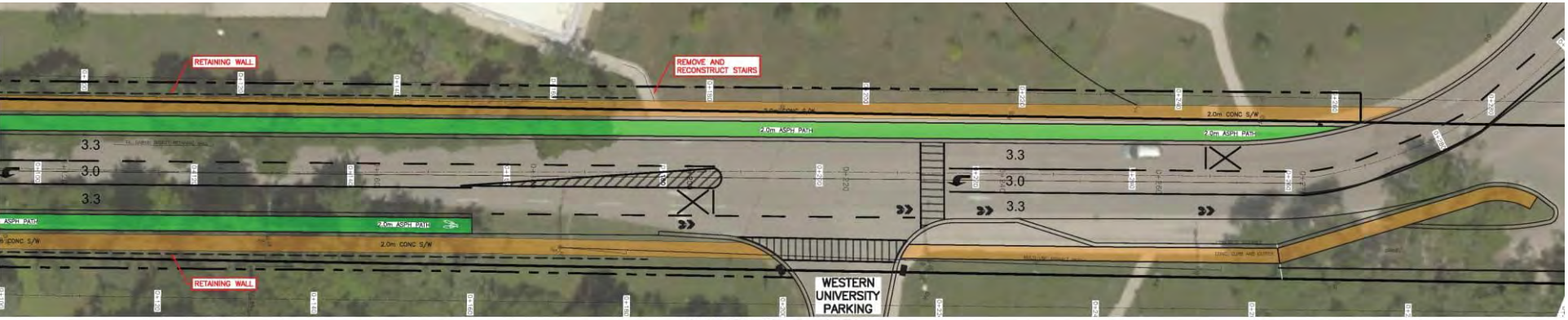
- Urban Cross Section with reconstructed/realigned Philip Aziz property entrance
- Overhead Services (south) relocation
- Retaining walls (N+S) with fence
- Increased left turn lane length
- Loss of vegetation (no SARs)
- Property requirement
  - N+S sides of road
  - Area at Thames River
- Stormwater Outfall relocation
- Reconstruct bus stop (just east of Western Rd)



Philip Aziz Ave - Concept Layouts







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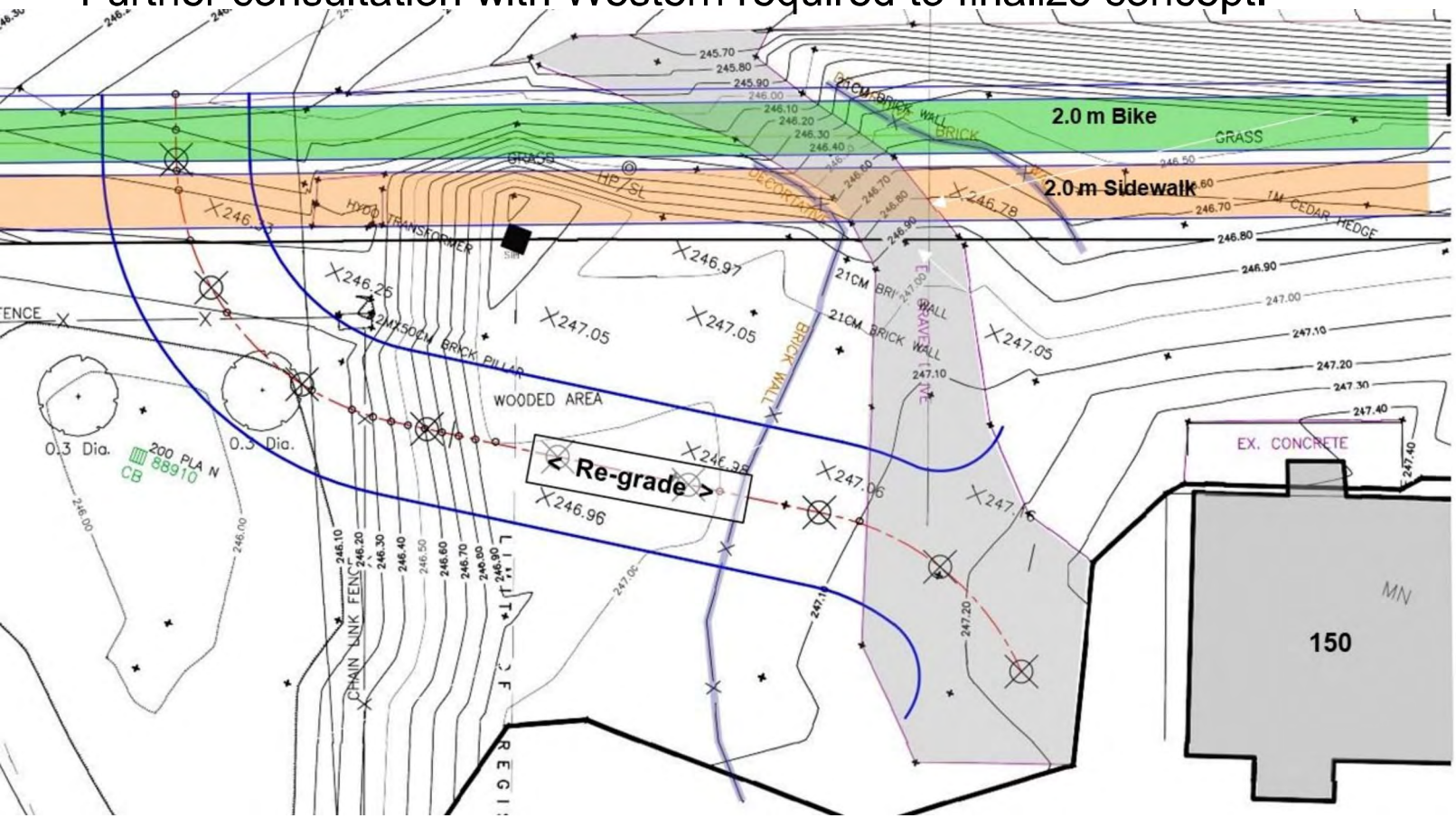
Philip Aziz Ave – Property Entrance Concept

- No impact to property buildings. Realigned for maintenance and fire access (with max 3% grade) including improved sightlines to property
- Reconstruct / reconfigure wall (Heritage Impact Assessment required)
- University owns all lands on the south side.
- Further consultation with Western required to finalize concept.



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Philip Aziz Ave – Existing Outfall

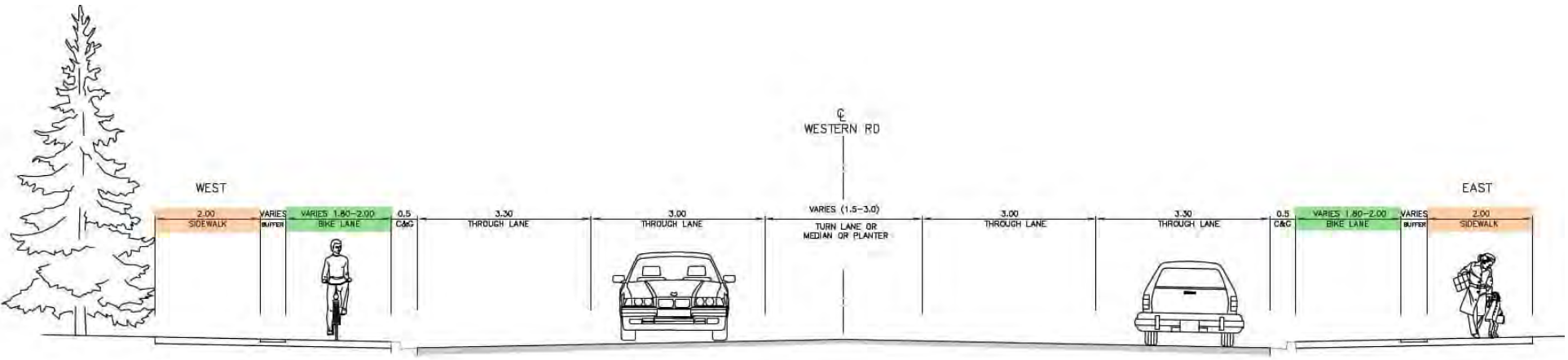
- Two existing Storm Sewer Outfalls at end of Philip Aziz Ave at Thames River

Philip Aziz Ave – 1050 mm diameter Outfall

- Relocate outfall 50 m to south (requires property)
- Benefits: reduces conflicts with other buried services and improves hydraulic flow
- Existing outfall and portion of sewer to remain (plugged and not functional)
- Campus outfall still present
- Thames R. provides Critical Habitat under Species at Risk Act (Silver Shiner, Black Redhorse)

Western Rd – Design Summary

- Connections with existing active-transportation facilities (N+S ends)
- Extended Southbound Right Turn Lane
- Adding bus bays (requires property) and maintaining other bus stops
- Active transportation in ROW
- Opportunity for median planters south of Lambton Drive (~30 m)
- Introduction of curb and gutter, storm sewer to meet current design standards
- Relocation of street light poles and guy poles/wires along entire length
- Hydro pole relocation – east side (from Essex Hall to Philip Aziz Ave)
- Property required throughout the corridor



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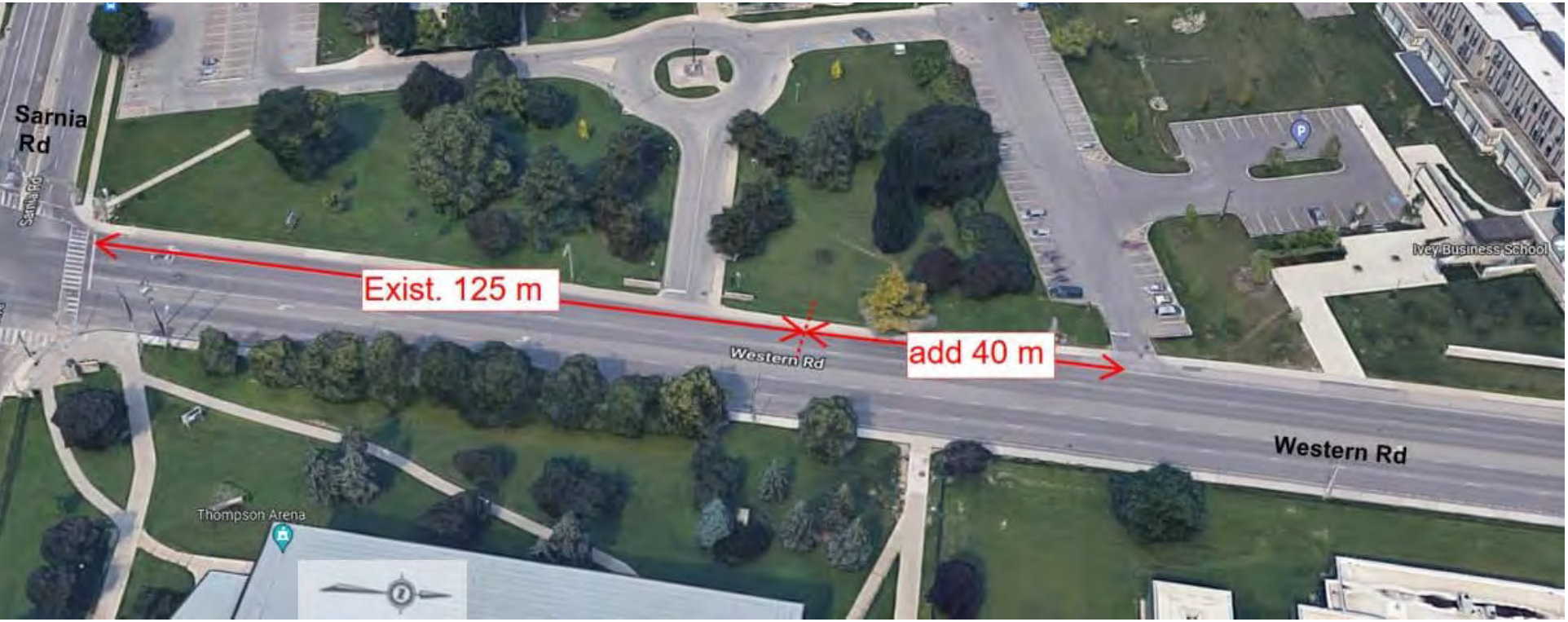
Western Rd – Extended SB Turn Lane

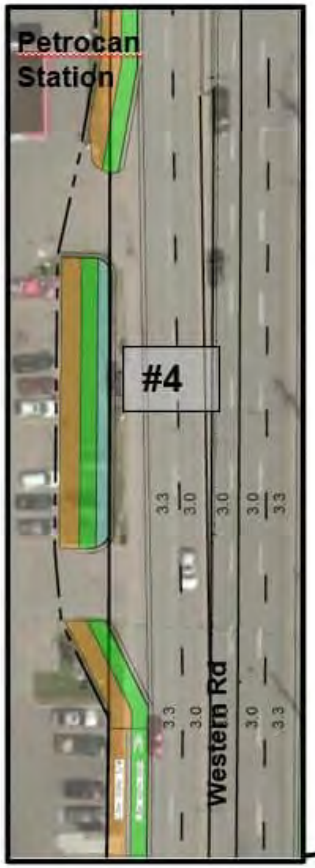
- Extend to Ivey Business School parking (+30% added length with minimal disruption)
- Requires section of property, to suit widened road platform with active transportation
- Extended turn lane will improve queue delay including southbound through lanes.



Proposed Bus Bays

- **Property required for all locations**
- **All locations recommended**

LTC to confirm bus bay usage to determine size (eg double vs articulated buses)



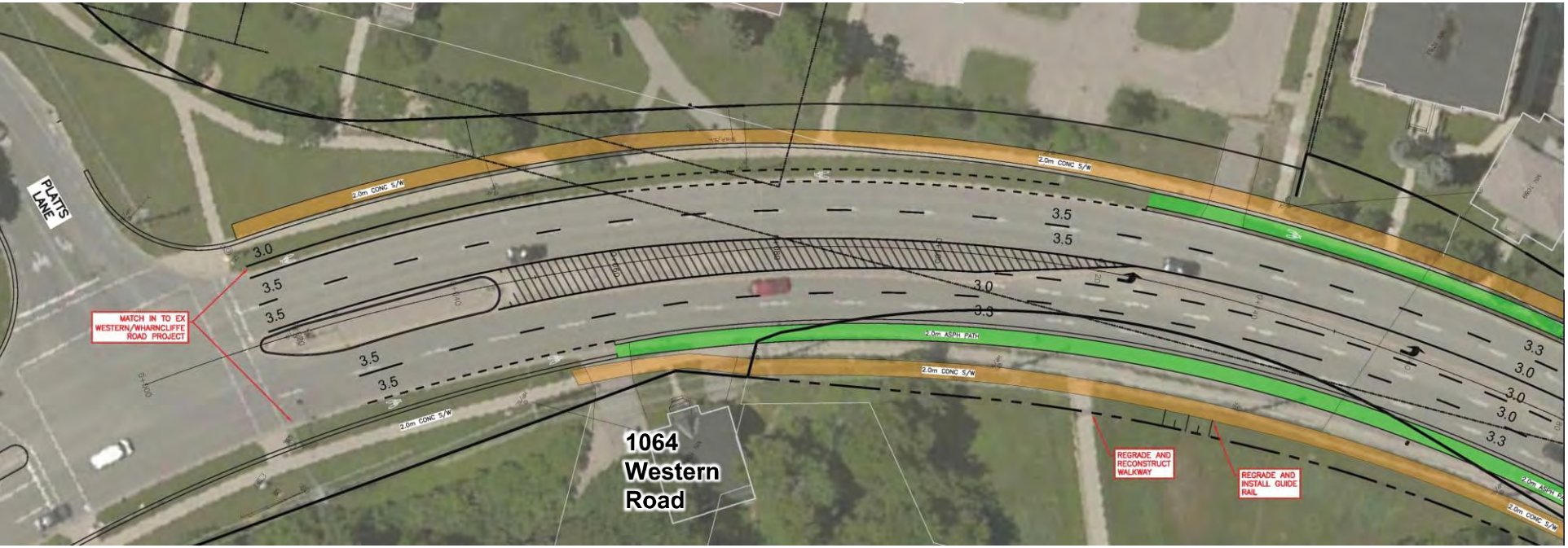
Existing Bay (north of Lambton Dr to be reconstructed

Western Rd at Platts Lane - Concept Layout

- Tight clearances at 1064 Western Rd (but no property required)
- East side requires grading for ±140 m and property taking
- Regrading and reconstruction of the walkway to Western Un. fields

LEGEND

- PROPOSED CONCRETE BUSPAD
- PROPOSED CONCRETE SIDEWALK
- PROPOSED ASPHALT BIKE PATH
- PROPOSED MULTI-USE PATH
- POTENTIAL PROPERTY REQUIRED
- PROPOSED PROPERTY LINE
- EXISTING STREET LINE
- EXISTING PROPERTY LINES



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Western Rd - Concept Layouts

LEGEND

- PROPOSED CONCRETE BUSPAD
- PROPOSED CONCRETE SIDEWALK
- PROPOSED ASPHALT BIKE PATH
- PROPOSED MULTI-USE PATH
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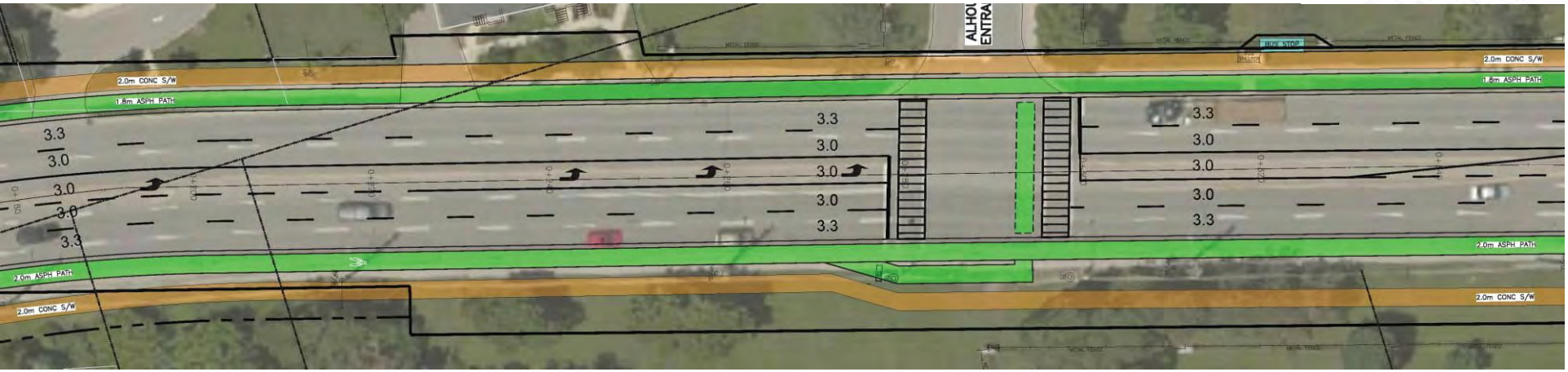

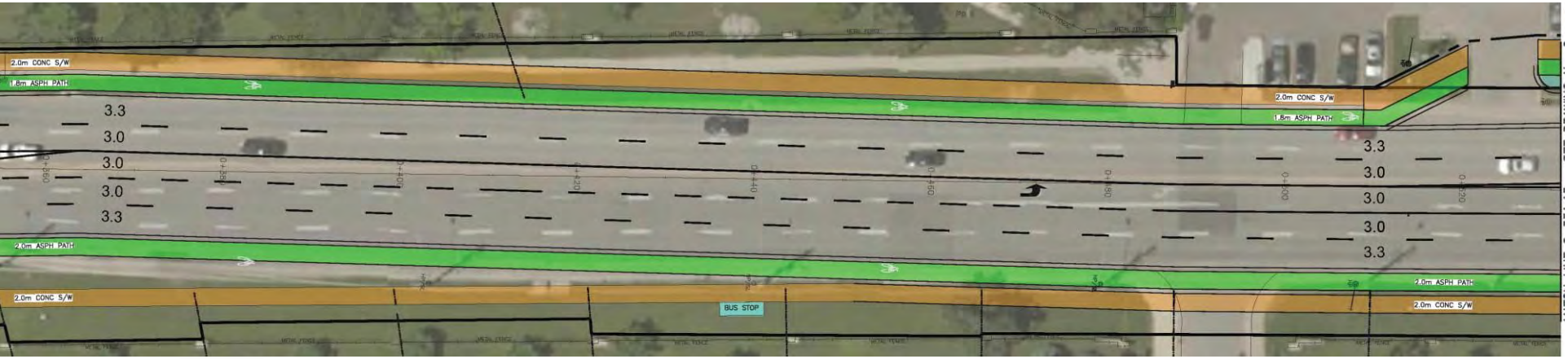

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Western Rd - Concept Layouts

LEGEND

- PROPOSED CONCRETE BUSPAD
- PROPOSED CONCRETE SIDEWALK
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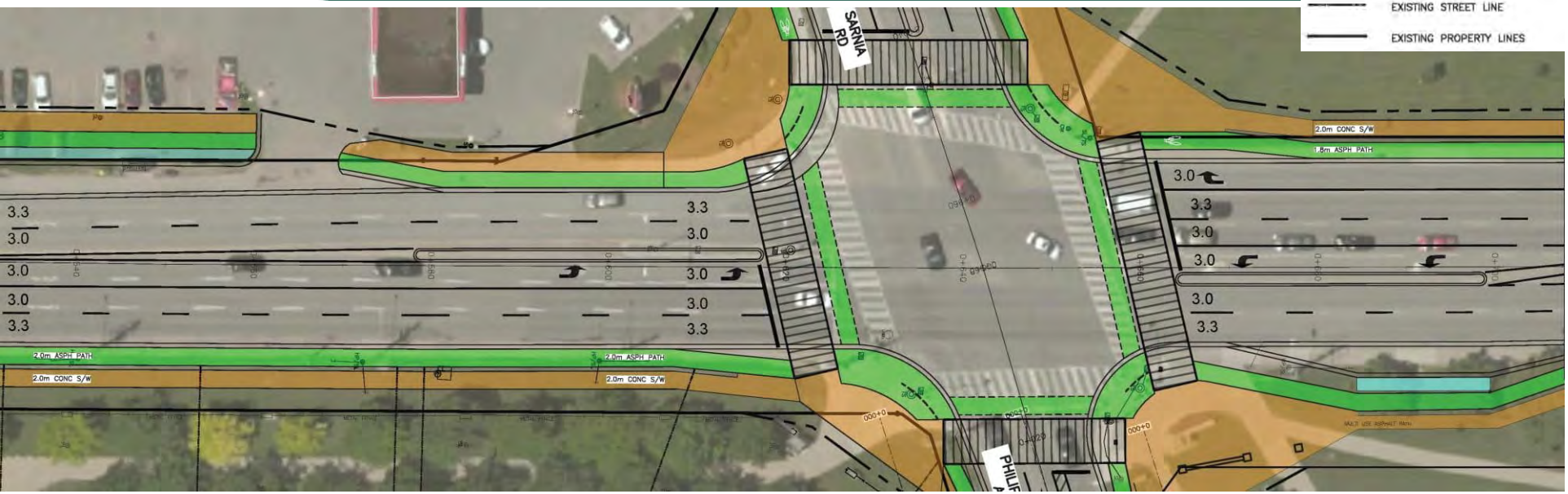

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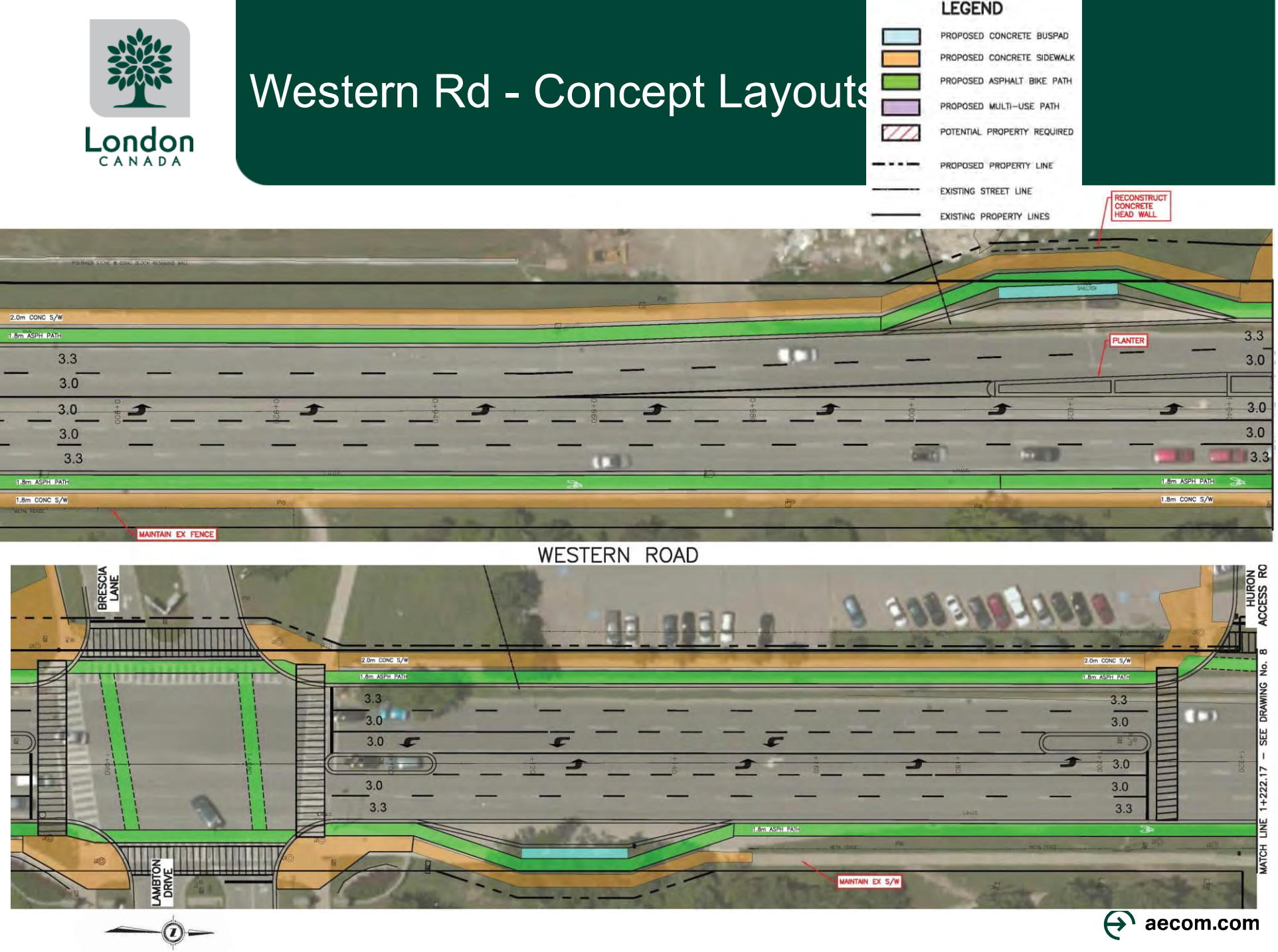
Western Rd - Concept Layouts



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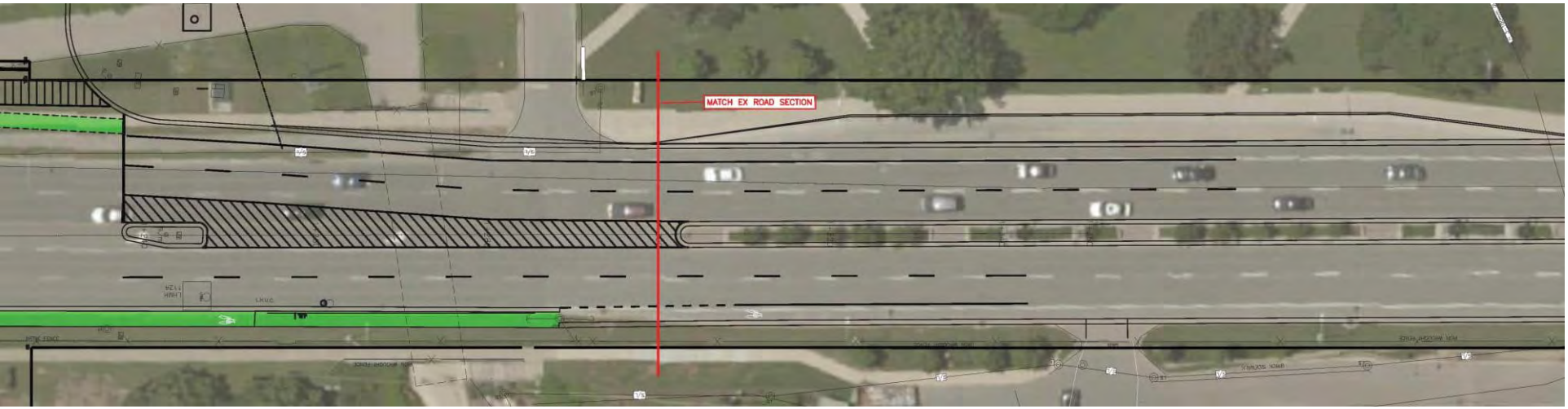
Western Rd - Concept Layouts



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Intersection Area - Traffic Considerations

Vehicular Traffic

- Western Rd – 28,500 vehicles per day
- Sarnia Rd – 24,000 vehicles per day

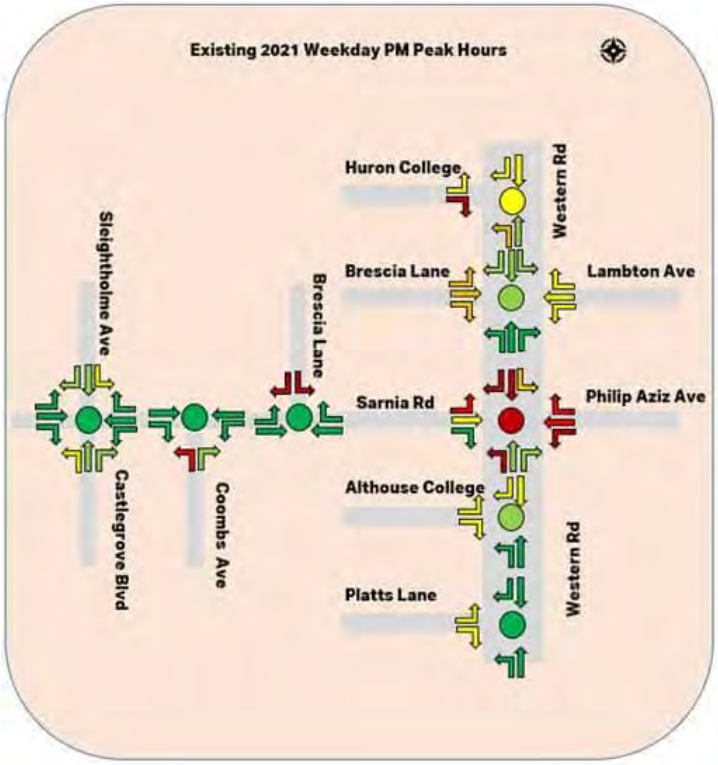
Pedestrian Volume

- < 1000 per hour (any direction), peak times per day and varies through the year

Primary trip generating/destination area

- Springett parking lot

The current LOS along the study corridor is illustrated in these figures for the peak travel times: morning (AM) and evening (PM).



Legend

Turning Movements:
- Level of Service-A
- Level of Service-B
- Level of Service-C
- Level of Service-D
- Level of Service-E
- Level of Service-F

Intersection:
- Level of Service-A
- Level of Service-B
- Level of Service-C
- Level of Service-D
- Level of Service-E
- Level of Service-F

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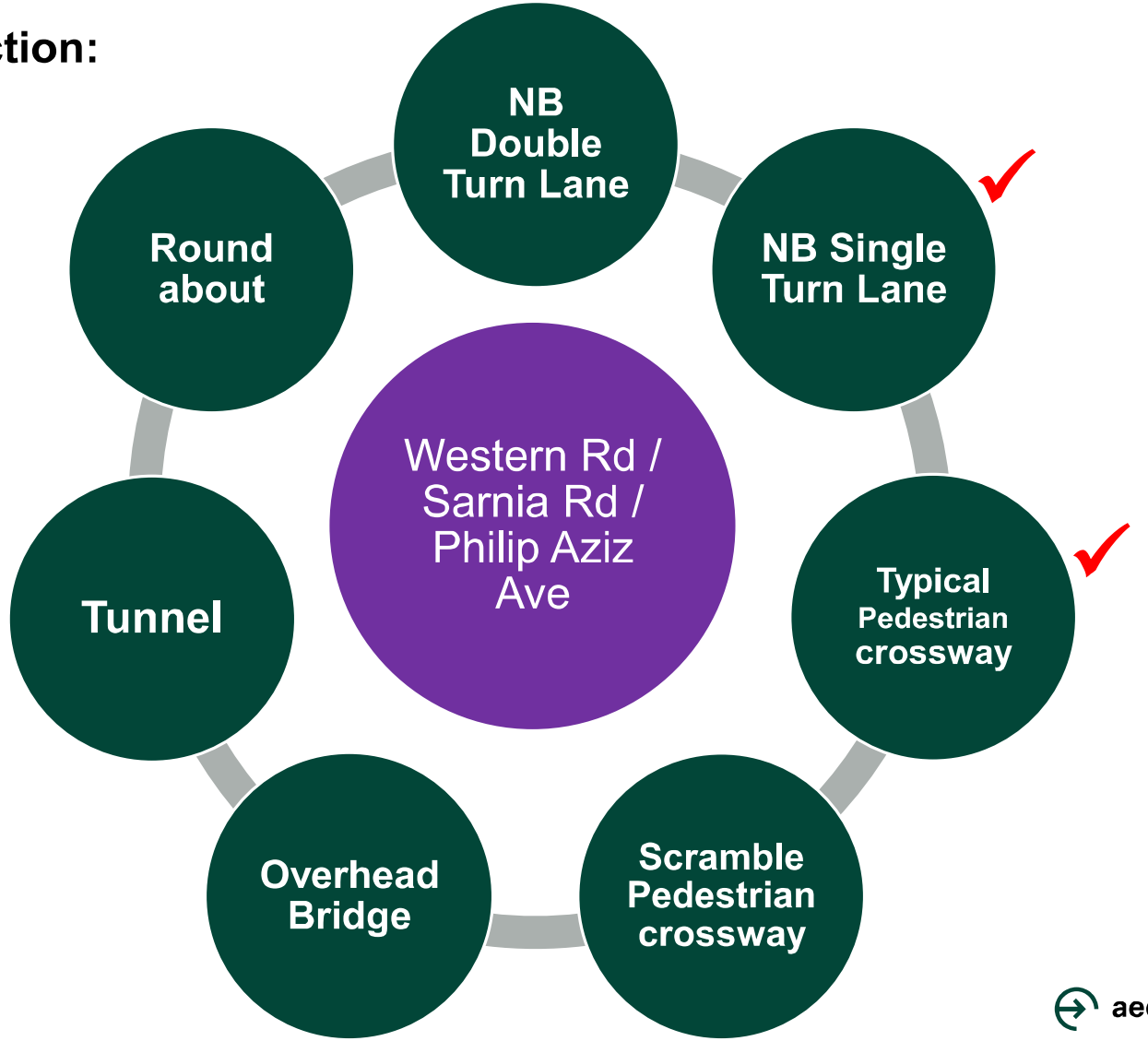
Intersection - Alternatives

Challenging Intersection:

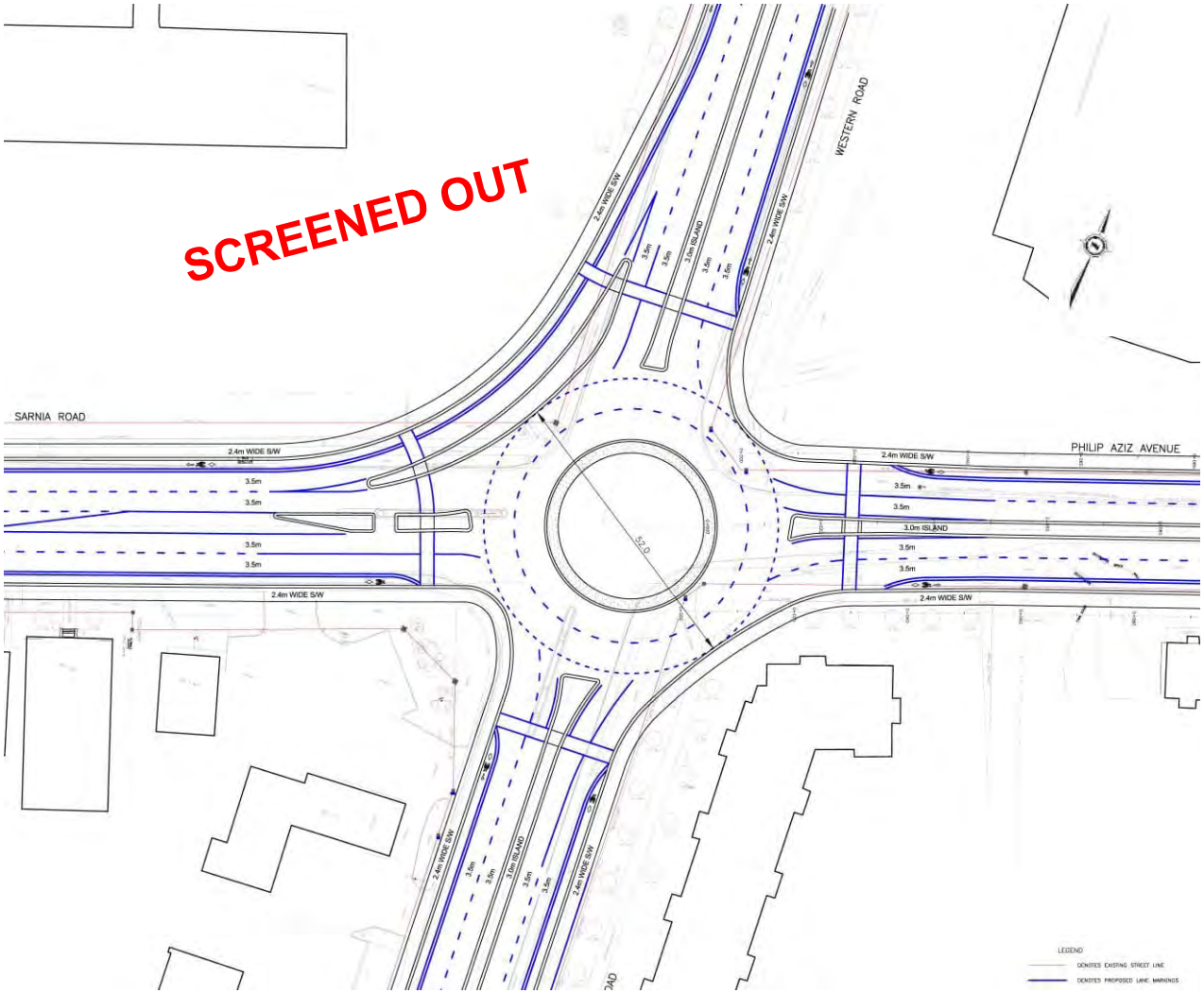
- Many competing interests for usage
- All forms of transportation
- Very different during times of the day and during the year
- Generally constrained with different property owners/functions
- How will the future change area, usage and the way we travel?



Intersection – Screened Alternatives

Roundabout Screening Rationale:

1. Insufficient Level of Service increase.
2. Lack of benefit to active transportation users.
3. High cost to implement
4. Significant property acquisition required



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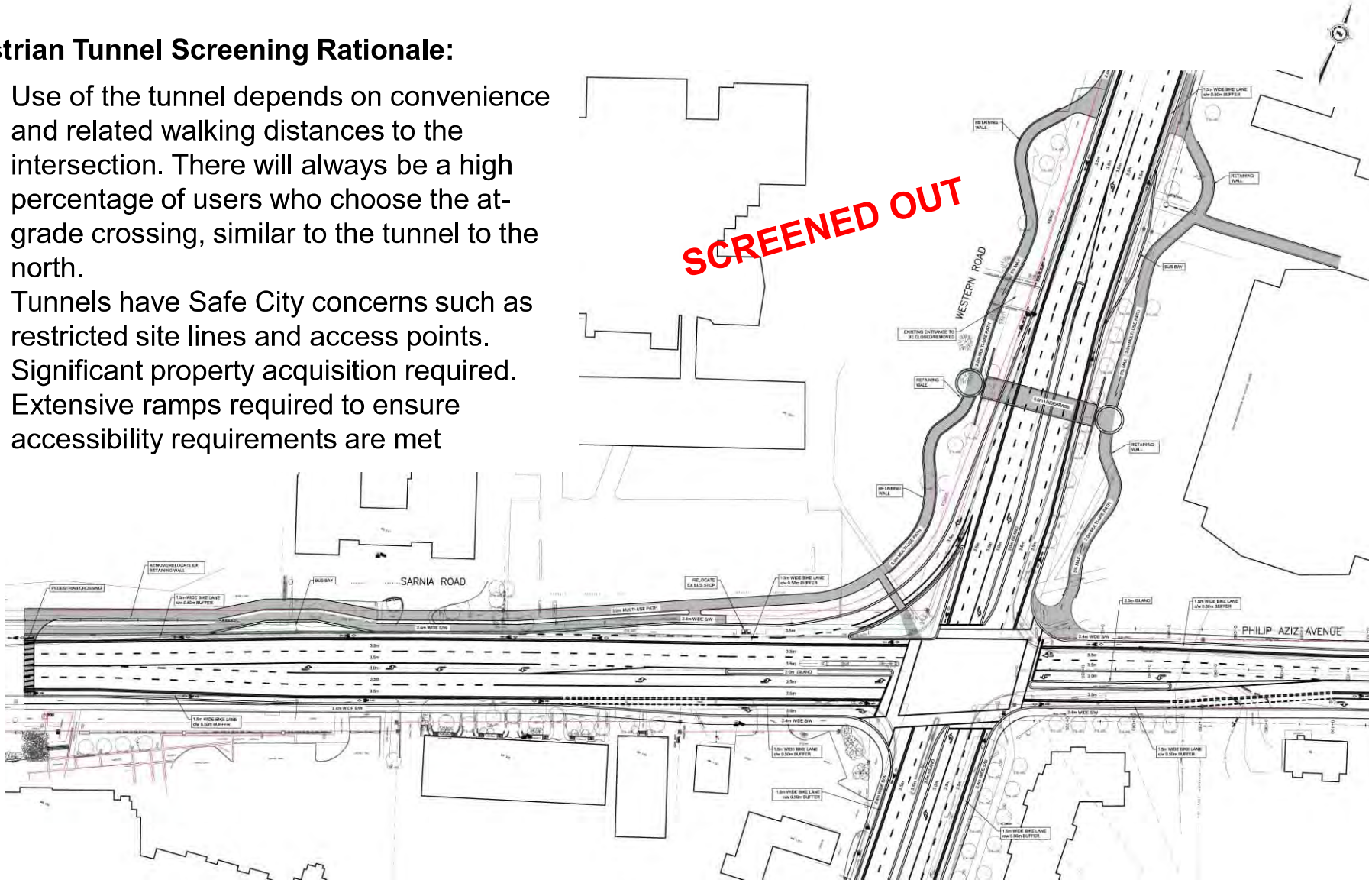
Intersection – Screened Alternatives

Pedestrian Tunnel Screening Rationale:

1. Use of the tunnel depends on convenience and related walking distances to the intersection. There will always be a high percentage of users who choose the at-grade crossing, similar to the tunnel to the north.
2. Tunnels have Safe City concerns such as restricted site lines and access points.
3. Significant property acquisition required.
4. Extensive ramps required to ensure accessibility requirements are met



Intersection – Screened Alternatives

Overhead Structure Screening Rationale:

SCREENED OUT

1. Use of the overhead structure would depend on convenience and related walking distances to the intersection. High percentage of users who choose the at grade crossing (similar to the tunnel to the north).
2. An overhead structure requires fully accessible with ramps at 8% slope. Due to required height over roadway, >75 m long approach ramps required both ends.
3. Structure arrangement represents a significant disruption to intersection and property acquisition required.

Double Left Turn Lane:

SCREENED OUT

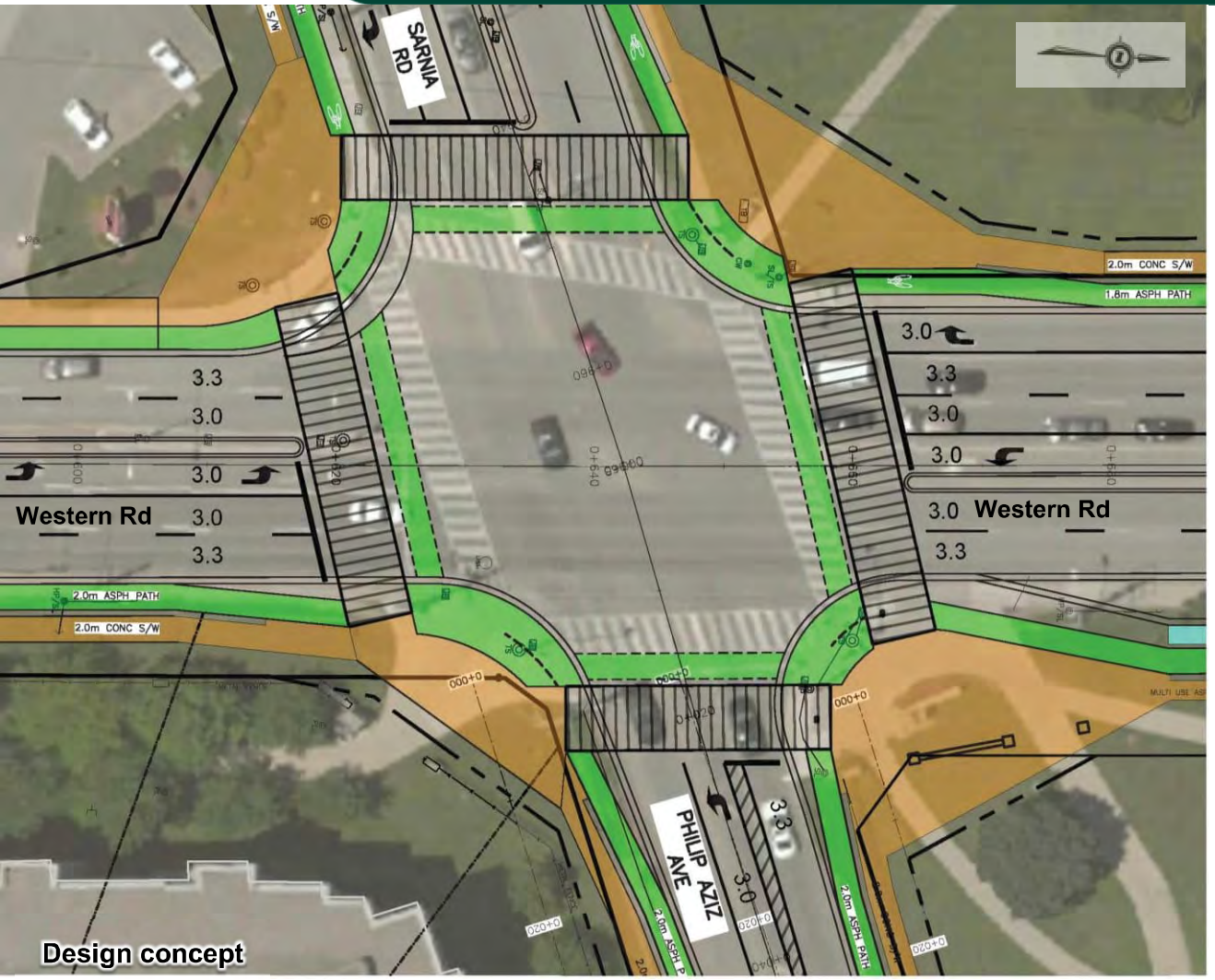
1. Only minimal improvement to vehicular level of service.
2. Reduced vehicular level of service in Off-peak hours
3. Negligible difference in the pedestrian Level of Service between double and single left turn lanes
4. Double left turn lanes add to the travel distance and related pedestrian cross times.

Intersection – Screened Alternatives

Scramble Intersection:

1. Safety concerns with bicycle movements.
2. Difficulty integrating Accessibility for Ontarians with Disabilities Act (AODA).
3. Insufficient number of pedestrians using the intersection to meet the threshold used to warrant a scramble intersection.

Intersection – Recommended Improvements



- Pedestrians: extra wide crossings (5 m), larger waiting areas, improved sight lines
- Bicycles: improved connectivity, waiting areas, better flow and markings
- Traffic: Improved through traffic flow with bus bays, added queue length on right turn lane
- Potentially some signal optimization
- Designed with features to address safety concerns such as:
  - Protected intersection design
  - Adoption of latest Book 18 design approaches
  - Islands to provide better safety for cyclists and pedestrians
  - Reduced turning radii to manage vehicle speeds

Other Work

- Watermain replacement on Western Rd from Platts Ln to Sarnia Rd.
- Sanitary sewer connection from sanitary lift pump station on Philip Aziz Ave to Western Rd.
- Stormwater sewer: Sarnia Rd, Western Rd and Philip Aziz Ave (to Thames River).
- Replacement of some streetlights and hydro poles: Western Rd and Philip Aziz Ave

Summary of Improvements

- This project is currently being scoped through the EA Study and can improve active transportation and localized operational issues in the area of Western University, the University Hospital and emergency access. This project will improve mobility and access for major destinations while also examining connectivity and improved safety for active transportation. Improvements to drainage infrastructure will also provide opportunities for increased resiliency to respond to climate change. As we finalize consultation and identify the EA recommendations, the project will be reviewed consistent with our climate emergency screening process and documented in the environmental study report.
- Highlights:
  - Wider pedestrian sidewalks with larger waiting areas at intersections
  - Protected bicycle lanes and connectivity through the corridor (Western Road, Sarnia Road and Philip Aziz Avenue)
  - Intersection improvements (safety and flow)
  - New bus bays
  - Stormwater sewer improvements

Alternative Route Through University / College

- An alternative access point to the City street network was not part of this study. As part of future campus developments, Western University likely to explore alternatives for a connection to Sarnia Road.
- The City would cooperatively review these future plans to bring traffic to Sarnia Road while ensuring there is no cut-through traffic onto the adjacent low traffic volume residential streets.

Next Steps

Summer 2022
Collect input from PIC #2

Receive and consider input from the public, agencies and stakeholders to confirm the preferred planning alternatives

Summer / Fall 2022
Environmental Study Report

Prepare Environmental Study Report

Report will be available for Public Review for 30-Days.

If no issues are raised within the 30-day review period and subject to MECP acceptance, the City can proceed to detailed design

Stay Connected

Visit our Get Involved website, **getinvolved.london.ca/westernsarnia** where you can:

- Ask questions and leave comments for the project team
- View the latest project materials
- Access a recording of this meeting

You can also reach us any time with comments or questions, using the contact information below. This presentation can be made available in alternative formats upon request.

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Email: kgrabows@london.ca

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Consultant Project Manager
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AECOM

Appendix A

A.4 Indigenous Community Consultation

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Oneida Nation of the Thames
2212 Elm Avenue
Southwold, ON N0L 2G0

Attention: Chief Adrian Chrisjohn

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Sheko:li Chief Chrisjohn,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

In 2016, the project was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). As it is related to this project, the northern routes for RT have been deferred and the City has decided to restart this project.

Two Public Information Centres (PICs) will be held, the first in October 2021, will present the updated problem/opportunity statement, a review of the study progress, the evaluation of the alternative solutions and project timeline. Another PIC will be held in April 2022.

See the City of London website for details:

https://london.ca/projects/western-road-sarnia-road-philip-aziz-avenue-environmental-assessment.

Work to be completed during the Class EA includes the following:

- Indigenous Community engagement and consultation;
- Technical studies (Transportation, Stormwater Management, Sanitary Servicing, Water Servicing, existing conditions assessment);
- Natural environment field surveys and inventories (terrestrial, aquatic, Species at Risk);
- Archaeological Assessment;
- Cultural Heritage Assessment; and
- Public and agency consultation.

Potential Involvement of Your Community

As we proceed with the Class EA, the Project Team is initiating the Indigenous Community engagement and consultation process. The Project Team would like to hear from the Onyota'a:ka

community of Oneida Nation of the Thames and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

As the study progresses, the Project Team will provide you with the results of analyses that may be of interest to your Community (e.g. environmental baseline studies, archaeological assessment, etc.).

Next Steps

We invite your Community to be involved in the engagement and consultation process and we would be happy to arrange a virtual meeting with you to discuss your community's involvement as well as any initial comments regarding the project.

Kindly indicate whether your Community is interested in participating in our engagement activities by identifying your preferred key contact person and providing their contact information to one of our Project Team contacts listed below.

Should you have any questions, please do not hesitate to contact:

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Corporation of the City of London
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London ON, N6A 4L9
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On behalf of the Project Team, thank you in advance for your cooperation and partnership throughout this Project.

Yaw^ko,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

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August 16, 2021

Kettle and Stony Point First Nation
6247 Indian Lane
Kettle and Stony Point FN, ON N0N 1J1

Attention: Chief Jason Henry

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Aanii Chief Henry,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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See the City of London website for details:

https://london.ca/projects/western-road-sarnia-road-philip-aziz-avenue-environmental-assessment.

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- Technical studies (Transportation, Stormwater Management, Sanitary Servicing, Water Servicing, existing conditions assessment);
- Natural environment field surveys and inventories (terrestrial, aquatic, Species at Risk);
- Archaeological Assessment;
- Cultural Heritage Assessment; and
- Public and agency consultation.

Potential Involvement of Your Community

As we proceed with the Class EA, the Project Team is initiating the Indigenous Community engagement and consultation process. The Project Team would like to hear from the Anishinaabeg

community of Chippewas of Kettle and Stony Point and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

As the study progresses, the Project Team will provide you with the results of analyses that may be of interest to your Community (e.g. environmental baseline studies, archaeological assessment, etc.).

Next Steps

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Kindly indicate whether your Community is interested in participating in our engagement activities by identifying your preferred key contact person and providing their contact information to one of our Project Team contacts listed below.

Should you have any questions, please do not hesitate to contact:

Karl Grabowski, P.Eng
Project Manager
Corporation of the City of London
300 Dufferin Avenue
London ON, N6A 4L9
Tel:519-661-2489 x5071
Email: kgrabows@london.ca

John Pucchio, P.Eng
Project Manager,
AECOM Canada Ltd.
250 York Street, Suite 410
London ON, N6A 6K2
Tel: 519-963-5880
Email: John.Pucchio@aecom.com

On behalf of the Project Team, thank you in advance for your cooperation and partnership throughout this Project.

Miigwech,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Caldwell First Nation
14 Orange Street
Leamington, ON N8H 1P5

Attention: Acting Chief Robyn Perkins

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Aanii Chief Perkins,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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- Cultural Heritage Assessment; and
- Public and agency consultation.

Potential Involvement of Your Community

As we proceed with the Class EA, the Project Team is initiating the Indigenous Community engagement and consultation process. The Project Team would like to hear from the Anishinaabeg

community of Caldwell First Nation and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

As the study progresses, the Project Team will provide you with the results of analyses that may be of interest to your Community (e.g. environmental baseline studies, archaeological assessment, etc.).

Next Steps

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Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Aamjiwnaang First Nation
978 Tashmoo Avenue
Sarnia, ON N7T 7H5

Attention: Chief Chris Plain

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Aanii Chief Plain,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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Potential Involvement of Your Community

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community of Aamjiwnaang First Nation and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

As the study progresses, the Project Team will provide you with the results of analyses that may be of interest to your Community (e.g. environmental baseline studies, archaeological assessment, etc.).

Next Steps

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Project Manager,
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250 York Street, Suite 410
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Tel: 519-963-5880
Email: John.Pucchio@aecom.com

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Miigwech,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Munsee-Delaware Nation
R.R. #1 289 Jubilee Road
Muncey, ON N0L 1Y0

Attention: Chief Mark Peters

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Koolamalsi Chief Peters,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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- Public and agency consultation.

Potential Involvement of Your Community

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community of Munsee-Delaware Nation and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

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Next Steps

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Email: John.Pucchio@aecom.com

On behalf of the Project Team, thank you in advance for your cooperation and partnership throughout this Project.

Anushiik,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Chippewas of the Thames First Nation
R.R. #1 320 Chippewa Road
Muncey, ON N0L 1Y0

Attention: Chief Jacqueline French

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Aanii Chief French,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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Potential Involvement of Your Community

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community of Chippewas of the Thames First Nation and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

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Miigwech,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Bkejwanong Territory (Walpole Island)
R.R. #3
117 Tahgahoning Road
Walpole Island, ON N8A 4K9

Attention: Chief Charles Sampson

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Aanii Chief Sampson,

In January 2015, the City of London, through its consultant AECOM, initiated the Western Road and Sarnia Road/Philip Aziz Avenue Improvements Municipal Class Environmental Assessment (MCEA) for improvements to Western Road from Platts Lane to Huron University College and Sarnia Road/Philip Aziz Avenue from Coombs Avenue east to the Thames River (See Map). An initial Public Information Centre (PIC) was held in June 2015.

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Potential Involvement of Your Community

As we proceed with the Class EA, the Project Team is initiating the Indigenous Community engagement and consultation process. The Project Team would like to hear from the Anishinaabeg community of Bkejwanong Territory (Walpole Island) and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

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Miigwech,

Karl Grabowski, .Eng.,
Project Manager
City of London

London
CANADA

300 Dufferin Avenue
P. O. Box 5035
London, ON
N6A 4L9

August 16, 2021

Delaware Nation at Moraviantown
14760 School House Line, RR3
Thamesville, ON N0P 2K0

Attention: Chief Denise Stonefish

Regarding: Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Municipal Class Environmental Assessment
NOTICE OF STUDY RESTART

Koolamalsi Chief Stonefish,

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- Cultural Heritage Assessment; and
- Public and agency consultation.

Potential Involvement of Your Community

As we proceed with the Class EA, the Project Team is initiating the Indigenous Community engagement and consultation process. The Project Team would like to hear from the Lunaapeewak

community of Delaware Nation at Moraviantown (Eelūnaapèewii Lahkèewiit) and would welcome your input in determining the extent that your Community would like to be involved in this process. Your input and feedback is important to us as we would like to know any issues or concerns your Community members may have.

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Anushiik,

Karl Grabowski, .Eng.,
Project Manager
City of London

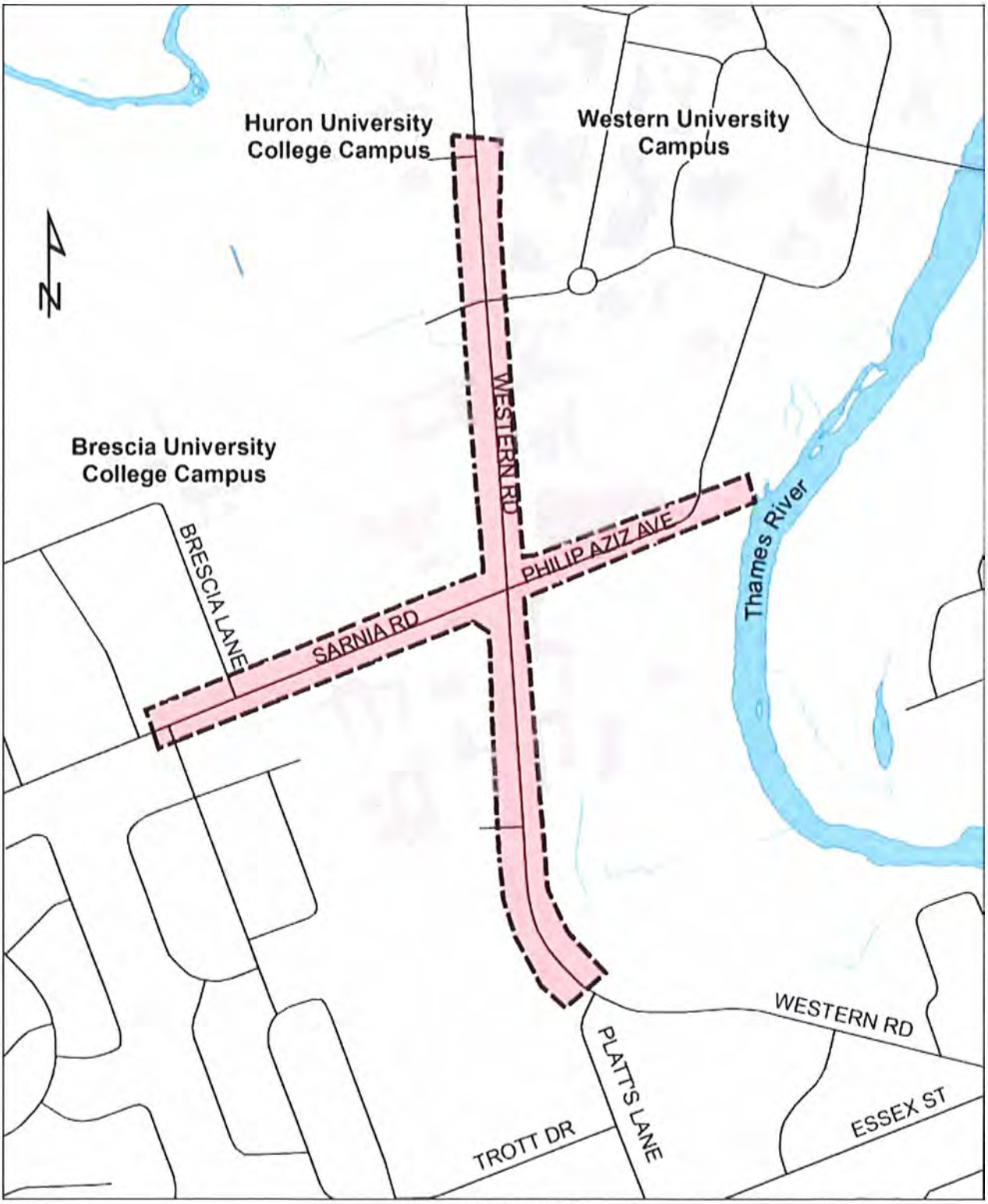

Figure 1: Study Area

Adams, Paul (London ON)

From:	Adams, Paul (London ON)
Sent:	December 2, 2021 4:46 PM
To:	rsmith@COTTFN.com
Cc:	Pucchio, John
Subject:	Western Road and Sarnia Road / Philip Aziz Intersection Improvements MCEA
Attachments:	Western_Sarnia_Int_Study_Area.shx; Western_Sarnia_Int_Study_Area.cpg; Western_Sarnia_Int_Study_Area.dbf; Western_Sarnia_Int_Study_Area.prj; Western_Sarnia_Int_Study_Area.sbn; Western_Sarnia_Int_Study_Area.sbx; Western_Sarnia_Int_Study_Area.shp

Aanii Rochelle,

Thank you for your call requesting the file for the MCEA Study Area Limits. Attached to this email you will find a shapefile for the study area. Please don't hesitate to contact myself or John Pucchio if you require further Information.

Miigwech,

Paul Adams.

Paul Adams, CPT
Environmental Planner, Environment
D +1-519-963-5873
M +1-519-636-6448
paul.adams2 @aecom.com

AECOM
250 York Street
Suite 410
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T +1-519-673-0510
aecom.com

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LinkedIn | Twitter | Facebook | Instagram

AECOM

Appendix A

A.5 Agency Consultation

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

September 13, 2021

Karl Grabowski
Project Manager
City of London

Re: **Western Road and Sarnia Road/Philip Aziz Avenue Improvements**
City of London
Municipal Class EA
Response to Notice of Commencement/Restart

Dear Karl Grabowski,

This letter is in response to the Notice of Commencement for the above noted project, which is being restarted since being put on hold in 2016. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of London (proponent) has indicated that the study is following the approved environmental planning process for a Schedule C project under the Municipal Class Environmental Assessment (Class EA).

The **updated (February 2021)** attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Aamjiwnaang First Nation
- Bkejwanong (Walpole Island)
- Caldwell First Nation
- Chippewas of Kettle and Stony Point
- Chippewas of the Thames First Nation
- Oneida Nation of the Thames
- Eelūnaapèewii Lahkèewiit (Delaware Nation or Moravian of the Thames)
- Munsee-Delaware Nation

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances subsequent to initial discussions with the communities identified by the MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities
- You have reason to believe that your proposed project may adversely affect an

Aboriginal or treaty right
- Consultation with Indigenous communities or other stakeholders has reached an impasse
- A Part II Order request is expected on the basis of impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

A draft copy of the report should be sent directly to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.

Please also ensure a copy of the final notice is sent to the ministry's Southwest Region EA notification email account (eanotification.swregion@ontario.ca) after the draft report is reviewed and finalized.

Should you or any members of your project team have any questions regarding the material above, please contact me at mark.badali1@ontario.ca.

Yours truly,

Mark Badali
Regional Environmental Planner – Southwest Region

Cc: Rob Wrigley, Manager, London District Office, MECP
John Pucchio, Project Manager, AECOM Canada Ltd.
Paul Adams, Environmental Planner, AECOM Canada Ltd.

Encl. Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

AREAS OF INTEREST (v. February 2021)

It is suggested that you check off each section after you have considered / addressed it.

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions,

Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

    - If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the "Map Legend" bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information

For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

- **Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

    1. Consider during the assessment of alternative solutions and alternative designs, the following:
        a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
        b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
    2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

- **Air Quality, Dust and Noise**

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
  - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

Species at Risk

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

- **Surface Water**

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

Excess Materials Management

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase

in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

Contaminated Sites

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
  - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

Servicing, Utilities and Facilities

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout

the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

Class EA Process

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020
Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Southwest Region, the email is eanotification.swregion@ontario.ca).

The public has the ability to request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES

DEFINITIONS

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers

issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. THE CROWN'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. THE PROPONENT'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;

- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;

- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;

- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

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Project # ***Client Reference:***
60661402

Subject: Western Road and Sarnia Road / Philip Aziz Avenue Corridor and Intersection Municipal Class Environmental Assessment

Dear Mr. Badali

This letter is in response to the MECP Project Review Unit Comments dated on May 19th, 2023. We have considered your comments and addressed them in the Final Environmental Study Report. Below is an outline of changes made to the report to address your comments.

1) **Section 2.1.1 of the ESR includes three references to a "Part II Order request". To reflect the changes made to the Environmental Assessment Act in July 2020 the ministry recommends revising these instances, for example to "section 16 order request" or "section 16 order request (formerly referred to as Part II Order request)".**

All references in the report to Part II Orders have been edited and now read as "Section 16 Order request"

2) **Section 3.4 of the ESR lists the Indigenous communities that were contacted throughout the study, and copies of these notification letters are documented in Appendix A.4, as is additional correspondence with Chippewas of the Thames First Nation (COTTFN). For Municipal Class EA projects the ministry recommends that proponents include in EA reports a summary of questions, comments and concerns raised by communities and how they have been or will be addressed. If no other comments or concerns were raised by communities for this study besides the documented correspondence with COTTFN, then the ministry recommends that the main body of the ESR be revised to indicate this.**

No other comments or concerns were raised during the consultation process. This has been noted and added to Section 3.4 of the ESR.

3) **The ESR indicates that a Stage 2 Archaeological Assessment is currently being undertaken and will be completed early in the detailed design phase of the project. The proponent should continue to engage with all communities that have been engaged with to date as the Class EA**

process proceeds. Furthermore, the proponent should ensure that communities are aware of this ongoing Stage 2 Archaeological Assessment and provided the opportunity to participate in that process if possible.

The City of London is committed to ongoing and meaningful consultation with all Indigenous Communities with an interest in this project. Consultation will continue as the EA proceeds to the Notice of Completion, during detailed design and during the Stage 2 (and any required Stage 3/4) Archaeological Assessment.

4) **The Section 5.3.1 of the ESR states, "Existing land uses within the Study Area are varied and consists of University / College campuses, student residences, single family homes, and commercial uses." Further, Table 11-1 in section 11.1 states with respect to Disturbance to Wildlife, "Restrict construction activities to daytime hours (sunrise to sunset)." Noise control measures should be addressed in construction mitigation plans in order to mitigate adverse noise impacts to nearby residential land uses within the study area during construction activities. The ministry recommends that the ESR be revised to include a description of mitigation measures for noise impacts from construction activities associated with the project.**

Table 11-1 Potential Impacts and Mitigation Measures was edited to include descriptions for Noise and Vibration Impact. See Below:

Potential Impact	Mitigation / Compensation or Enhancement Measure
Noise and Vibration	Construction operations to occur during day shift. Adhere to municipal noise by-laws, where possible. Use of low noise equipment during construction, where possible. Implement a vibration, noise and dust monitoring and response program along with limits.

5) **The ESR proposes the construction of overland flow routes to deal with the potential for ponding and localized flooding at several locations within the Study Area, and Table 11-1 in section 11.1 of the ESR notes that consideration should be given to Low Impact Development techniques to manage water inputs to the Thames River. The ministry notes that trees should be incorporated as much as possible in all development green space. Beyond interception capabilities of trees, the root zones increase macropore opportunities to greatly increase soil water holding capacity.**

Noted. The following text was added into section 11.2.2 Climate Change Potential Operational Effects Stormwater Capacity sub section 11.2.2.1 Mitigation:

‘Tree planting should be incorporated wherever possible in all development green space as the root zones increase macropore opportunities to greatly increase soil water holding capacity.’

Thank you for providing these comments to us. We have documented the receipt of these comments, including this response letter in the consultation section of the Project File Appendix.

Sincerely,
AECOM Canada Ltd.

Paul Adams
Environmental Planner
Paul.adams2@aecom.com

Encl.
cc:

AECOM

Appendix A

A.6 Notice of Completion

AECOM

Appendix B

B.1 Traffic Study Report

AECOM

Municipal Class Environmental Assessment (MCEA)

Traffic Study Report – Western Road and Sarnia Road / Philip Aziz Avenue Improvements

City of London

60661402

March 2023

Delivering a better world

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1. Introduction

1.1 Background

AECOM Canada Ltd. was retained by the City of London to undertake the Municipal Class Environmental Assessment (MCEA) of Western Road and Sarnia Road/Philip Aziz Avenue to identify future transportation deficiencies and assess traffic operations at the Western Road and Sarnia Road/Philip Aziz Avenue intersection.

The City of London is situated in the heart of Southwest Ontario with a population of over 383,000 people. The Western Road and Sarnia Road corridors are designated as arterial roads located in the southwest parts of the Western University (Western) campus and to the northwest of downtown, approximately 1500 metres west of the Thames River. Philip Aziz Avenue is classified as a local road which provides access to the University Campus.

In the period from 2014 to early 2016, AECOM initiated consultation work and conceptual design work as part of the MCEA for the study area. At that time, preliminary consultation was initiated with major stakeholders including Western, various committees of Technical Agencies, and the Upper Thames River Conservation Authority (UTRCA). The project was placed on hold in 2016 when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). Given that the north and west routes for RT were delayed for impending discussion and after the next update of the 2030 Transportation Master Plan (TMP), the City decided to reactivate this project. The current project study area is very similar to the previous project study area but was extended along Western Road from Platts Lane northerly to Huron College and the Sarnia Road/Philip Aziz Avenue corridor from Coombs Avenue easterly to the Thames River.

The study context is provided in **Figure 1**, and the study area is provided in **Figure 2**. Western Road between Huron College and Platt's Lane is part of the City's primary transportation corridor that services University and other local institutions. Within this corridor, the intersection of Western Road/Sarnia Road/Philip Aziz Avenue is a core node that is heavily trafficked. The intersection experiences high turn volumes and is an important controlled crossing facility for pedestrians and cyclist. Transit stops are provided on each leg of the intersection. Active transportation and transit use are expected to increase greatly in the future. The improvement needs at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue were identified in the City of London 2030 TMP. The TMP noted this intersection should be improved to accommodate the forecast increase in traffic, address safety, and improve road width constraints along Philip Aziz Avenue.

1.2 Purpose of the MCEA Study and the Supporting Traffic Study

This MCEA study is being undertaken to validate and confirm the improvement needs for the Western Road and Sarnia Road/Philip Aziz Avenue intersection as well as the wider transportation road network within the study area limits. Active Transportation needs will be considered for future conditions for an integrated corridor management strategy, including a multi-use trail with connections into adjacent neighbourhoods. Using a Context Sensitive Design approach, this study follows a comprehensive and sound planning process that will recognize the multimodal transportation needs within the corridor while supporting established community areas, businesses, and the development of institutional space in the future. The study is classified as a 'Schedule C' Environmental Assessment (EA). This EA builds-on on the previous completed Phases 1 and 2 analyses in support of Phases 3 and 4 of the planning and design process.

Figure 1: Study Context

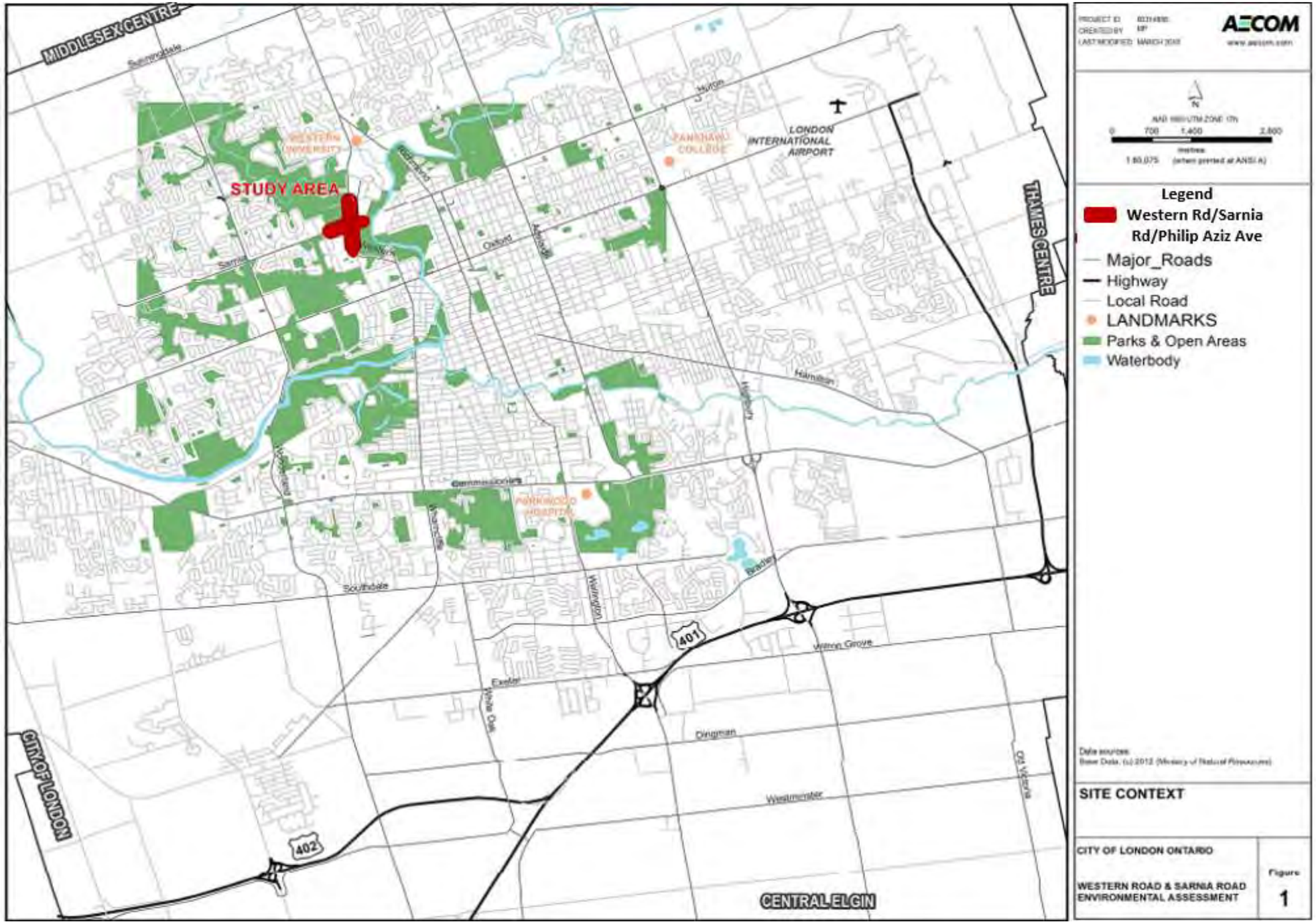
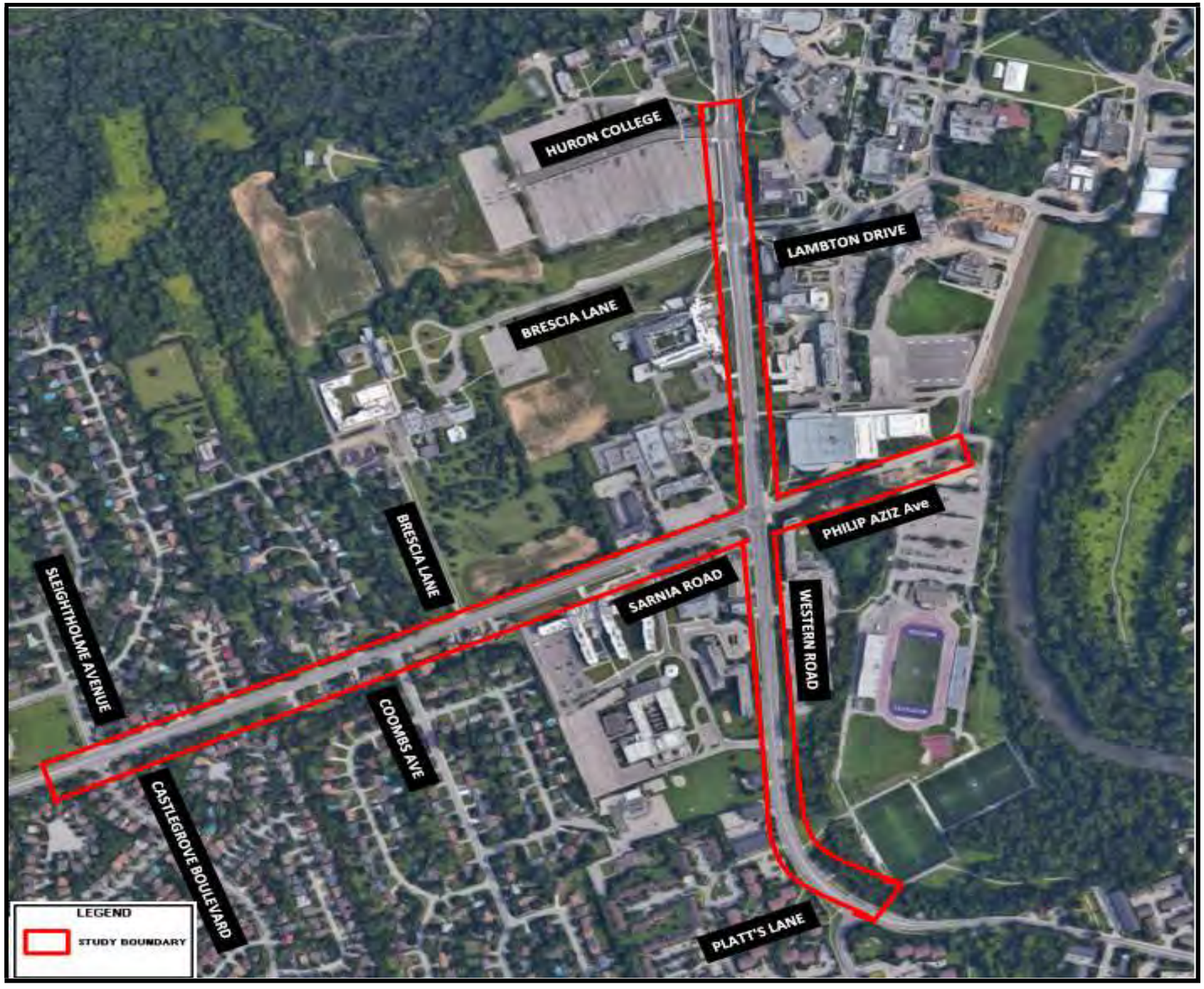


Figure 2: Study Location



This traffic study is conducted in support of the Schedule C EA. The purpose is to assess the existing traffic conditions at key intersections along Western Road between Platt's Lane and Elgin Drive, and along Sarnia Road between Coombs Avenue and Huron Drive. The study will examine existing conditions and the expected impact of future traffic volumes; analyze the operational impacts from a multi-modal corridor context and evaluate potential improvements to infrastructure and / or operations (i.e., signal timing) to address the deficiencies and the future traffic demand from a sustainable perspective in the horizon year 2032.

1.3 Scope of the Traffic Study

The following scope of work will be undertaken to complete the traffic study:

- Data Collection includes updating the road network inventory, a review of historical traffic volumes to obtain growth factors within the corridors, an assessment of historical collision data, collection of relevant traffic data and signal timing plans from the City, and a review and summary of relevant background materials.
  - **Road Network Inventory** – Task includes updating the study area road inventory including road classifications, lane configurations, traffic operation attributes and other pertinent data based on the latest information. An initial site review will also be completed to ensure any recent changes in the road network are represented in the updated study.
  - **Historical Traffic Volumes** – Historical data will be confirmed and collected, where possible, in and around the study area for past five years to aid in assessing general traffic volumes and growth.
  - **Traffic Count Survey** – The traffic study completed to support the MCEA in 2015 will form the base of the current study. The traffic counts could be updated with new traffic counts or applying a reasonable growth factor to the 2015 traffic volumes.
  - **Traffic Signal Timing and Phasing** – Current traffic signal timing plans from the City will be required to update existing conditions traffic models.
  - **Historical Collision Data** – Updates will be collected related to the latest collision data recorded during the last five years. The collision dataset will be updated with the latest information in order to undertake a road safety analysis within the study area.
  - **Transit Network Data** – The transit network information will be updated incorporating the latest routes, the transit headways, transit stops, and any other relevant information related to the current transit facilities that operate within and across the study area.
  - **Active Transportation Network Data** – Updates to Active Transportation data and planned improvements over the various study horizons will be collected and confirmed with the City.
  - **Other Study Reports** – Review the current TMP recommendations and extract potential information for our use and traffic analyses. Other future road improvement plans will be considered in the study including enhancement of the transit network, potential Rapid Transit (RT) development and potential active transportation system improvements within the vicinity of the study area.

- Data Analysis includes an assessment of both the existing and future traffic conditions using Synchro/SimTraffic:
  - **Existing Traffic Conditions Analysis** – Task includes assessing existing traffic operations/conditions at key intersections along Western Road between Platt's Lane and Elgin Road, inclusive for weekday AM and PM peak hours, as well as identification of deficiencies

(where applicable). The assessment includes establishing predominant modal splits, the existing transit usage and active transportation activities.

  - **Future Traffic Conditions Analysis** – Task includes forecasting future traffic volumes for the near term, midterm, and long-term horizons (2032). Modal split will also be forecast to represent future system updates. The future traffic conditions assessment will then be completed. Should analysis of (a) roundabout(s) be required, SIDRA or equivalent software will be used for the assessment. Recommendations to future transit and active transportation facilities will be included along with the recommendations for changes to the existing roadway infrastructure.

- Documentation of all findings and recommendations.
  - A detailed traffic study report will be prepared to capture various outputs completed during study. The report will also summarize the findings, identify any existing or potential future shortcomings, and develop potential mitigation measure alternatives in order to address any traffic operation or circulation issues.

2. Existing Network

This section outlines the existing conditions within the study area.

2.1 Existing Road Network Inventory

Western Road is designated as an arterial road and has a posted speed limit of 50 km/h, beginning at the south end of the study limit (Platts Lane) through to the north end of the study limit. Western Road is in the northwest quadrant of the City of London and is generally aligned in the north-south direction. It is one of the main access routes to the University campus, University hospital and various student residences.

Sarnia Road is designated as an east-west arterial road. It originates at Hyde Park Road to the west and terminates at Western Road and becomes Philip Aziz Avenue. Philip Aziz Avenue is classified as a local road which provides access to the Western University campus, including the TD Waterhouse Stadium.

According to the City of London Official Plan (OP) that is currently in effect (approved 1989), arterial roads under the jurisdiction of the City are designed to accommodate high volumes of intra-urban traffic at moderate speeds, contain moderate volumes of inter-neighbourhood traffic, and contain limited accesses, coupled with the provision of transit, bicycle and pedestrian services. Arterial roads are usually designed with a high degree of access control to minimize conflicts with mainstream traffic flow.

As per the 2016 City of London Official Plan and 2018 London Complete Streets Design Manual, both Western Road and Sarnia Road arterial roads are classified as a “Civic Boulevard”. This is a new designation that was introduced in the 2016 OP, and therefore is not yet in effect; however, this is the classification that the City would like to apply to these roadways. Civic Boulevards prioritize pedestrian, cycle, and transit movements. They are designed to accommodate medium to high volumes of cycle, transit, and vehicular traffic. They have high quality pedestrian realm and high standard of urban design.

The 2016 OP includes other arterial road classifications. “Rapid Transit Boulevards” are the corridors that will be transformed to incorporate London’s planned rapid transit (RT) network. “Urban Thoroughfares” accommodate many different land uses, often on large land parcels, including residential, employment, retail, institutional and recreational. The City’s vision for these corridors includes moderate density development and active street frontages. “Main Streets” are neighbourhood hubs with vibrant commercial activity with high quality pedestrian realm, active street frontages, and multi-modal travel options. For comparison, **Table 1** categorizes the eight complete street typologies into the more common arterial, primary collector, secondary collector, local, and rural street/road types. **Appendix A** contains the street classifications table as per City of London Complete Streets Design Manual 2018

Table 1: Complete Street Classification (London Complete Streets Design Manual, 2018)

Functional Classification	The London Plan Classification
Arterial	Rapid Transit Boulevard
	Main Street
	Urban Thoroughfare
	Civic Boulevard
Primary/Secondary Collector	Neighbourhood collector
Local	Neighbourhood street
Rural Roads	Rural Thoroughfare
	Rural Connector

2.2 Roadway Characteristics

Western Road corridor within the study limits has a five-lane cross-section, two lanes per direction of travel and a two-way centre left turn lane north of the Platts Lane intersection, providing access to many of the stop-controlled side streets. Uninterrupted sidewalks are provided in both the north and south direction with connecting spurs to many of the larger properties. The primary intersection of Western Road and Sarnia Road/Philip Aziz Avenue has auxiliary left-turning lanes on all four approaches.

Within the study area limits there are a total of six (6) signalized intersections located at Platt's Lane North, Althouse Lot, Sarnia Road/Sleightholme Avenue, Sarnia Road/ Philip Aziz Avenue, Brescia Lane/Lambton Drive, and the Huron College Entrance. A total of four (4) unsignalized intersections are located within the Study Area. Two (2) of them are located at Elborn College entrance on Western Road between Sarnia Road and Brescia Lane/Lambton Drive and two (2) are located on Sarnia Road at Coombs Avenue and Brescia Lane. There are four (4) closely spaced private accesses located on Western Road in the southwest corner of the Sarnia Road/Western Road intersection.

Platts Lane crossing Western Road and Coombs Avenue crossing Sarnia Road within the study area are designated as neighbourhood collector roads as per the City of London Official Plan (2016); however, both roads are classified as secondary collector roads in the 1989 OP. All primary and secondary collector roads are classified as neighbourhood connector in the 2016 London OP. All access roadways to Western University and affiliated institution campuses are designated as private roadways; this classification is assumed to be same in both official plans as no updates can be found in 2016 OP.

An illustration of the existing conditions lane configurations, intersection control and location of minor accesses within study area limits is provided **Figure 3**. It is noted that there are no restrictions on any turning movements made to and from minor accesses.

A site visit was conducted on September 6 and 7, 2021 to confirm these roadway characteristics.

2.3 Existing Transit Infrastructure and Usage

Currently, several London Transit Commission (LTC) routes service the study area. The routes traverse through and/or pass in the vicinity of the Western Road/Sarnia Road intersection. Transit Route 2: 'Dundas', Route 33: 'Proudfoot' and Route 93: 'Wharncliffe' operate in the north/south direction on Western Road and service the University campus.

Route 9: 'Whitehills', serves the Whitehills and Gainsborough Meadows communities located west of the study area. This route services the University campus and continues downtown. Route 10: 'Wonderland' and Route 31: 'Hyde Park' operate in the east-west direction along Sarnia Road and terminate at the University Campus.

Figure 3: Existing Conditions Lane Configurations and Traffic Control

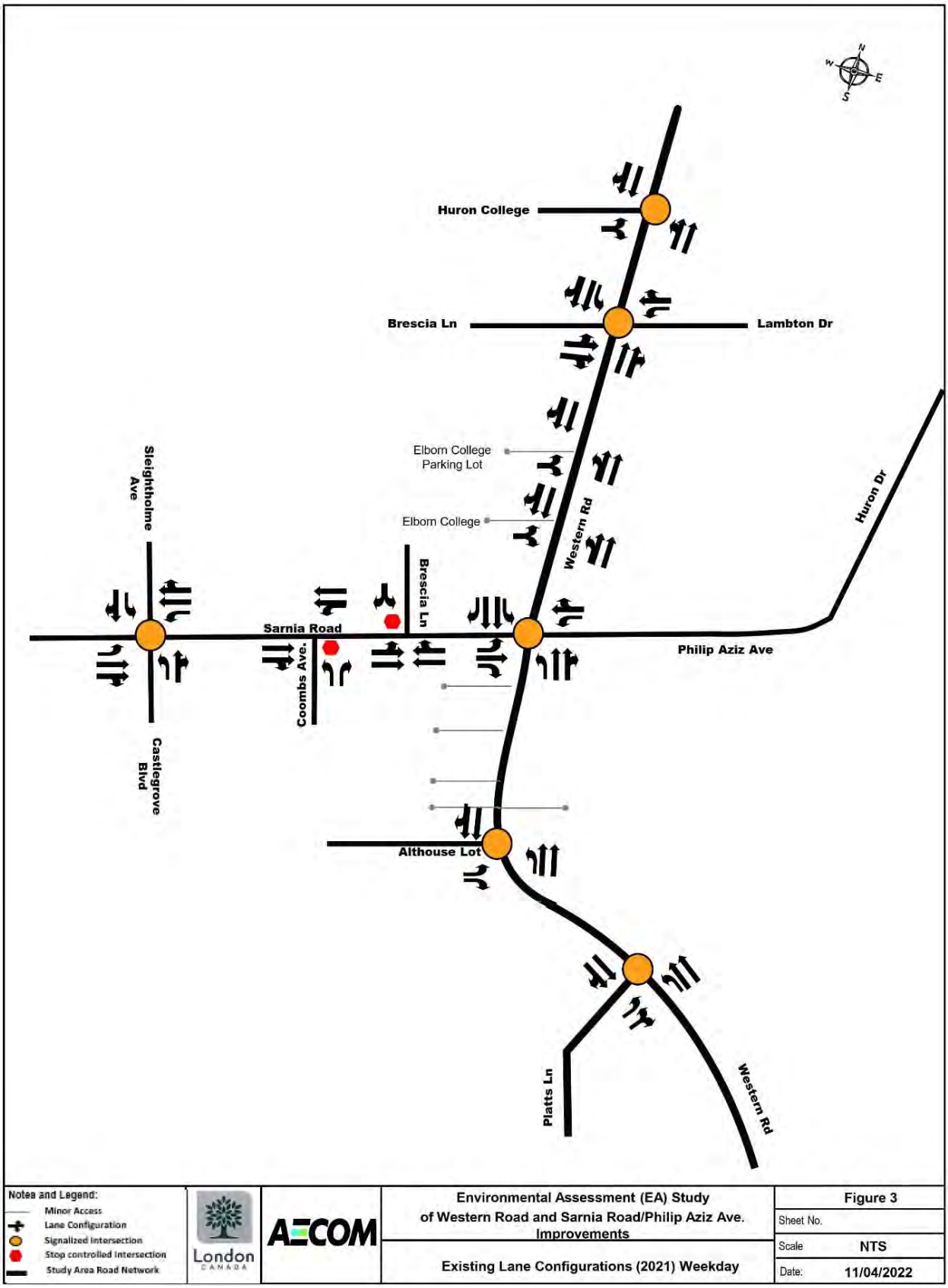


Figure 4 portrays the existing transit service map for the study area, identifying the routes that access each stop.

Figure 4: Transit Service Map (Study Area)

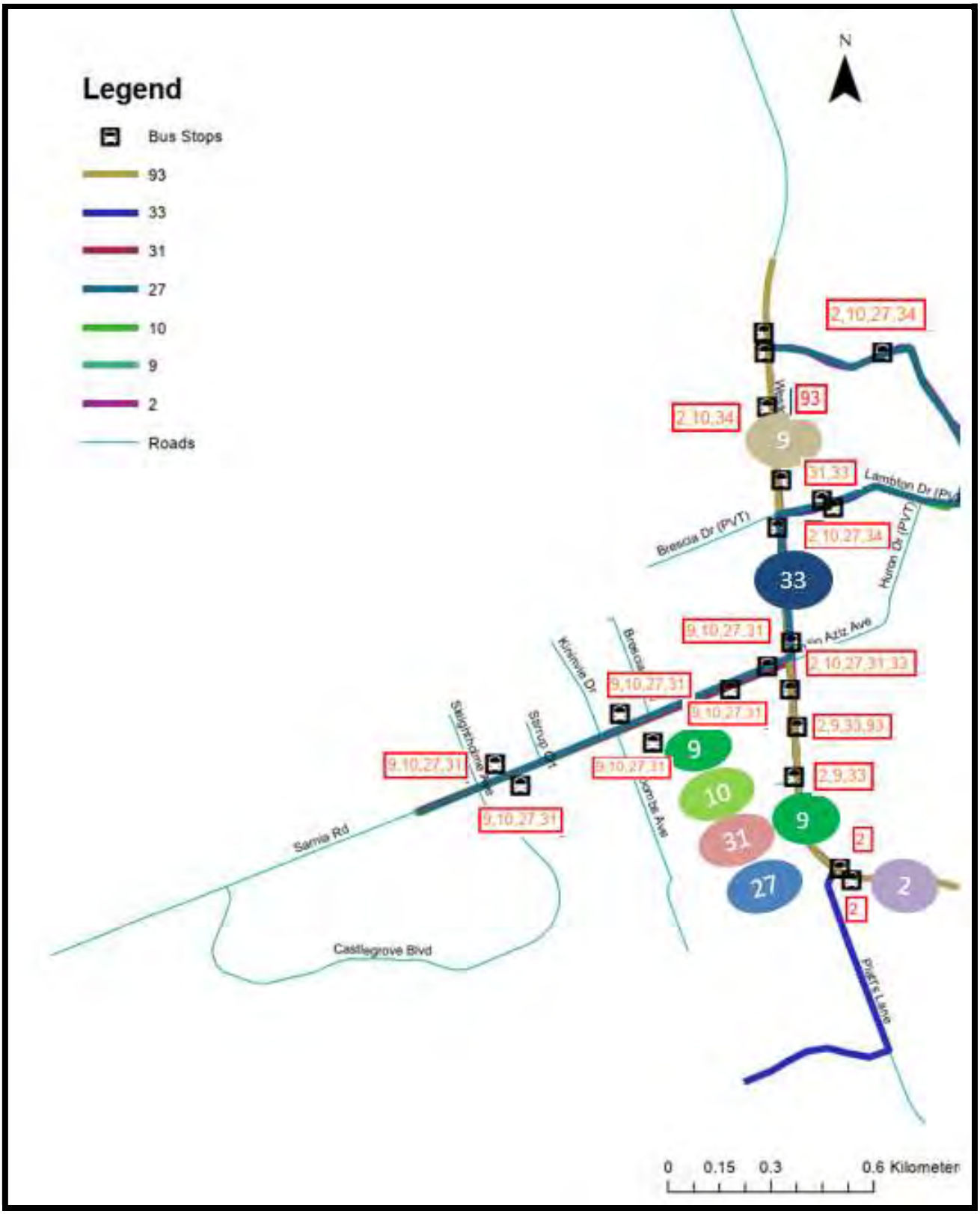


Table 2 summarizes transit service headways. Headways typically less than 10 minutes are considered as higher frequency service.

Table 2: Route 2 Transit Headways

Time Period (approx. spans of service	Weekday	Saturday	Sunday
Early AM (6:00 AM-7:30 AM)	10-15 min	10-15 min	30 min (Service begins approx. 6:40 AM)
AM Peak (7:30 AM-10:00 AM)	10-15 min	10-15 min	30 min
Midday (10:00 AM-3:00 PM)	10-15 min	10-15 min	10-15 min
PM Peak (3:00 PM-7:30 PM)	10-15 min	10-15 min	10-15 min
Evening (7:30 PM-10:30 PM)	10-15 min	10-15 min	10-15 min
Night (10:30 PM-12:30 AM)	30 min	30 min	10-15 min (No service after 11:15 PM)

Within the study are, bus stops are located on both sides of the street on Western Road immediately north and south of Sarnia Road, and on Sarnia Road between Coombs Avenue and Western Road. **Table 3** summarizes average stop usage at the six stops closest to the Western Road and Sarnia Road/Philip Aziz Avenue intersection.

Table 3: Bus Stop Usage

Day	Western & Lambton Dr SB (Bus stop #1996)			Day	Western & Sarnia Rd Far Side 1 SB (Bus stop #2003)			Day	Western &Philip Aziz Near Side NB (Bus stop #2290)		
	Trips on	Trips off	Runs		Trips on	Trips off	Runs		Trips on	Trips off	Runs
Weekdays	34	19	39	**Weekdays**	138	88	104	**Weekdays**	4	19	18
Saturday	19	8	22	**Saturday**	104	62	69	**Saturday**	4	20	15
Sunday	19	7	19	**Sunday**	64	40	48	**Sunday**	4	17	14
Day	**Sarnia & Western Rd WB SB (Bus stop #1647)**			**Day**	**Sarnia & Western Rd EB SB (Bus stop #1646)**			**Day**	**Western & Philip Aziz Far Side NB (Bus stop #2291)**		
	Trips on	Trips off	Runs		Trips on	Trips off	Runs		Trips on	Trips off	Runs
Weekdays	98	45	82	**Weekdays**	18	56	50	**Weekdays**	66	107	103
Saturday	75	47	60	**Saturday**	24	48	43	**Saturday**	50	77	69
Sunday	60	30	45	**Sunday**	11	36	29	**Sunday**	39	55	54
Day	**Sarnia at Castlegrove Blvd EB (Bus stop #1639)**			**Day**	**Sarnia at Sleightholme WB (Bus stop #1644)**						
	Trips on	Trips off	Runs		Trips on	Trips off	Runs				
Weekdays	100	27	67	**Weekdays**	25	106	71				
Saturday	40	31	37	**Saturday**	25	42	42				
Sunday	31	20	30	**Sunday**	26	32	31				

The summary shows that the busiest stops in the study area are the north and southbound farside stops (Bus stop #2003 and #2291) at the Western and Sarnia/Philip Aziz intersection (busiest periods have been shown in red). These stops are busiest in terms of boarding's and alighting's and also busiest in terms of the number of buses serving the stop over the days of the week. Stop usage is typically higher during weekdays at most stops, compared to weekend usage rates. A detailed breakdown of stop usage by route is included in **Appendix B.**

2.4 Existing Active Transportation Infrastructure

The study area includes a network of infrastructure for pedestrians and cyclists. There is a system of sidewalks on both sides of Sarnia Road and Western Road within the study area limits. The segment of Philip Aziz Avenue just east of Western Road has no sidewalks, though it is paralleled by a wide private sidewalk on the north side behind a retaining wall and embankment. This private sidewalk on the north side of Philip Aziz Avenue does not meet the AODA requirements due to the presence of stairs. Lambton Drive is flanked by sidewalks on both sides and

Brescia Lane has a sidewalk on the south side. There are several other sidewalk connections from Western Road along driveways or in midblock locations.

Cycling infrastructure within the study area is inconsistent. Western Road has on-street bicycle lanes from the north extent of the study area to just north of the Lambton Drive / Brescia Lane intersection. Platt's Lane also has on-street bicycle lanes. **Figure 5** illustrates the existing walking and cycling infrastructure within the study area.

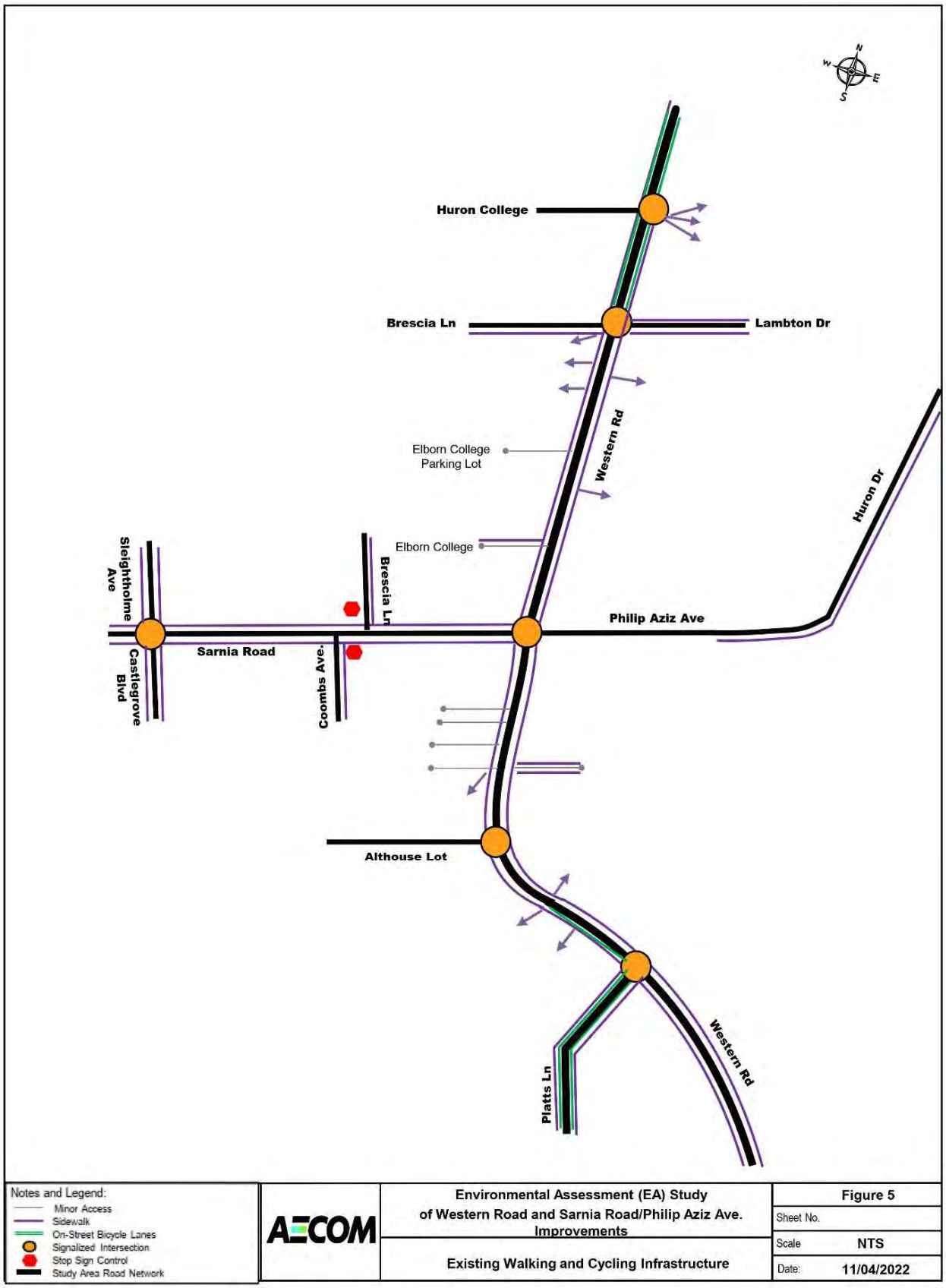
According to the Manual of Administrative Policies and Procedures, Western University Canada Procedure for Policy 1.27 Parking & Traffic Regulations, Section 11.00 Traffic, Item 11.01 Vehicles must yield the right-of-way to pedestrians; however, this by-law is potentially confusing to student pedestrians who may not understand which roadways are governed under this by-law. At the time of writing, a map identifying campus roadways was not found on the University website. Lack of clarity on the by-law and where the by-law applies may lead pedestrians to crossing the City of London roadways that are in proximity to the campus, including Western Road and Sarnia Road, with the incorrect expectation that vehicles will yield to the pedestrians.

2.5 Field Investigations

The AECOM team closely examined the entire study area on Thursday December 9, 2021. The subject site was visited during the afternoon peak period on Thursday December 9, 2021 to confirm whether potential road safety issues / concerns identified on Wednesday April 15, 2015 have been resolved or still exist.

The detailed field investigation findings are noted in **Section 5.1** and **Appendix C**.

Figure 5: Existing Walking and Cycling Infrastructure



3. Relevant Background Reports

3.1 London 2030 Transportation Master Plan (2013), by AECOM

Derived from the evaluation of alternative network strategies, the London 2030 Transportation Master Plan (TMP) defined future transportation system needs that are addressed by roadway extensions and widening to support forecast population and employment growth. The 'Baseline Road Network Improvements' as shown in 'Exhibit 27' was developed to meet London's forecasted roadway capacity needs a citywide level. Excerpt of Exhibit 27 is provided in **Figure 6**.

Generally, the exhibit shows the continued expansion of the City's four lane arterial road network by widening two-lane arterials in support of travel growth demand in suburban growth areas. One of the enhancements included in the citywide TMP is the construction of additional northbound and eastbound left turn lane to create double left and additional westbound through lane to create 4 lane cross-section on east leg of Western Road and Sarnia Road/Philip Aziz Avenue intersection which has not been constructed yet.

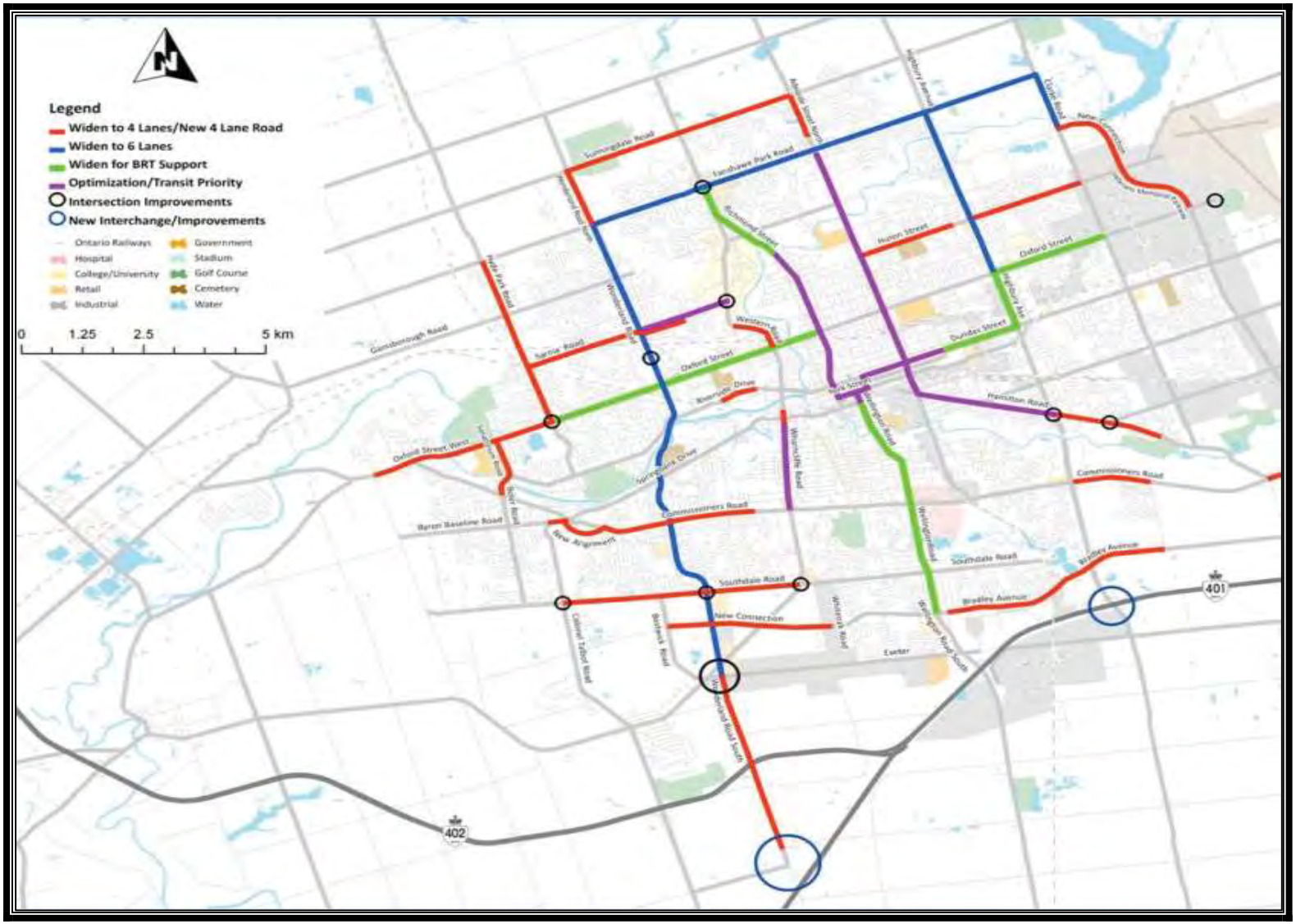
In addition, a Bus Rapid Transit (BRT) network was proposed consisting of a north/south corridor along Richmond Street/Wellington Road and an east/west corridor along Dundas Street/Oxford Street, both serving the downtown area and the broader central area. If the project is kept to its current timeline, construction is phased and estimated to begin on the east corridor in 2020 and on the north corridor in 2022, with the opening of these corridors in 2023 and 2026 respectively. Construction would then begin on the south corridor in 2023 and on the west corridor in 2025, and open by 2026 and 2028.

Intersection improvements including the addition of queue jump lanes and signal upgrades to support transit signal priority were also proposed in Richmond Street, Wellington Street, Dundas Street/Oxford Street East, and Oxford Street West to reduce/protect transit run time and service reliability. As a part of transit priority implementation strategy, transit priority optimization is proposed on Sarnia Road in the east-west direction, between Wonderland Road North and Western Road.

The City initiated a Class EA study for RT, aptly named Shift, that will provide justification for the type of transit system, the corridor selection, and detailed parameters for the selected corridor. This study will have regard for potential issues that may impact the Western Road study area and identify potential needs during detailed design. Route selection will be reviewed in the Shift RT Class EA and the possibility of a corridor routed up Western Road from Oxford Street through this study area will potentially be considered as an alternate to the previously identified concept of a Richmond Street corridor.

The 2030 TMP also identifies on-street bike routes in support of the City's initiative to provide more active transportation infrastructure. Four Priority On-Street Bike Routes are identified, including two east/west corridors (Sarnia-Cheapside and Thames-King-Queens-Fanshawe) and two north/south corridors (Western-Colborne-Adelaide and Western-Talbot-Rideout). The Sarnia-Cheapside route travels along Sarnia Road from Hyde Park Road to Western Road and south along Western Road to Platts Lane. As per Google Maps, this route has not yet been fully constructed. On-street bike lanes are provided between Western Road and Platts Lane. Also, there is an on-street bike lane from Hyde Park to Castlegrove Boulevard/Sleightholme Avenue.

Figure 6: TMP 2030 Baseline Road Network Improvements



3.2 Official Plan (1989 and 2016), City of London

The city is currently working with two official plans. The London Plan was adopted by City Council and then approved by the province in December 2016. The London Plan was appealed by numerous parties and remains partially under appeal. Until the London Plan is fully in force, the 1989 Official Plan is also a relevant planning document. Both plans must be consulted for a full picture of the applicable policy framework.

The 1989 Official Plan [1](OP) for the City of London contains policies approved by Council to provide direction for the allocation of land use, provision of services and facilities and policies to control the use of land, having regard for social, economic, and environmental matters. Section 18 of the OP outlines transportation requirements for the City. Transportation policies deal with the various elements of the transportation system and the modes of travel that they support. The following objectives and policies as outlined in Section 16 and 18 of the OP apply to this project.

- ***Section 16.4.1 (Pedestrian Bicycle Circulation System)*:** Council will promote the development of a pedestrian and bicycle circulation system which will link parks to residential and other areas by pedestrian paths, sidewalks along certain roads and bicycle routes.

- ***Section 18.1 (Transportation Objectives):***

  i) Meet the immediate and long-term requirements of all sectors of the community related to the safe and efficient movement of people and goods within and through the City.

  x) Provide a high level of accessibility to the Downtown, major institutions, industrial areas, major shopping areas and other areas where there is a significant concentration of employment.

  xii) Support the planning and development of bicycle routes and pedestrian paths that provide linkages among open space areas, major activity centres, employment nodes and the public transit system and that enhance the convenience, safety, and enjoyment of these modes of travel.

  xiv) Support the provision of safe and effective pedestrian movement within the City for all populations.

  xvi) Optimize the capacity, operational capabilities, and Level of Service of the existing transportation system as the basis for future transportation planning.

  xviii) Select achievable plans for prioritized expansion, enhancement, and improvement of the existing transportation system, with emphasis on roadway capacity and continuity, improved transit services and Transportation Demand Management (TDM) targets.

- ***Section 18.2.2 (Transportation Network Corridors)*:** Streets must serve a number of functions such as providing transportation corridors for all kinds of users and vehicles and providing a right-of-way for underground utilities. Healthy communities will offer a broader range of mobility choices by continuing to work well for vehicles while making bicycle, walking and public transit viable options for many daily trips including the trip to work.

- ***Section 18.2.5 (Road Widening)*:** Council shall provide for the widening of existing road allowances to the road allowance requirements established under policy 18.2.4. Privately owned land needed for road allowance widening may be acquired by the City through purchase; expropriation; dedication as a

[1] | City of London

condition of subdivision, land severance or site plan approval; or other appropriate means. Table 18.1 of the OP provides the Functional Classification of Roads, including the road allowance dimensions, number of lanes, operating speed, and allocation for parking, pedestrian, and cyclist accommodations for various roadway classifications, such as arterial, collector, and local roadways.

- ***Section 18.2.13 (Bicycle Policies)*:** Council recognizes that the bicycle, during most times of the year, is a viable alternative to other modes of transportation, is environmentally sound and supports active, healthy lifestyles. Wherever feasible, Council shall promote and initiate improvements to enhance bicycling as a means of transportation.

  The 2016 London Plan [2]emphasises creating attractive mobility choices through the following policy guidelines:

  I. Create active mobility choices such as walking, cycling and transit to support safe, affordable, and healthy communities.
  II. Ensure that mobility structure is accessible and accommodates people of all abilities.
  III. Establish a high-quality rapid transit system in London and strategically use it to create an incentive for development along rapid transit corridors and at transit villages and stations.
  IV. Link land use and transportation plans to ensure they are integrated and mutually supportive.
  V. Focus intense, mixed-use development to centres that will support and be served by rapid transit integrated with walking and cycling.
  VI. Dependent upon context, require, promote, and encourage transit-oriented development forms.
  VII. Utilize a grid, or modified grid, system of streets in neighbourhoods to maximise connectivity and ease of mobility.
  VIII. Promote and grow existing commuter and recreational cycling network within London.
  IX. As opportunities arise, utilize rail corridors as mobility links for transit, cycling and walking.
  X. Strengthen north south connections from Highway 401 and explore potential collaboration with neighbouring municipalities for further connections.
  XI. Provide for safe and efficient movement of people, goods, and services through the city to keep London competitive.
  XII. Plan for a strong network of transportation corridors that promote connection and mobility throughout the city and to the surrounding region and highways. Connect London to cities throughout Ontario and beyond through high-speed rail.

3.3 Bicycle Master Plan (2005) & Cycle Master Plan (2016), City of London

The Bicycle Master Plan (BMP) sets out the long-term visioning guidelines for on-and off-road bicycle routes for both commuter and recreational users. The document covers a range of components associated with the bicycle network including facilities, design standards and implementation. Specifically, the master plan “provides guidance for the planning of various City-initiated capital transportation projects which will fill ‘gaps’, provide extensions to the bicycle network or meet interim needs in an alternate fashion”.

2. The London Plan (Official Plan) | City of London

The Master Plan identifies two options for bicycle facilities on arterial roads within the City. These include:

- **Widen Curb Lanes** – a right hand lane of a shared roadway that is typically 4.0 to 5.0 m wide to better accommodate both bicycles and motor vehicles in the same lane. The width of the lane would be a function of traffic volume and speed with a wider lane required as volume and speed increases (less than 20,000 AADT); and
- **On-Road Bicycle Lane** – a portion of the roadway within the right-hand lane that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. This is a requirement on high traffic roads (in excess of 20,000 AADT).

Within the study area, the BMP did not identify any proposed on-street bike lanes.

The City updated the BMP with a focus on a higher demand for active transportation. The City of London adopted "London ON Bikes" as its Cycling Master Plan (CMP)[3] in September 2016. The CMP examined existing travel routes and explored future bicycle travel needs and potential bicycle facilities and infrastructure. Bike lanes are proposed on Western Road/Wharncliffe Road, north from Oxford Street to where bike lanes currently exist just north of Sarnia Road and on Sarnia Road, east of Wonderland Road, through the Western Road intersection and along Philip Aziz Avenue to University Drive. Additional bike lanes are proposed on Sleightholme Avenue and Bloomfield Drive to Ramsay Road. A desired connection is also identified on Brescia Lane west from Western Road, through Brescia College to Ramsay Road.

The CMP provides a categorization of cycling facilities based on the level of separation from motor vehicle traffic:

- Shared Facilities: where the cyclist is asked to share the roadway with motorists.
- Designated Facilities: where cyclists are provided their own "designated" space delineated by a painted line.
- Separated Facilities: where cyclists are provided either physical or spatial separation from motorists and other road users.

The cycling mode share in the CMP was estimated at 1%, with a mode share target of 5% by 2030. The CMP does not provide details about how the cycling mode share will be measured and evaluated in the future, nor does it provide any analysis that would indicate that the proposed plan is sufficient to attain the stated target. The CMP includes different facility types categorized as "shared" and "separated"; separated facilities can be further categorized as those with buffers and those with physical separation. A summary of the existing and proposed cycling facilities are summarized in **Table 4** cycling facilities.

Table 4: Cycling Facilities

Facility Type		Existing (km)	Proposed (km)	Total (km)
Shared Facilities	Signed Bike Route	50.8	157.9	208.7
	Signed Bike Route with Edgeline	0	2.6	2.6
	Signed Bike Route with Sharrow	10	23	33
Designated Facilities	Paved Shoulder	0	81.6	81.6
	Bike Lane	60	48.3	108.3
Separated Facilities	Buffered Bike Lane	0	31.9	31.9
	Buffered Paved Shoulder	0	10.7	10.7
	Cycle Track	0	7.5	7.5
	In-Boulevard Multi-use Pathway	42	28.2	70.2
	Multi-use Pathway	166	78.7	244.7
Total		**328.8**	**470.4**	**799.2**

3. Biking | City of London

On September 18, 2019, City of London Staff presented an update to the city's CMP to the Cycling Advisory Committee (CAC). Their review stated that among the 799 km of cycling facilities that are proposed in the CMP, only 7.5 km (less than 1%) are cycle tracks. From the perspective of increasing ridership, cycle tracks (protected bike lanes) are considered the most effective since they provide the best physical separation and are typically located along routes that have many destinations. Notably absent from the CMP is any discussion about providing connections between destinations within the City. For example, major destinations such as downtown, Western University, and Fanshawe College should receive additional consideration for providing safe cycling connections. Cycling lanes have the potential to provide excellent connections between these locations, since the distances between them are within a comfortable cycling distance. CMP does not emphasize the need for All-Ages-and-Abilities infrastructure, nor the need to achieve gender equity among urban cyclists. With these points in mind, it appears that the City of London CMP prioritizes other factors above the safety of all road users, such as cyclists, when considering street design by leaving out higher-order hazard reduction initiatives, including cycle tracks. In this regard, the current CMP does not support the Vision Zero objectives of zero deaths or serious injuries on the City's roads.

3.4 Western University Master Plan[4] (2015)

Western University completed an update to their 2007 Master Plan. This iteration will guide future development of the main campus to accommodate increasing enrollment and necessary facilities expansions. It is estimated that new campus buildings and research demands will add approximately 270,000 m^2 to 350,000 m^2 to the core campus area.

The Master Plan identifies key initiatives for the University to focus on:

- intensification of the core campus.
- improvements to the pedestrian & cycling environment of Western Road.
- promoting parking management alternatives.
- improving campus connectivity.
- creating high quality public spaces; and
- identification of campus gateways.

Intensification of the core campus includes both short- and long-term development of sites within the main campus area on both sides of Western Road. Short term development includes additional buildings and parking facilities at the following development sites: South Valley lands, Perth Drive, Westminster and the Springett Lot. Longer term development plans include the Social Science building, Weldon Library, the Elgin Drive entrance, Perth Drive, and secondary development sites.

The Master Plan also addresses the need for increased parking facilities and a stronger emphasis on TDM including reducing travel demand, promoting active transportation, increasing transit use, and implementing rideshare programs to accommodate growth within the university environment.

Western Road Considerations

- The lack of centre median offers no respite for pedestrians crossing the wide road
- Multiple driveways disrupt the flow of traffic
- The large number of students crossing at Sarnia Road need a more pedestrian friendly intersection
- There is an opportunity to continue Western signage along Western Road to create a stronger University identity.

[4] Campus Master Plan 2015 - Public Accountability Key Resources - Western University (uwo.ca)

*Western Road Opportunities (refer to **Appendix A** for Campus Master Plan "Design Precedents and Opportunities" map)*

- Extend the landscaped median south to Sarnia Road
- Create a signalized pedestrian crossing at the entrance to the new Ivey building
- Improve pedestrian crossings and lengthen crossing times on all sides of the intersection for Western Road and Sarnia Road.

Springett Lot Considerations

- Springett Lot is now accessed on the north side with a new road shared with Huron University College.
- To better engage Western Road, the eastern section of Springett Lot is a prime location for new academic buildings.

Springett Lot Opportunities

- Provide parking to the rear of new academic buildings, respecting existing agreements.

The Master Plan also addresses the need for increased parking facilities and a stronger emphasis on TDM including reducing travel demand, promoting active transportation, increasing transit use, and implementing rideshare programs to accommodate growth within the university environment. **Appendix A** includes a map of the existing and proposed Parking Spaces on the main campus, as shown in the Master Plan.

3.5 London Complete Streets Design Manual (CSDM) (2018)

This manual is a transformative tool that will guide the way streets are designed in London. It serves as a valuable resource for integrating the various functions of our streets and has been written for all practitioners, advocates and citizens involved in the street design process.

A "Complete Street" is one that is designed to accommodate the mobility needs of all ages, abilities, and modes of travel. Safe and comfortable access for pedestrians, bicycles, transit users, and the mobility challenged are not design after-thoughts but are integral to the planning of the street from the start. Beyond these mobility functions, the complete streets approach prioritizes "placemaking", the creation of places in our streets that contribute to healthy ecosystems, social inclusion, and vibrant business activity. CSDM[5] defines a clear set of priorities for the future of London's streets, highlighted by the city's Vision Zero target – the concept that no loss of life as a result of traffic-related collisions is acceptable. Additionally, the manual prioritizes the creation of functional, attractive street environments that better serve pedestrians and cyclists. These priorities need to be balanced with the need to accommodate critical utilities and allow for efficient maintenance and operations. The City's official plan suggested the preparation of a Complete Streets Manual to establish overall cross-sections for the street classifications and design parameters for the public realm. Achieving the City's complete streets vision requires a comprehensive process that spans from the initial planning and prioritization stage to project implementation and monitoring. City staff and engineering consultants will be incorporating complete streets elements into capital projects for new construction, reconstruction, or rehabilitation.

Within our study area Western Road and Sarnia Road are classified as Arterial (Civic Boulevard) in the updated London Official Plan (2016). Civic Boulevard is one of the four types of Arterial Road (Main Street, Urban Thoroughfare and Rapid Transit Boulevard being the other three). As per the CSDM, Civic Boulevards provide multi-modal connections between different neighbourhoods across the City including downtown. With a preferred right-of-way width of 36 m, these corridors provide for multi-modal travel, with a priority on pedestrian, cyclist, and transit movements, while moving medium to high volumes of vehicular traffic and provide access to many prominent destinations. Land uses fronting onto Civic Boulevards include residential, employment, retail, institutional and recreational.

[5] London Complete Streets Design Manual

The City's vision for these corridors includes transit-supportive development with moderate density development and active street frontages. A high-quality public realm is a priority and should include seating, waste receptacles, publication boxes, shade trees and where appropriate pedestrian wayfinding and clearway widths exceeding the 1.5 m minimum standard. Cycling facilities should be considered on all corridors, especially those included in the City's Cycling Master Plan and due to the typical volume and speed of motor vehicle traffic, physically separated and continuous facilities are preferred. The preferred width of the buffer zone between a cycling facility and the adjacent motor vehicle travel or parking lane is 1.0 m to accommodate snow.

The provision of frequent and efficient transit service is prioritized on Civic Boulevards. Queue jump lanes, transit signal priority and bus shelters should be considered at all intersection / stop locations. Cycling facilities may be integrated into the stop with pavement markings and signage indicating that cyclists must yield to pedestrians when bus doors are open.

A 3-5 lane cross section is typical for Civic Boulevards, and depending on access requirements, either a planted median or two-way left turn lane may be appropriate. Desired separation between driveway accesses is 75 m or greater and speed limit of 60 km/h is preferred. Planted medians can be included to enhance aesthetics, facilitate pedestrian crossings, and separate oncoming vehicular traffic, though frequent breaks may be required to accommodate left turn vehicle access and left turn vehicle storage. In terms of "Green infrastructure", street trees are highly desirable, and their location should be determined by "The Right Tree, Right Location" selection process. This process matches site conditions with the appropriate tree which can include ensuring the proper amount of soil volume is available to support the eventual mature size of the tree. Planted centre medians may be appropriate if they do not have an undue negative impact on emergency services' response times or demand for left turns into / from private property.

The CSDM also provides guidance for designing street intersections in Chapter 5 of the manual with example intersections with different street classifications in the City of London.

Other types of Arterial Roads (i.e., Rapid Transit Boulevard, Urban Thoroughfare and Main Street) differs from Civic Boulevard in terms of road cross-section, transit facilities, cycling facilities, pedestrian accommodation, cyclist accommodation, utility accommodation, motorist and freight accommodation which can be found in detail in Section 4 of the London Complete Streets Design Manual.

3.6 Ontario Traffic Manual Book 18 (2021)

This edition of OTM Book 18 – Cycling Facilities has been developed by MTO in association with the Ontario Traffic Council (OTC). The design guidelines presented in OTM Book 18 are considered to be consistent with the intent of the Highway Traffic Act (HTA) with respect to municipal roads and infrastructure. The purpose of the manual is to provide practical guidance on the planning, design, and operation of cycling facilities in Ontario. The guidance in this manual applies to on- and off-road facilities within the road right-of-way.

This new manual recommends increased separation of cyclists from motorists while introducing lower motor vehicle volume and speed thresholds to make cycling safer and more enjoyable. Physically separated bike lanes are more effective at encouraging people to cycle than conventional, painted bike lanes.

A physically separated bike lane is a portion of a roadway which has been designated for the exclusive use of people riding bikes. It is separated from adjacent motor vehicle lanes by a horizontal buffer plus vertical elements within the buffer such as flex bollards or a barrier curb. The buffer restricts encroachment of traffic, creating a more secure and comfortable environment for cyclists. This increases access to low-cost mobility for lower income populations, providing a first- or last-mile connection to transit and expanding access to employment opportunities. Protected/separated bike lanes can be achieved through various separation techniques such as a parking lane, flex

bollards, planters, a pre-cast concrete curb, cast-in-place concrete curb, rubber curb, concrete barrier, and guide rail. A painted buffer used without other vertical forms of separation is not considered a physically-separated bikeway.

The desired width of the horizontal buffer is 1.0 m, for all types of separation. The minimum width of the buffer varies depending on the separation technique used, but generally ranges from 0.3 to 1.0 m. There are several factors which should be considered when selecting a separation technique such as traffic volumes, speeds, width of roadway, transit stops, curbside land uses, etc. To maximize the operating width of the physically separated bicycle lane, the separation treatment should be placed as close to the vehicle lane as practical. The recommended and suggested minimum widths for one-way and two-way physically separated bicycle lanes are shown in **Table 5.**

Table 5: Desired and Suggested Minimum Widths for Physically Separated Bicycle Lanes

Facility	Desired Width	Suggested Minimum
One-way Physically Separated Bicycle Lane	1.8 m[a] lane + 1.0 m buffer	1.5 m[b,c] lane + 0.3 md buffer
Two-way Physically Separated Bicycle Lane	3.5 m lane + 1.0 m buffer	2.7 m lane + 0.3 m[d] buffer

Notes:
a) Where higher volumes of cyclists are anticipated (>1,500 cyclists per day), consider providing a wider separated bicycle lane, up to 2.5 m wide. Wider facilities of 2.0 to 2.5 m allow for easier passing, better accommodation of cyclists travelling at different speeds, and are supportive of side-by-side riding. The effective operating width may also be increased by positioning the vertical separation element as close to the vehicle lane as practical, which reduces the risk of cyclists clipping the separation element or the curb.
b) 1.8 m is the minimum width to allow overtaking within the bicycle lane. Where 1.8 m cannot be provided, consider providing gaps in the separation treatment to allow cyclists to exit the lane to overtake. Place the vertical separation element as close to the vehicle lane as possible to maximize the operating space.
c) Maintenance procedures and costs should be considered since small street sweeper vehicles typically require 1.8 m of unobstructed running width. Practitioners should check the requirements for their municipality and factor in higher maintenance costs should their chosen facility widths require the use of specialized equipment or manual sweeping.
d) Where a parking lane is adjacent to the separated bicycle lane, the minimum buffer width is 0.6 m.

4. Traffic Data and Travel Patterns

4.1 Turning Movement Count Data

Turning Movement Counts (TMCs) were provided by the City of London and collected by a third-party agency where data was unavailable. **Table 6** provides an inventory of the available TMC data utilized in the existing condition analyses.

Table 6: Turning Movement Counts Inventory

No.	Location	Intersection Control	Date (Month, Day, Year)	Source
1	Western Road / Platt's Lane North	Signalized	April 18, 2013	City of London
2	Western Road / Althouse Lot	Signalized	October 2, 2013	City of London
3	Western Road / Sarnia Road	Signalized	April 12, 2012 March 31, 2015	City of London AECOM
4	Western Road / Lambton Drive	Signalized	April 17, 2013	City of London
5	Western Road / Huron College Entrance	Unsignalized	November 26, 2014	City of London
6	Western Road / Wellington Drive	Signalized	September 30, 2013	City of London
7	Sarnia Road / Coombs Avenue	Unsignalized	September 22, 2014	City of London
8	Sarnia Road / Sleightholme Avenue	Signalized	October 12, 2017	City of London
9	Sarnia Road/Brescia Lane	Unsignalized *traffic lights for pedestrians only	October 11, 2018	City of London

It is noted that the City provided traffic data was collected on different days and no data was provided for the driveways between intersections. Eight (8)–hour TMC data collection activity was undertaken at the Western Road and Sarnia Road / Philip Aziz Avenue intersection on March 31st, 2015 to supplement AM Peak Hour data gaps. The results of the initial traffic analysis were compared to the field observations, and it was noted that the observed traffic volumes for some of the movements may not represent a typical weekday. To confirm and/or validate the irregularities between the supplied City of London and 2015 surveyed TMC data, AECOM conducted spot checks at the key turn movements for 30 minutes during the peak hour on April 7th, 2015 (PM peak hour) and April 8th, 2015 (AM peak hour). The southbound left-turn was counted during the PM peak hour; eastbound left-turn, northbound through, and northbound right-turn were counted during the AM peak. The TMC data collected at the Western Road/Sarnia Road key intersection was then adjusted to reflect these field observations.

Additional data collection was conducted on April 17th, 2015 to record the turning movement volumes at mid-block driveways. Driveways to the Elborn College parking lot (two driveways) and to the plaza located on the southwest corner of the Western Road/Sarnia Road intersection (four driveways) were included.

More recent traffic count data was not provided or collected for use in this assessment (Apart from the Sleightholme Avenue at Sarnia Road intersection) due to the potential for COVID-related impacts including reduced traffic volumes and pedestrian volumes. Instead, the data identified in **Table 6** was used with the application of a growth factor obtained from the City's TransCad model to obtain traffic volumes that would be representative of pre-COVID conditions and therefore be more appropriate for determining design requirements. This approach for estimating traffic volumes for use in this study was confirmed with the City. Only for the Sleightholme Avenue at Sarnia Road intersection, a growth rate of 2% based on the Census data was used as per City's recommendation.

All TMC data, field observations and mid-block driveway data are provided in **Appendix D**.

4.2 Intersection Traffic Control

The signal timing plans for the study area were provided by the City of London. Most of the intersections are signalized within the study area along Western Road. The STPs are dated as year 2015. As no new STPs were available at the time this study was undertaken, it was assumed that the STPs remains unchanged from 2015, and the information was used with no adjustments in the Existing Conditions (2021) Synchro Analysis (refer to **Table 9**).

All signalized intersections in the study area currently operate as actuated co-ordinated, with a cycle length ranging between 65 and 130 seconds in the AM and PM peak hours. The signalized intersection of Western Road and Sarnia Road/Philip Aziz Ave is actuated co-ordinated with a 130 second cycle length.

4.3 Pedestrian and Cyclist Data

To understand the pedestrian and cycling characteristics in the vicinity of Western University a customized data collection exercise was undertaken on April 15, 2015 for the midblock segment along Western Road between the Sarnia Road / Philip Aziz Avenue and Brescia Lane / Lambton Drive intersections. The following is noted:

- A total of four screen line locations were defined on Western Road between Sarnia Road and Lambton Drive/Brescia Lane.
- On-road and off-road (on sidewalk) bike and pedestrian activity was recorded traveling in the north-south direction on Western Road crossing the defined screen line.
- All pedestrian / cyclist crossing activity in the east-west direction across Western Road between Sarnia Road and Lambton Drive/Brescia Lane was noted.

4.4 Heavy Vehicles Percentages

The heavy vehicle percentages for the Western Road and Sarnia Road corridor for the weekday AM and PM peak hours were calculated based on the turning movement volumes. Heavy vehicle percentages were calculated using a similar approach to determine the volume of trucks/buses traversing Western Road/Sarnia Road during the peak hours. The analysis showed between 2% to 5% heavy vehicles were recorded on the Western Road corridor, between Platt's Lane and Windermere Road.

4.5 Modal Distribution

The 2015 traffic study looked at the modal distribution for Western Road and the surrounding area using the Household Travel Survey Database developed for the London 2030 TMP. The database was created using an expanded survey sample of London residents in 2010. In the absence of a new travel survey, the 2015 traffic study was not further updated. **Table 7** illustrates the transportation zones within and surrounding the study limits.

Trips originating from the zones outlined in **Figure 7** were filtered by their mode of transportation. Additionally, internal trips (i.e., trips starting and ending in these zones) were filtered by their mode of transportation to determine the mode split for these shorter-distance trips. **Figure 8** provides an overview of the modal distribution within and surrounding the study area compared with the modal distribution across the entire city.

Figure 7: TMP 2030- Study Area Transportation Zones

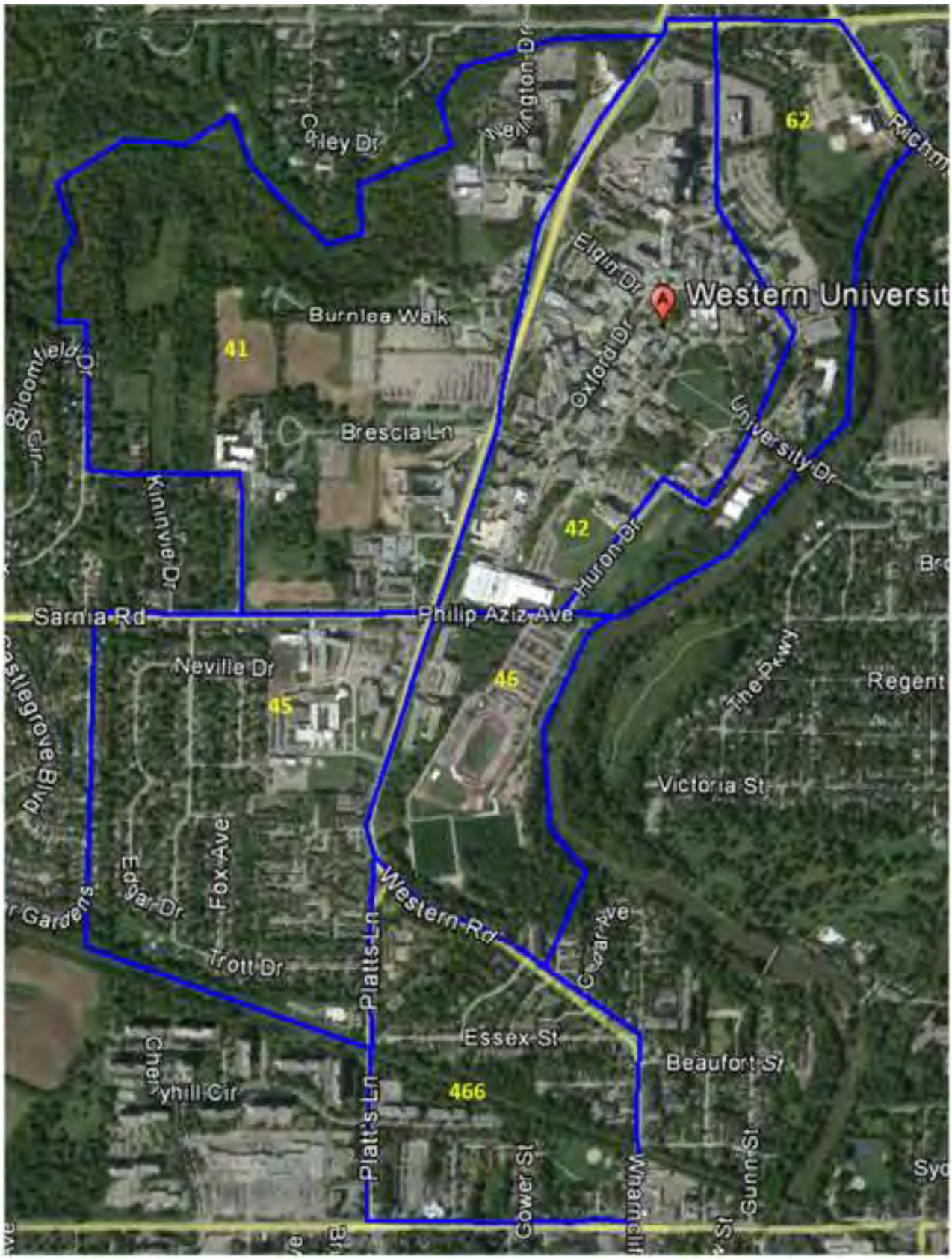
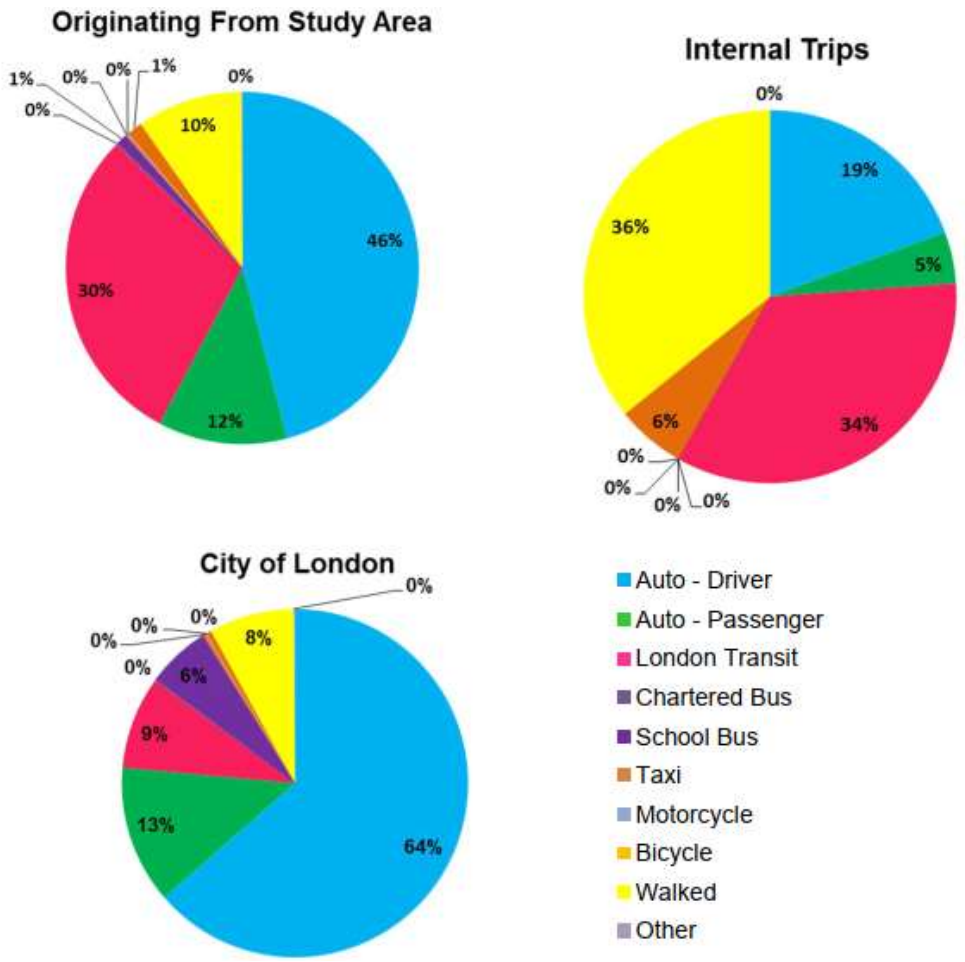


Figure 8: Study Area Modal Distribution and City Modal Distribution



The above modal distribution summary for the study area and the surrounding area illustrates greater emphasis on London Transit and active transportation trips. The close proximity to Western University is an assumed factor in modal distribution for the surrounding study area in comparison to the city-wide mode split.

4.6 Historical Growth Rates

In 2015, AECOM undertook a traffic study in support of this MCEA. That traffic study forms the basis of this current study. At that time, and in the absence of multiple years of traffic data, growth factors were extracted from the City's TransCad model. The TransCAD model had previously been updated as part of the London 2030 TMP assignment, completed in (2011). Refer to Section 3.1 for a summary of the London 2030 TMP.

As part of the 2015 traffic study, the growth factors for the critical PM peak hour volumes were developed based on average link volumes traffic growth between the TransCAD model base year (year 2009) and forecasting year (year 2030) within the study area for the Western Road and Sarnia Road corridors. The following growth rates were calculated.

- 1.5% per annum growth rate for north-south traffic volumes on the Western Road corridors
- 0.5% per annum growth rate for east-west traffic volumes on the Sarnia Road corridor
- 2% per annum growth rate for Sleightholme at Sarnia Road intersection as per City's request after extension of study area.

It was determined at the restart of this assignment that, rather than collect new traffic counts, a reasonable growth factor would be applied to the 2015 traffic volumes to project 2021 Existing Conditions traffic volumes. This approach was selected due to anticipated altered travel patterns from the province wide COVID restrictions and concerns that new traffic surveys (including pedestrian and cyclist volumes) might not reflect the normal volumes. Existing Conditions traffic volumes are further discussed in **Section 6.3.** However, in discussions with the City for the Sleightholme Avenue at Sarnia Road intersection, the City advised that a 2% growth rate be used for that intersection as per data obtained from Statistics Canada on overall City of London population growth.

4.7 Link Intersection and Volumes

The traffic volume from the 2015 traffic study is used to update volumes for the 2021 existing conditions by applying the growth factors noted in **Section 4.6**.

Figure 9 shows link volumes on Western Road for weekday AM and PM peak hours and **Figure 10** shows base year (2021) turning movements volumes at the above noted study area intersections

4.8 Average Annual Daily Traffic AADT

The City of London provided Average Annual Daily Traffic (AADT) data for Western Road and Sarnia Road for year 2015. This AADT data was adjusted using the historical growth rates discussed in **Section 4.6** to project AADT values to year 2021 (Existing Conditions).

- Western Road 28,500 vehicles per day
- Sarnia Road 24,000 vehicles per day

These AADT volumes are generally consistent with the peak hour link volumes shown in **Figure 9**, assuming an approximate 10% conversion from peak hour to daily traffic volumes.

4.9 Study Area Travel Patterns

The analysis of the year 2021 link and turning movement volumes in **Figure 9** and **Figure 10** shows that the parking lots located in northwest corner of Brescia Lane/Lambton Drive intersection, i.e., ‘Springett Lot’, ‘Brescia University College Lots’, and ‘Huron College Lot’ are the main trip attraction points during the AM peak hour. Approximately 1174 vehicles access these parking lots: 164 vehicles through Brescia Lane and 1010 vehicles through the Huron College access road. About 65% of these vehicles are traveling in the northbound direction along Western Road to access the parking lots, which results in high left-turning volumes to Brescia Lane and the Huron College access road. The total outbound volume from these two streets is about 59 vehicles during AM peak hour. The main turning movements during the AM peak hour are northbound through and eastbound left at the Western Road/Sarnia Road intersection, and southbound through at the Huron College entrance/Western Road intersection.

Traffic volumes during the PM peak hour are generally higher compared to the AM peak; however, the direction of travel is reversed. The ‘Brescia University College Lots’, ‘Springett Lot’ and ‘Huron College Lot’ become the main trip origin in the study area. Approximately 1041 vehicles start their trip from those parking lots: 142 vehicles through Brescia Lane and 899 vehicles through Huron College access road. This travel pattern in the study area leads to high traffic volumes for the southbound through and right turn at the Western Road/Sarnia Road intersection. Traffic volumes approaching from Philip Aziz Avenue during the PM peak hour are much higher compared to the AM peak.

Figure 9: Existing Conditions (2021) Link Volumes

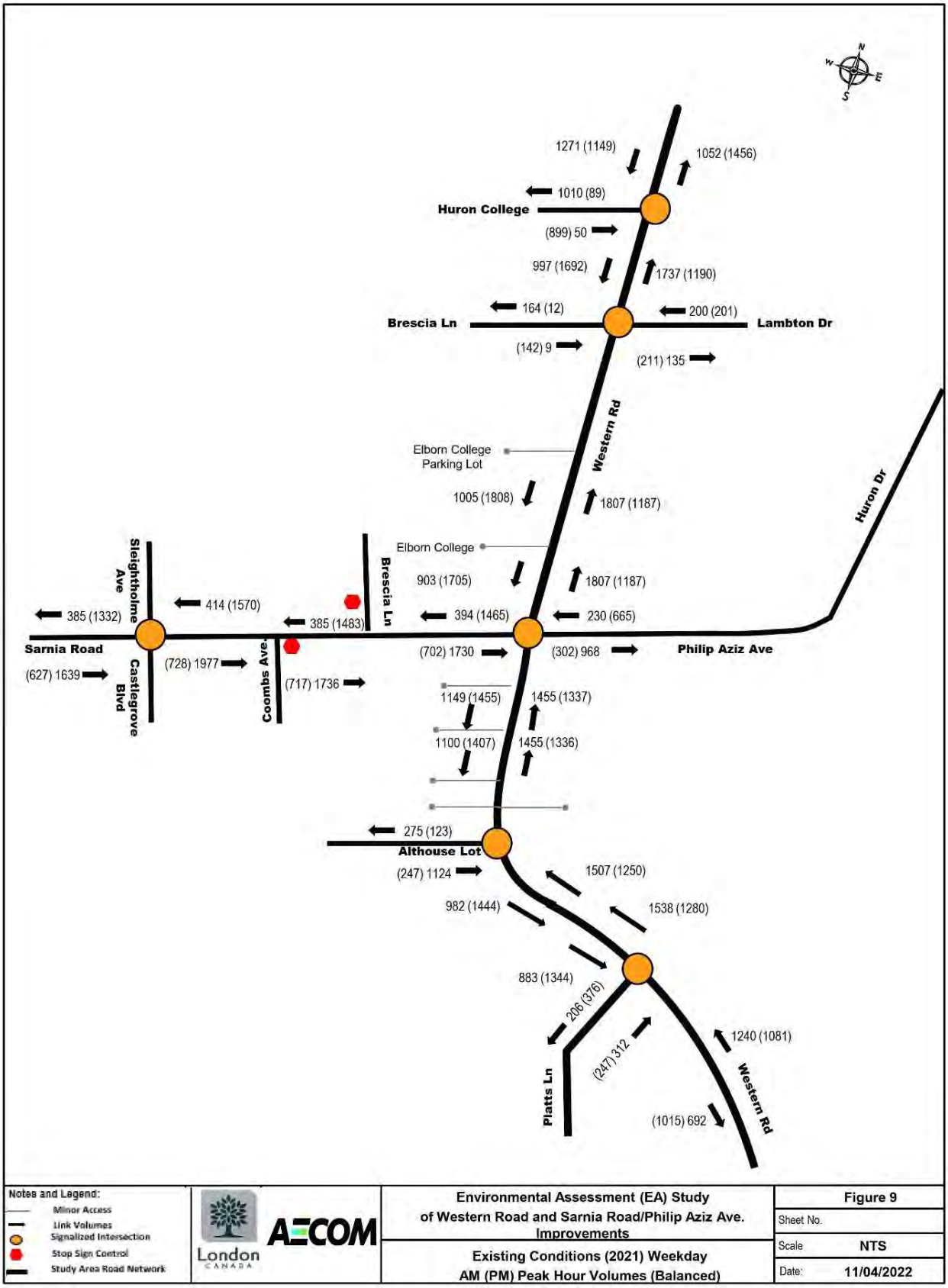
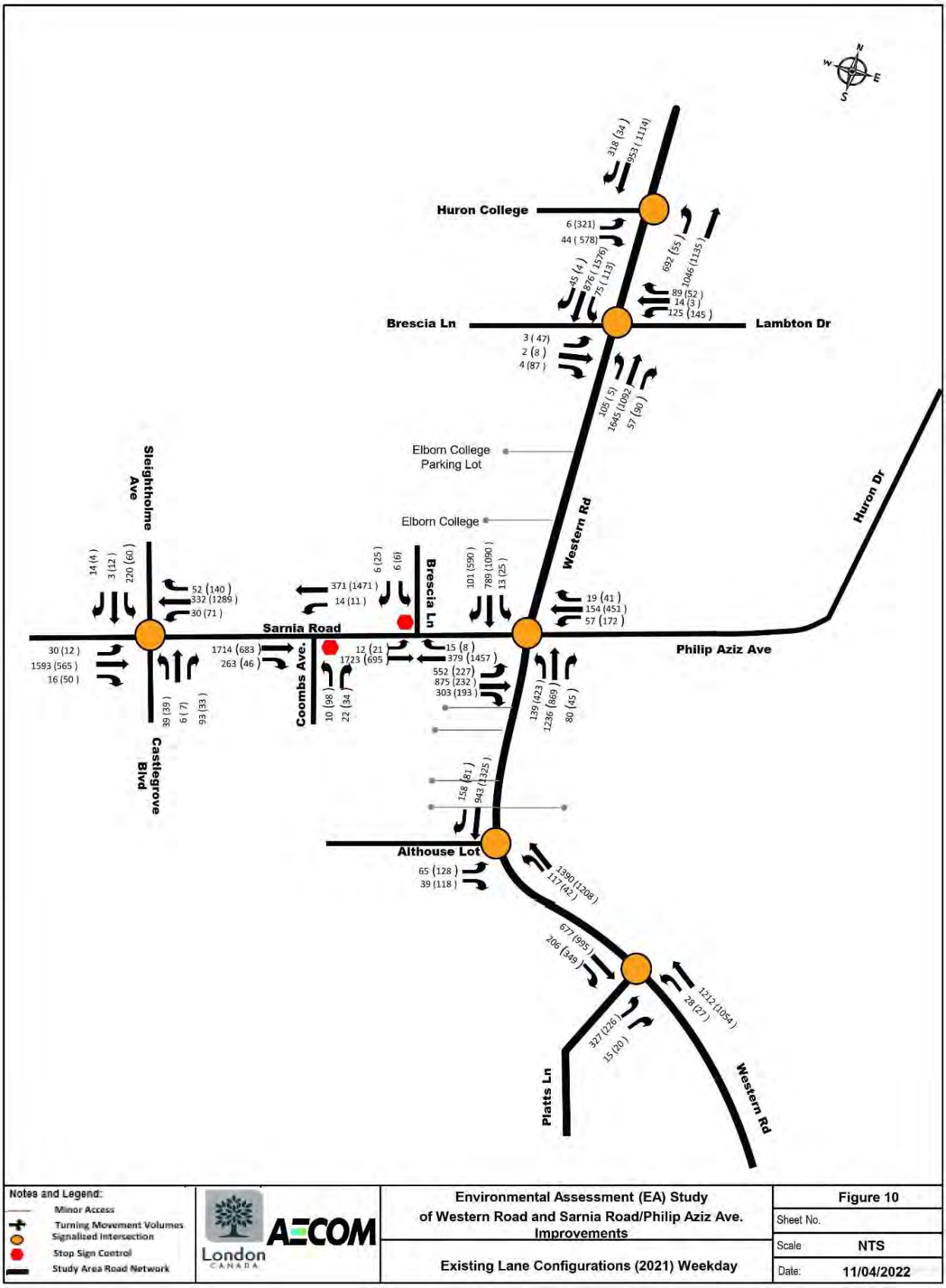


Figure 10: Existing (2021) Turning Movements



5. Collision Assessment

A review of the "reportable" collisions was undertaken to identify potential collision trends within the study area. The collision data for the year 2015-2021 was provided by the City. As detailed in **Appendix C**, for the purpose of collision analysis, the study corridors were segmented into mid-block road sections and intersections. The following intersections and mid-block road sections along Western Road and Sarnia Road-Philip Aziz Avenue were analyzed as part of the road safety assessment.

Intersections:

- Sarnia Road at Sleightholme Avenue;
- Stirrup Crescent at Sarnia Road;
- Kininvie Drive at Sarnia Road;
- Sarnia Road at Brescia Lane;
- Sarnia Road at Coombs Avenue;
- Western Road at Sarnia Road/Philip Aziz Avenue;
- Western Road at the access road to Perth Hall (Althouse lot);
- Western Road at Platt's Lane;
- Western Road at Lambton Drive;
- Western Road at Huron College entrance;

Mid-block road sections:

- Western Road from Wellington Drive to Lambton Drive;
- Philip Aziz Avenue between Western Road and the western most driveway to the TD Stadium parking lot;
- Sarnia Road between Brescia Lane and Western Road;
- Sarnia Road between Coombs Avenue and Brescia Lane;
- Sarnia Road between Coombs Avenue and Kininvie Drive;
- Sarnia Road between Kininvie Drive and Stirrup Crescent;
- Sarnia Road between Sleightholme Avenue and Stirrup Crescent;
- Western Road between the access road to Perth Hall (Althouse lot) and Platt's Lane;
- Western Road between the access road to Perth Hall (Althouse lot) and Sarnia Road;
- Western between Sarnia Road and Lambeth Drive;

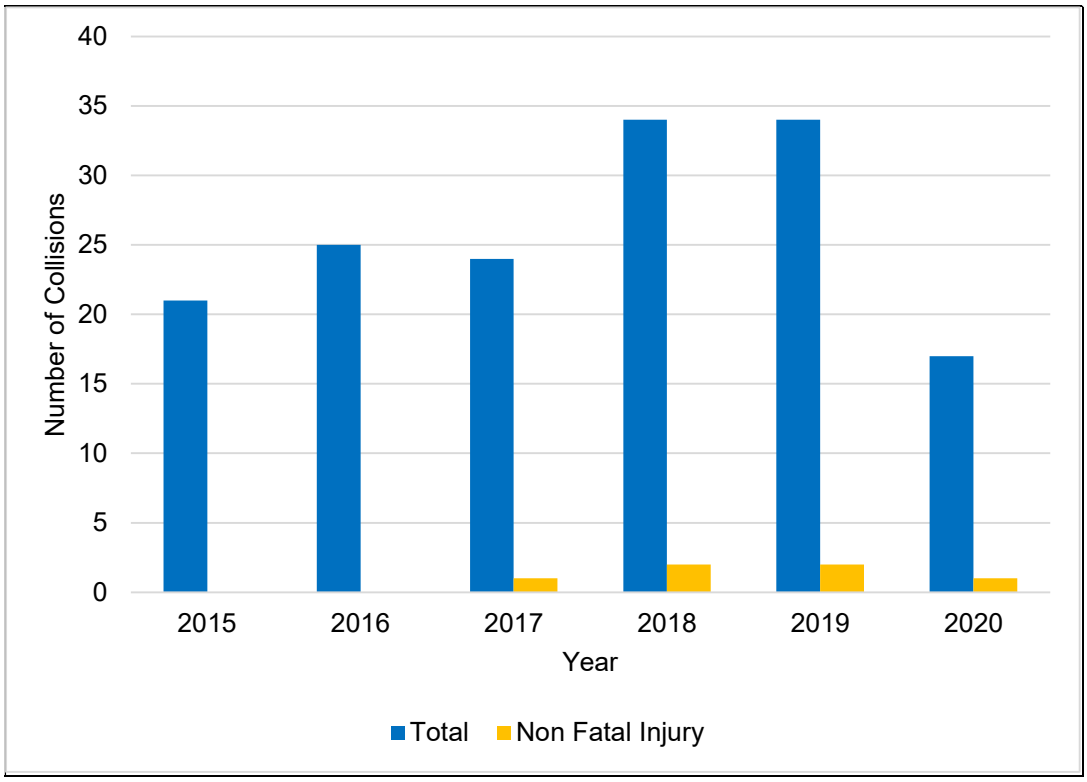
A total of 222 collisions for mid-block and 260 collisions at intersections, including a total of 82 "Non-fatal injury" and "Property Damage Only (PDO)" collisions, were included in the collision database over the approximate six-year period between January 2015 and July 2021. Of the recorded collisions the following was noted:

- 41 collisions were coded as "Non-fatal injury" including 10 vehicle-pedestrian collisions.
- 53 collisions were coded as "property damage only" (PDO); and
- 388 collisions were coded as "Other/Non-Reportable".

Figure 11 shows the yearly distribution of the total number of collisions ("blue" bars) and the number of non-fatal injury collisions ("orange" bars) over the six-year study period. A typical pattern was identified as having very low proportion of "non-fatal injury" collisions between 2017 and 2020.

The findings of the collision analysis showed that the signalized intersection of Western Road at Sarnia Road/Philip Aziz Avenue has a higher number of total and severe collisions than those of the other intersections within the study area. Over the six-year study period, 6 severe (i.e., non-fatal injury) collisions were reported to have occurred at this intersection.

Figure 11: Total Number of Collisions at Western/Sarnia Intersection (2015-2020)



The mid-block section between Western Road to Wellington Drive and Western Road between Althouse lot and Sarnia Road saw the highest number of reportable collisions of all mid-block sections (i.e., 8 collisions at each location). It should be noted that these mid-block sections are directly north and south of the Western Road at Sarnia Road-Philip Aziz Avenue intersection.

5.1 Road Safety

As part of the 2015 traffic study, a road safety review was completed on Thursday December 9, 2021. The following items were noted as part of that study that are still relevant in 2021.

- Many uncontrolled pedestrian crossings throughout the study area are marked with pavement markings and signage, which could give a false impression to pedestrians that they have the right-of-way at these crossings
- The site investigations confirmed the presence of a “desire line” between the Richard Ivey School of Business and Elborn College on the west side of Western Road to the Western Sports & Recreation Centre (i.e., Athletic Centre) and the parking lots on the east side of the road. However, there is no “controlled” mid-block pedestrian crossing location for the relatively long (measured at 420 m) section between Sarnia Road/Philip Aziz Avenue and Brescia Lane/Lambton Drive.
- Pavement markings (indicating lanes, pedestrian crosswalks, turning arrows, etc.) are often faded and not easily recognizable to motorists and pedestrians.
- Previously gravel and other debris were identified in on-road cycling lanes next to the roadway curb noted as a potential contributor to cyclists losing control and falling on the ground with a potential for serious injury to the cyclists. At the time of recent inspection, this appeared to be minimal though recent rain and snow events may have pushed the gravel and debris into the curbs.

- There are no stop signs at the Elborn College exit and Ivy business school parking lot exit despite having painted stop bars at the approach to the intersections.
- Formal bicycle lanes are intermittent throughout the study area corridor.
- There is no formal sidewalk available for the pedestrians on Philip Aziz Ave between Western Road and Huron Drive; given the available cross-section and two-way traffic in this section, pedestrians are walking within the vehicle travel lanes.
- The Western Rd at Sarnia Road-Philip Aziz Avenue intersection has a skewed orientation, and as such, the marked pedestrian crosswalks do not cross the roadway at a right-angle. This orientation may be confusing to some pedestrians, and specifically for the visually impaired who may assume a crossing direction that is directly perpendicular to the edge of the roadway.

Refer to **Appendix C** for the full Road Safety report and details of the December 9 field investigation.

6. Existing Conditions Assessment

6.1 Link Volumes/Capacity Analysis

The capacity of a facility reflects its ability to accommodate a moving stream of vehicles and represents the maximum number of vehicles that can reasonably be expected to pass a given point during a specified period. The Level of Service for corridor operation for Western Road is based on a desired service volume of 900 vehicles per hour per lane (vphpl). **Table 7** outlines the current (year 2021) operating condition of the study area corridors. The capacity analysis utilizes the maximum mainline volume between unbalanced intersections. Link volume capacity analysis results indicate that the Western Road corridor within the study area has residual capacity available only in few road sections during weekday peak; sections that are at or approaching capacity are highlighted in red in **Table 7** (i.e., v/c .0.80).

Table 7: Link Volumes/Capacity Results

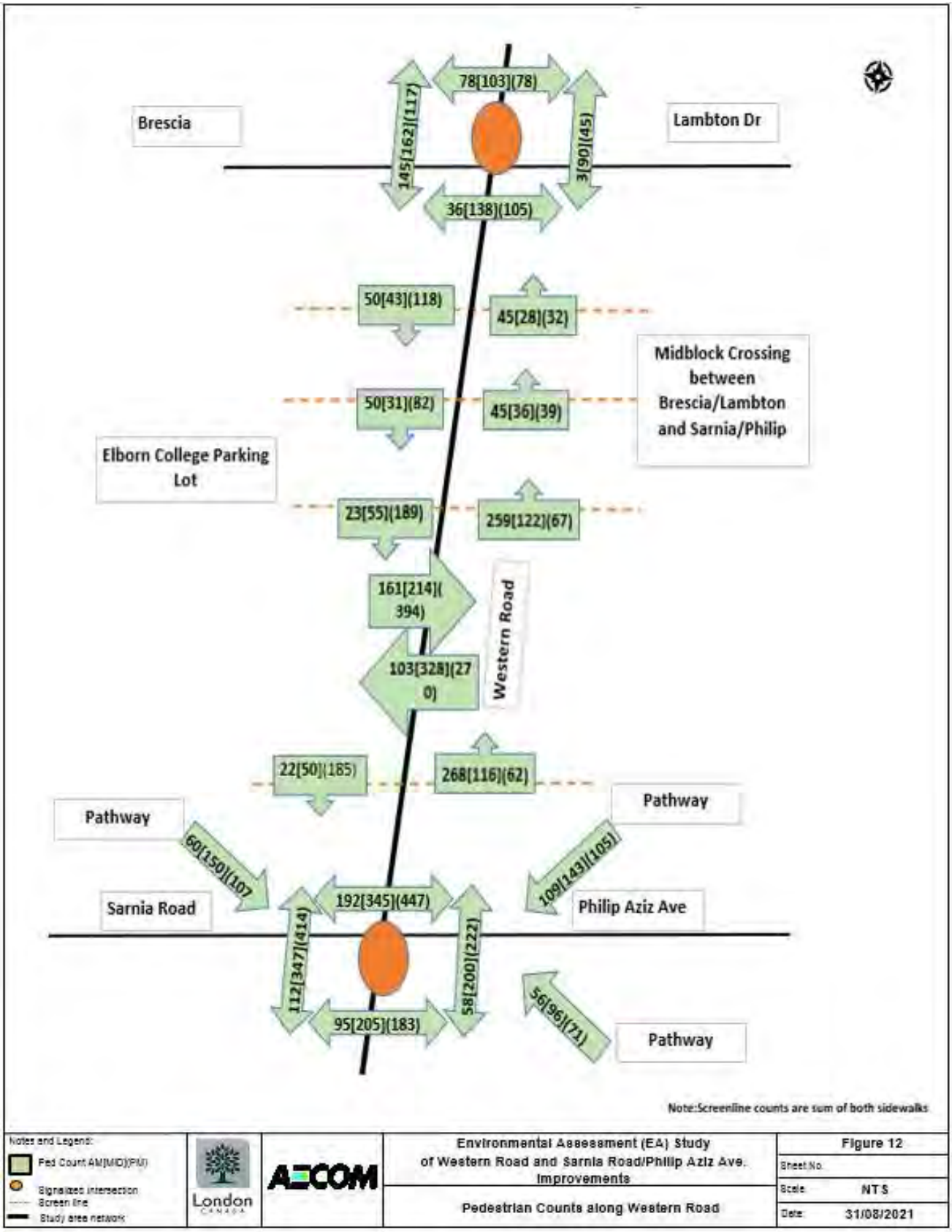
Road Section on Study Corridors	Lanes per Direction	Desired Capacity (vph)	AM Peak Hour				PM Peak Hour			
			NB/EB		SB/WB		NB/EB		SB/WB	
			Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C
Western Road										
Platts Lane to Althouse Lot	2	1800	1538	0.86	982	0.55	1280	0.71	1444	0.80
Althouse Lot to Sarnia Rd	2	1800	1455	0.81	1149	0.64	1337	0.74	1455	0.81
Sarnia Rd to Brescia Lane / Lambton Dr	2	1800	1807	1.00	1005	0.56	1187	0.66	1808	1.00
Lambton Dr to Huron College Entrance	2	1800	1737	0.97	997	0.56	1191	0.66	1692	0.94
Sarnia Road/Philip Aziz Avenue										
Sleightholme Ave to Coombs Ave	2	1800	1977	1.09	414	0.23	728	0.40	1570	0.87
Coombs Ave to Brescia Lane	2	1800	1736	0.96	385	0.22	717	0.40	1483	0.82
Brescia Lane to Western Rd	2	1800	1730	0.96	394	0.22	702	0.39	1465	0.81
Western Rd to Huron Dr	1	900	968	1.07	230	0.26	302	0.34	665	0.74

6.2 Existing Active Transportation Analysis

Being within a large university, the Western Road corridor has a large volume of pedestrian traffic along and across it. **Figure 12** illustrates the pedestrian activity within the core segment of Western Road, between the Sarnia Road / Philip Aziz Avenue intersection and the Brescia Lane / Lambton Drive intersection. The counts illustrated include crosswalk counts at intersections, midblock sidewalk counts, and midblock crossing counts. It is anticipated that pedestrian traffic would have increased since the count data was collected in 2015. For this reason, the counts taken in 2015 have been adjusted to the existing 2021 scenario using the same growth factor for projecting the turning movement count data to year 2021 (i.e., the annual growth factor of 1.5% for Western Road corridor, 0.5% for Sarnia Road corridor (Only volumes of Sleightholme Avenue at Sarnia Road intersection were grown by 2% as per City's advice), as discussed in **Section 4.6**, were applied to the 2015 pedestrian volumes to obtain 2021 volumes).

The data in **Figure 12**, combined with pedestrian counts at intersections toward the periphery of the study area, indicate that the study area intersection with the highest pedestrian counts is the Western Road and Sarnia Road / Philip Aziz Avenue intersection. The lowest peak hour for people walking at this intersection is the morning, with much higher volumes during the midday and afternoon peak hours. This timing is consistent with the boarding's and alighting's observed at bus stops near this intersection, as discussed in **Section 2.3**. The north and west crosswalks are the busiest crosswalks, which is consistent with surrounding land uses, which are densest on the north and west sides of the intersection.

Figure 12: Pedestrian Counts along Western Road



There is also a substantial amount of midblock crossing just north of the Western Road and Sarnia Road / Philip Aziz Avenue intersection. The total midblock crossing volume between the Sarnia Road / Philip Aziz Avenue and Brescia Lane / Lambton Drive intersection is similar to the volume crossing Western Road at Sarnia Road / Philip Aziz Avenue. The midblock crossing volume is much higher than the crossing volume at the Brescia Lane / Lambton Drive intersection. This volume of midblock crossing indicates that there are midblock desire lines that are not adequately served by the two closest signalized crossings at Western Road / Sarnia Road and Brescia Lane / Lambton Drive, which are approximately 400 m apart.

North-south pedestrian volumes along Western Road illustrate a time-of-day directional flow. Morning volumes are much heavier northbound and afternoon volumes are much heavier southbound. The screenline volumes illustrate that volumes are much higher closer to the Sarnia Road / Philip Aziz Avenue crossing and are lower closer to Brescia Lane / Lambton Drive crossing, consistent with the crossing volumes at these intersections. It is likely that the midblock crossing volume is also oriented closer to the Sarnia Road / Philip Aziz Avenue crossing.

6.3 Existing Conditions Intersection Operations Analysis

Traffic operations were analyzed using Synchro/SimTraffic version 11.0 software. The Synchro methodologies for signalized and unsignalized intersections were utilized for the operations result table. The LOS describes the “driver experience” on a transportation facility; see **Table 8** for further description.

Table 8: LOS in Signalized & Unsignalized Intersections

LOS	Signalized Intersections		Unsignalized Intersections	
	Description	*Ave Delay*	*Description*	*Ave Delay*
A	Very seldom does a vehicle wait longer than one red light. The approach appears open, turns are easily made, and drivers have freedom of operation.	≤10 sec	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.	≤10 sec
B	An occasional green light is fully used, and many greens approach full use. Many drivers begin to feel somewhat restricted within groups of vehicles approaching the intersection	≤20 sec	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.	≤15 sec
C	Intersection operation is stable but often has fully used greens. Drivers feel more restricted and occasionally may wait more than one red light. Queues may develop behind turning vehicles	≤35 sec	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.	≤25 sec
D	Drivers experience increasing restriction and instability of traffic flow. There are substantial delays to vehicles during short peaks within the peak hour, but there is enough time with lower demand to permit occasional clearing of queues and prevent excessive backups.	≤55 sec	Long traffic delays occur. Drivers emerging from minor streets experience significant restriction and frustration. Drivers on the major street will experience congestion and delay.	≤35 sec
E	The capacity of the road is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	≤80 sec	Very long traffic delays occur. Operations approach the capacity of the intersection.	≤50 sec
F	Vehicle demand exceeds the available capacity and delays extending through the peak hour are experienced.	>80 sec	Vehicle demand exceeds the available capacity. Very long traffic delays occur frequently.	>50 sec

Traffic analysis was conducted to determine existing conditions at each of the key intersections along the Western Road corridor within the study area. The analysis reviewed the Level of Service (LOS) and volume to capacity ratio (V/C). The intersection analysis was conducted for the intersections noted in **Table 10**.

For the LOS analysis the Ideal Saturated Flow Rate is assumed to be 1900 vphpl, the Peak Hour Factor (PHF) is assumed to be 0.92, and the lane widths are assumed to be 3.5 m. The signal timing plans provided in **Appendix C** were input to the Synchro model. All other inputs to the Synchro model were assumed to be the default values. Synchro was used to generate the Synchro reports.

The V/C ratio represents how saturated a road or intersection movement is, based on actual volumes versus the maximum number of vehicles that can travel. A v/c between 0.00 and 0.49 means that less than half the capacity is being used by vehicles; this is generally associated with good operating conditions. As the v/c approaches 1.00, traffic conditions worsen and at 1.00 the theoretical maximum number of vehicles is reached, and operations are generally denoted as 'very poor'. A v/c can exceed 1.00, indicating very poor/over saturated conditions and extended traffic delays.

The "critical movements" identified in the capacity analyses summary tables are based on the City of London's TIA guidelines. According to the guidelines, critical movements are defined as having an LOS of "E" or "F" and/or a V/C ratio of 0.90 or greater for signalized intersections, and for unsignalized intersections an LOS of "E", or" F". Note that because traffic volumes for the existing conditions (2021) were projected from older data, this is a reasonable approximation of the existing conditions. Movements having V/C>1 are calibrated in Synchro and calibration assumptions are tabulated below in **Table 9.**

Table 9: Synchro Calibration Assumptions

Peak Hour	Intersection	Movements	Adjustment
AM	Western Road/Sarnia Road	NBT	PHF=1, Lost time=-2,Lane Utilization factor=1
		SBT	PHF=0.95, Lost time=-1
		WBL	PHF=1, Lost time=-2, Saturation flow=1829
	Western Road/Huron College	SBTR	PHF=1, Lost time=-3, Lane Utilization factor=1
PM	Western Road/Sarnia Road	EBL	PHF=1, Lost time=-3, Saturation Flow=1969
		WBTR	PHF=1, Lost time=-3
		NBL	PHF=1, Lost time=-3, Saturation Flow=1779
		SBT	PHF=1, Lost time=-1
		SBR	PHF=1, Lost time=-3, Saturation Flow=1673
	Western Road/Huron College	EBR	PHF=1, Saturation Flow=1807
	Coombs Avenue/Sarnia Road	NBL	PHF=1, tC (Critical gap time) =6.6

Existing conditions were analyzed, and the traffic operational analysis results are summarized in **Table 10**. The Synchro/SimTraffic reports are provided in **Appendix E**.

Table 10: Existing Condition Traffic Analysis-AM and PM Peak Hours

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road / Brescia Lane / Lambton Drive (Signalized)	EB	Thru-Left/Thru-Right	20.6	C	0.02	35.9	D	0.45
	WB	Thru-Left/Thru-Right	35.7	D	0.61	33.7	C	0.62
	NB	Left	6.2	A	0.28	5.4	A	0.04
		Thru-Right	13.6	B	0.80	6.8	A	0.52
	SB	Left	91.1	F	0.96	13.8	B	0.51
		Thru-Right	16.3	B	0.54	10.0	B	0.68
	Overall Intersection		**17.8**	**B**	**0.96**	**11.5**	**B**	**0.68**

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road / Huron College (Signalized)	EB	Left	33.5	C	0.23	33.7	C	0.65
		Right	15.5	B	0.25	60.2	E	0.99
	NB	Left	23.2	C	0.91	53.9	D	0.51
		Thru	3.5	A	0.39	11.0	B	0.62
	SB	Thru/Thru-Right	49.4	D	0.99	24.4	C	0.78
	Overall Intersection		**26.5**	**C**	**0.99**	**27.0**	**C**	**0.99**
Sarnia Road / Brescia Lane (Unsignalized) *traffic lights for pedestrians only	EB	Left	0.2	A	0.01	1.0	A	0.06
		Thru	0.73	A	0.73	0.7	A	0.30
	WB	Thru	0.16	A	0.16	0.0	A	0.62
		Right	0.09	A	0.09	0.0	A	0.32
	SB	Left	0.07	C	0.07	38.6	E	0.24
		Right	0.07	C	0.07	38.6	E	0.24
	Overall Intersection		**0.20**	**A**	**0.73**	**0.80**	**A**	**0.62**
Sarnia Road / Coombs Avenue (Unsignalized)	EB	Thru	0.0	A	0.73	0.0	A	0.29
		Right	0.0	A	0.53	0.0	A	0.17
	WB	Left	2.0	A	0.08	0.2	A	0.01
		Thru	1.4	A	0.16	0.1	A	0.63
	NB	Left	216.5	F	0.42	157.3	F	0.97
		Right	26.1	D	0.12	11.8	B	0.07
	Overall Intersection		**1.4**	**A**	**0.73**	**6.3**	**A**	**0.97**
Sarnia Road / Sleightholme Avenue (Signalized)	EB	Left	8.9	A	0.06	6.5	A	0.07
		Thru	18.5	B	0.82	4.4	A	0.26
	WB	Left	34.3	C	0.43	5.70	A	0.14
		Thru	8.0	A	0.21	7.40	A	0.60
	NB	Left	25.9	C	0.13	21.8	C	0.20
		Thru-Right	24.0	C	0.28	10.5	B	0.16
	SB	Left	51.8	D	0.80	24.5	C	0.32
		Thru-Right	13.	B	0.04	17.1	B	0.06
	Overall Intersection		**20.2**	**C**	**0.82**	**7.3**	**A**	**0.60**
Western Road / Platts Lane (Signalized)	SB	Thru/Thru-Right	5.7	A	0.46	6.9	A	0.65
	NB	Left	6.3	A	0.10	6.9	A	0.50
		Thru/Thru	9.2	A	0.60	9.4	A	0.20
	EB	Left/Left-Right	26.7	C	0.58	26.3	C	0.50
	Overall Intersection		**10.3**	**B**	**0.60**	**8.7**	**A**	**0.65**
Western Road / Althouse College (Signalized)	EB	Left	29.1	C	0.32	30.0	C	0.49
		Right	11.3	B	0.18	28.2	C	0.49
	NB	Left	10.3	B	0.43	10.0	A	0.30
		Thru	5.6	A	0.58	5.6	A	0.56
	SB	Thru-Right	8.0	A	0.49	23.7	C	0.67
	Overall Intersection		**7.4**	**A**	**0.58**	**16.4**	**B**	**0.67**
Western Road / Sarnia Road / Philip Aziz Ave (Signalized)	EB	Left	42.9	D	0.93	84.8	F	0.99
		Thru	50.0	D	0.96	31.6	C	0.36
		Right	4.6	A	0.39	5.6	A	0.37
	WB	Left	163.9	F	0.98	68.7	E	0.79
		Thru-Right	42.5	D	0.42	83.9	F	0.99
	NB	Left	57.9	E	0.79	79.4	E	0.98
		Thru/Thru-Right	55.3	E	0.99	19.4	B	0.57
	SB	Left	51.8	D	0.25	36.7	D	0.18
		Thru	77.6	E	0.99	67.1	E	0.98
		Right	3.8	A	0.16	67.0	E	0.99
	Overall Intersection		**52.6**	**D**	**0.99**	**55.8**	**E**	**0.99**

Based on the intersection capacity analyses results presented in **Table 10**, the majority of signalized intersections within the study operate with an overall good LOS C or better with reserved capacity during both the AM and PM peak hours. The Western Road / Sarnia Road / Phillip Aziz Avenue intersection operates at a LOS D in the AM Peak hour and a LOS E in the PM Peak Hour. Of all the study area intersections, this intersection has the highest vehicle turning movement volumes combined with very high pedestrian crossing volumes. Each of these movements competes for “green time” with the high through traffic volumes, resulting in the overall poor intersection operation (LOS D and E).

7. Identification of the Problem/Opportunity

As part of Phase 1 of the Class EA process, the problem or deficiency is identified to provide a clear understanding of the problem and or opportunity to be addressed. Therefore, it is necessary to document all factors which lead to the conclusion that an improvement or change is necessary.

The improvement needs at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue were identified in the London 2030 TMP. The TMP noted this intersection should be revised to accommodate the forecasted increase in traffic, address safety and improve road width constraints along Philip Aziz Avenue.

The key signalized intersection of Western Road/Sarnia Road and Philip Aziz Avenue is currently operating near capacity at LOS E during the PM peak hour and at LOS D in the AM peak hour. A number of individual through and turning movements were found to be critical including the eastbound and westbound left turn during both the peak hours. Given this LOS, the movement and safety of pedestrian, bicycle and vehicular traffic will continue to degrade as immediate and anticipated long term growth and development occurs within the area.

Problem:

- Transportation analysis suggests that the existing roadway will experience capacity or over-capacity conditions in some roadway sections along the Western/Sarnia corridors.
- If untreated, traffic congestion will occur resulting in increased delays and decreasing level of service.
- Western Road/Sarnia Road intersection is currently operating at a poor level of service. From a traffic perspective, there are high traffic volumes at this intersection – the highest vehicle turning movement volumes of all the study area intersections. In addition, pedestrian volumes are the highest at Western Road and Sarnia Road / Philip Aziz Avenue intersection compared with other study area intersection. This intersection is one of the main pedestrian crossing locations for the University and has adjacent bus stops with high numbers of transit passengers alighting and boarding near this intersection. Of all the study area intersections, this intersection has the highest vehicle turning movement volumes combined with very high pedestrian crossing volumes. Each of these movements competes for “green time” with the high through traffic volumes, resulting in the overall poor intersection operation (LOS D and E).
- A gap within the on-street cycling infrastructure exists within the study area.
- The removal of the Springett Parking Lot access road through Brescia Lane resulted in added pressure to the only remaining parking lot access through the Western Road/Huron College intersection.

Opportunities:

- Improve turning movements during peak AM and PM hours at the Western Road and Sarnia Road/Philip Aziz Avenue intersection.
- Provide additional roadway capacity by eliminating existing roadway constraints.
- Provide opportunities to improve intersection operations.
- Provide opportunities to improve pedestrian accommodations, including people with disabilities, and cyclist accommodations (i.e., separated/protected cycle lanes).

8. Future Traffic Conditions Analysis

8.1 Future Traffic Volumes

For the purposes of this EA study, projected future traffic volumes corresponding with horizon year 2032 were developed for Western Road corridor using the City of London's city-wide TransCAD model, updated as part of the London 2030 TMP project. These traffic volume forecasts are be based on land use plan developed as part of the TMP.

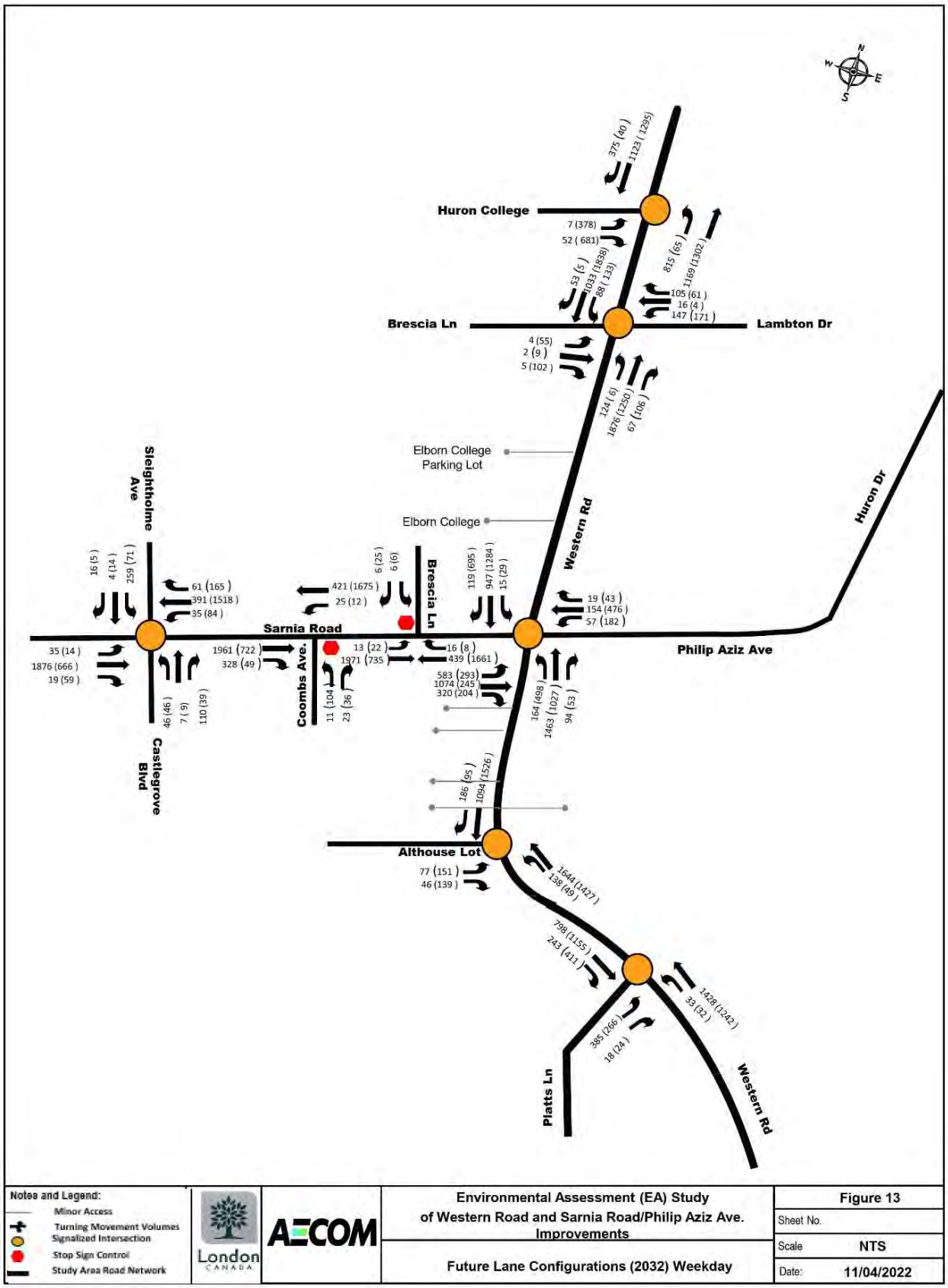
The growth factors for the critical PM peak hour volumes were developed based on average link volumes traffic growth between the TransCAD model base year (year 2021) and forecasting year (year 2032) within the study area for the Western Road and Sarnia Road corridors.

The following growth rates were calculated.

- 1.5% per annum growth rate for north-south traffic volumes on the Western Road corridors
- 0.5% per annum growth rate for east-west traffic volumes on the Sarnia Road corridor
- 2% per annum growth rate for Sleightholme at Sarnia Road intersection as per City's request.

These annual growth rates were applied to the link volumes at Western Road and Sarnia Road corridors and distributed as per the prevailing traffic conditions **Figure 13** illustrates the Future Horizon year (2032) traffic volume.

Figure 13: Future Horizon Year 2032 Volumes



8.2 Future Traffic Operations – Do Nothing Scenario

Traffic analysis was conducted to determine future horizon year 2032 conditions at each of the key intersections along the Western Road corridor within the study area. The existing condition Synchro models were updated with the future projected traffic volumes, keeping all of the other variables (i.e., the lane and intersection configuration) and calibration constant. This is referred to as the Do-Nothing Scenario, as it represents the case where no changes are made to the existing network; however, traffic volumes continue to grow over time. The analysis reviewed the Level of Service (LOS) and volume to capacity ratio (V/C). The intersection analysis was conducted for the intersections noted in **Table 11**.

Table 11: Future Condition Traffic Analysis-AM and PM Hours

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road / Brescia Lane / Lambton Drive (Signalized)	EB	Thru-Left/Thru-Right	19.1	B	0.02	35.5	D	0.47
	WB	Thru-Left/Thru-Right	36.0	D	0.65	36.6	D	0.89dl
	NB	Left	8.8	A	0.41	8.7	A	0.09
		Thru-Right	23.8	C	0.94	9.2	A	0.62
	SB	Left	111.9	F	1.14	31.5	C	0.83
		Thru-Right	23.8	C	0.70	14.2	B	0.82
	Overall Intersection		**26.4**	**C**	**1.14**	**15.3**	**B**	**0.83**
Western Road / Huron College (Signalized)	EB	Left	33.6	C	0.06	32.7	C	0.69
		Right	15.3	B	0.33	93.7	F	1.10
	NB	Left	45.1	D	1.03	77.8	E	0.72
		Thru	2.0	A	0.43	14.0	B	0.75
	SB	Thru/Thru-Right	109.4	F	1.16	39.9	D	0.95
	Overall Intersection		**55.8**	**E**	**1.16**	**39.8**	**D**	**1.10**
Sarnia Road/Brescia Lane (Unsignalized) *traffic lights for pedestrians only	EB	Left	0.20	A	0.01	1.5	A	0.07
		Thru	0.10	A	0.84	0.9	A	0.31
	WB	Thru	0.0	A	0.19	0.0	A	0.71
		Right	0.0	A	0.10	0.0	A	0.36
	SB	Left	29.4	D	0.09	57.0	F	0.33
		Right	29.4	D	0.09	57.0	F	0.33
	Overall Intersection		**0.3**	**A**	**0.84**	**1.0**	**A**	**0.71**
Sarnia Road / Coombs Avenue (Unsignalized)	EB	Thru	0.0	A	0.84	0.0	A	0.31
		Right	0.0	A	0.63	0.0	A	0.19
	WB	Left	7.4	A	0.19	0.2	A	0.02
		Thru	3.9	A	0.19	0.1	A	0.71
	NB	Left	603.6	F	0.92	291.3	F	1.30
		Right	33.8	D	0.17	12.1	B	0.07
	Overall Intersection		**3.4**	**A**	**0.92**	**11.0**	**B**	**1.30**
Sarnia Road / Sleightholme Avenue (Signalized)	EB	Left	8.7	A	0.08	7.9	A	0.10
		Thru	34.2	C	0.98	4.9	A	0.30
	WB	Left	42.5	D	0.52	6.6	A	0.18
		Thru	8.6	A	0.25	10.7	B	0.71
	NB	Left	27.3	C	0.15	21.9	C	0.23
		Thru-Right	27.8	C	0.32	10.2	B	0.17
	SB	Left	65.6	E	0.90	25.1	C	0.37
		Thru-Right	13.5	B	0.05	16.6	B	0.07
	Overall Intersection		**32.3**	**C**	**0.98**	**9.6**	**A**	**0.71**
Western Road / Platts Lane (Signalized)	SB	Thru/Thru-Right	6.9	A	0.55	10.1	B	0.78
	NB	Left	9.2	A	0.17	19.3	B	0.36
		Thru/Thru	12.3	B	0.73	8.5	A	0.60
	EB	Left/Left-Right	26.5	C	0.62	26.4	C	0.54
	Overall Intersection		**12.3**	**B**	**0.73**	**11.0**	**B**	**0.78**

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road / Althouse College (Signalized)	EB	Left	29.4	C	0.37	30.2	C	0.54
		Right	17.0	B	0.22	30.0	C	0.55
	NB	Left	25.1	C	0.66	23.4	C	0.46
		Thru	8.3	A	0.69	8.3	A	0.67
	SB	Thru-Right	5.3	A	0.57	15.0	B	0.78
	Overall Intersection		**8.5**	**A**	**0.69**	**13.6**	**B**	**0.78**
Western Road / Sarnia Road / Philip Aziz Ave (Signalized)	EB	Left	95.2	F	1.11	99.7	F	1.05
		Thru	143.4	F	1.23	32.0	C	0.38
		Right	13.4	B	0.46	5.6	A	0.39
	WB	Left	168.8	F	1.02	75.4	E	0.84
		Thru-Right	38.8	D	0.41	96.3	F	1.04
	NB	Left	225.3	F	1.37	127.6	F	1.16
		Thru/Thru-Right	93.6	F	1.11	28.7	C	0.67
	SB	Left	48.6	D	0.28	39.9	D	0.25
		Thru	65.2	E	0.97	121.4	F	1.16
		Right	6.6	A	0.19	122.8	F	1.16
	Overall Intersection		**95.0**	**F**	**1.37**	**85.6**	**F**	**1.16**

Based on the intersection capacity analyses results presented in **Table 11**, intersection delay is predicted to increase for all of the study area intersections. Western Road/Huron College, and Western Road/Sarnia Road/Philip Aziz Ave intersections are predicted to operate overcapacity with V/C ratio more than 1 and significant delays. All the individual critical movements are highlighted in **Table 11**. Synchro outputs are provided in **Appendix F.**

8.3 Alternatives Assessment – Western Road and Sarnia Road/Philip Aziz Avenue Intersection

Table 12 summarizes the future alternative scenarios considered for the intersection of Western Road and Sarnia Road/Philip Aziz Avenue.

Table 12: Future Alternatives

Scenario	Description
Alternative 1	■ Single left turn lane for northbound direction with typical pedestrian crosswalk
Alternative 2	■ Single left turn lane for northbound direction with scramble pedestrian crosswalk
Alternative 3	■ Introduction of double left turn lanes for northbound direction with typical pedestrian crosswalk
Alternative 4	■ Introduction of double left turn lanes for northbound direction with scramble pedestrian crosswalk

Scramble pedestrian crosswalk is the name given to a special phase in a signalized intersection timing plan that allows pedestrians to cross an intersection to/from all directions; meaning it allows for diagonal crossing of an intersection. A scramble pedestrian crosswalk phase is primarily used for high-pedestrian traffic intersections because it allows for a larger number of pedestrians to cross the intersection than a typical crosswalk. It achieves this by stopping all vehicles for the duration of the scramble phase and giving a walk signal to pedestrians in all directions. Crossing the intersection on a diagonal can reduce the delay for pedestrians who would otherwise have waited for two typical crossing phases to make this same movement. This scramble phase for pedestrians only does increase the delay for vehicles at the intersection.

In the following assessment a Type C scramble intersection is considered. The Type C allows for the special scramble pedestrian only phase, as well as allowing pedestrians to cross during the typical phases, except for during protected left-turns for vehicles. This Type C phase was selected for comparison as Synchro 11 software can assess this type of pedestrian phase.

8.3.1 Alternative 1 – Single Left-turn Lane with Typical Pedestrian Crossing

As discussed in **Section 8.1**, future traffic volumes were analysed using the existing lane configuration and signal timing plans provided by the City of London. The existing cycle length of 130 seconds was kept unchanged for the Do-Nothing scenario. The traffic operational analysis results of the intersection of Western Road and Sarnia Road are summarized in the **Table 11** from the **Section 8.2** assessment, the Future Do-Nothing scenario shows that this intersection operates poorly in both the AM and PM peak hours, LOS F and v/c >1.00 (i.e., 1.37 v/c for a.m. peak and 1.16 v/c for p.m. peak). Detail Synchro outputs are provided in **Appendix F.**

To compare the Do-Nothing scenario between existing and optimized signal timing, the cycle length was optimized to 120 seconds from the existing 130 seconds for the best possible operation. Optimization does not improve the AM peak hour operations, but the intersection operation improves during PM peak hour as the delay reduces from 85.6 seconds to 76.5 seconds. Based on the intersection capacity analyses results presented in **Table 13**, the signalized intersection of the Western Road and Sarnia Road will continue to operate poorly even with signal optimization. The intersection is predicted to operate over capacity during both AM and PM peak hour (overall LOS of “F”), and v/c >1.00 (i.e., 1.40 v/c ratio for a.m. peak and 1.27 v/c ratio for p.m. peak hour).

Table 13: Alternative 1 – 2032 Weekday AM and PM Capacity and LOS analysis

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road/ Sarnia Road/Philip Aziz Ave (Signalized)	EB	Left	89.2	F	1.09	73.8	E	0.96
		Thru	149.9	F	1.25	30.2	C	0.39
		Right	13.7	B	0.47	5.4	A	0.38
	WB	Left	141.2	F	0.94	79.7	E	0.88
		Thru-Right	39.2	D	0.45	108.6	F	1.09
	NB	Left	247.1	F	1.40	173.2	F	1.27
		Thru/Thru-Right	92.5	F	1.11	23.3	C	0.67
	SB	Left	43.8	D	0.26	34.8	C	0.24
		Thru	61.0	E	0.96	91.2	F	1.09
		Right	6.7	A	0.19	88.4	F	1.08
	Overall Intersection		**95**	**F**	**1.40**	**76.5**	**E**	**1.27**

8.3.2 Alternative 2 – Single Left turn Lane with Scramble Pedestrian Crossing

In Alternative 2 a scramble pedestrian crossing at the intersection of Western Road and Sarnia Road is analysed for the 2032 horizon year. The cycle length was optimized to 150 seconds from the existing 130 seconds for the best possible operation with the scramble pedestrian crosswalk. Future traffic volumes were analysed using the existing lane configuration and signal timing plans provided by the City of London. The traffic operational analysis results of the intersection of Western Road and Sarnia Road are summarized in **Table 14**. Detail Synchro outputs are provided in **Appendix F.**

Based on the intersection capacity analyses results presented in **Table 14**, the signalized intersection of the Western Road and Sarnia Road will operate poorly with the addition of a scramble pedestrian crossway. The intersection is predicted to operate over capacity during both AM and PM peak hour (overall LOS of “F”), and v/c >1.00 (i.e., 2.13 v/c for a.m. peak and 1.54 v/c for p.m. peak).

Table 14: Alternative 2 – 2032 Weekday AM and PM Capacity and LOS analysis

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road/ Sarnia Road/Philip Aziz Ave (Signalized)	EB	Left	543.1	F	2.13	298.7	F	1.54
		Thru	444.3	F	1.91	49.2	D	0.51
		Right	22.4	C	0.61	8.4	A	0.47
	WB	Left	230.4	F	1.18	147.7	F	1.09
		Thru-Right	55.4	E	0.53	185.8	F	1.27
	NB	Left	22.6	C	0.48	36.0	D	0.70
		Thru/Thru-Right	25.0	C	0.75	17.1	B	0.56
	SB	Left	32.4	C	0.16	53.6	D	0.28
		Thru	46.1	D	0.80	244.4	F	1.44
		Right	8.6	A	0.22	90.4	F	1.10
	Overall Intersection		**186.0**	**F**	**2.13**	**124.4**	**F**	**1.54**

8.3.3 Alternative 3 – Dual Left-turn Lanes with Typical Pedestrian Crossing

In Alternative 3, northbound dual left turn lanes and a typical pedestrian crossway at the intersection of Western Road and Sarnia Road is analysed. The cycle length was optimized to 120 seconds from the existing 130 seconds for the best possible operation with the dual northbound left turn. Future traffic volumes were analysed using the existing lane configuration and signal timing plans provided by the City of London. The traffic operational analysis results of the intersection of Western Road and Sarnia Road are summarized in **Table 15**. Detail Synchro outputs are provided in **Appendix F.**

Table 15: Alternative 3 – 2032 Weekday AM and PM Capacity and LOS analysis

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road/ Sarnia Road/Philip Aziz Ave (Signalized)	EB	Left	79.6	E	1.07	54.2	D	0.87
		Thru	140.7	F	1.23	28.3	C	0.37
		Right	11.5	B	0.45	5.1	A	0.37
	WB	Left	141.2	F	0.94	77.4	E	0.86
		Thru-Right	39.2	D	0.45	104.9	F	1.08
	NB	Left	163.0	F	1.13	139.6	F	1.16
		Thru/Thru-Right	102.2	F	1.13	25.4	C	0.70
	SB	Left	45.1	D	0.26	33.0	C	0.26
		Thru	74.7	E	1.02	56.5	E	0.97
		Right	7.0	A	0.19	55.5	E	0.98
	Overall Intersection		**94.3**	**F**	**1.23**	**59.0**	**E**	**1.16**

Based on the intersection capacity analyses results presented in **Table** , the signalized intersection of the Western Road and Sarnia Road will continue to experience significant delays (overall LOS of “F” for a.m. peak and LOS “E” for p.m. peak), reflected by an overall v/c ratio greater than 1.0 during both the AM and PM peak hours (i.e., 1.23 v/c for a.m. peak and 1.16 v/c for p.m. peak) even if dual left turns are implemented.

This alternative presents the best overall operation for vehicles at the intersection compared to Alternatives 1, 2 and 4.

8.3.4 Alternative 4 – Dual Left-turn Lanes with Scramble Pedestrian Crossing

In Alternative 4, northbound dual left turn lanes and a scramble pedestrian crossing at the intersection of Western Road and Sarnia Road is analysed. The cycle length was optimized to 150 seconds from the existing 130 seconds for the best possible operation with the dual left turn lanes and scramble pedestrian crosswalk. Future traffic volumes were analysed using the existing lane configuration. The traffic operational analysis results of the intersection of Western Road and Sarnia Road are summarized in **Table 16**. Detail Synchro outputs are provided in **Appendix F.**

Table 16: Alternative 4 – 2032 Weekday AM and PM Capacity and LOS analysis

Intersection	Approach/Movement		Weekday AM			Weekday PM		
			Delay(s)	LOS	V/C	Delay(s)	LOS	V/C
Western Road / Sarnia Road/Philip Aziz Ave (Signalized)	EB	Left	543.1	F	2.13	298.7	F	1.54
		Thru	444.3	F	1.91	49.2	D	0.51
		Right	22.4	C	0.61	8.4	A	0.47
	WB	Left	230.4	F	1.18	147.7	F	1.09
		Thru-Right	55.4	E	0.53	185.8	F	1.27
	NB	Left	65.4	E	0.45	49.8	D	0.52
		Thru/Thru-Right	25.0	C	0.75	17.1	B	0.56
	SB	Left	30.3	C	0.16	35.2	D	0.20
		Thru	37.4	D	0.71	84.5	F	1.04
		Right	7.6	A	0.20	51.4	D	0.98
	Overall Intersection		**185.8**	**F**	**2.13**	**80.8**	**F**	**1.54**

Based on the intersection capacity analyses results presented in **Table 16**, the signalized intersection of the Western Road and Sarnia Road will operate poorly if a dual left turn and scramble pedestrian crossway are implemented. The intersection is predicted to operate over capacity during both AM and PM peak hour (overall LOS of “F”), and v/c >1.00 (i.e., 2.13 v/c for a.m. peak and 1.54 v/c for p.m. peak).

8.4 Turning Lane Sensitivity Assessment

A sensitivity assessment for southbound right turning lane of Western Road at Sarnia Road intersection was conducted using SimTraffic 11. The assessment was done for existing turning lane of 60 m and an increased turning lane of 150 m for the future horizon year 2032 PM scenario.

Table 17: Sensitivity Assessment for Turning Lane

Existing Turning Lane (60 m)			Proposed Turning Lane (150 m)	
Movement	95th percentile Queue	Total Delay/Vehicle	95th percentile Queue	Total Delay/Vehicle
SBL	41.2	96.2	21.7	65.8
SBT	385.7	82.7	219.3	63.3
SBR	67.5	69.5	159.9	36.7

The assessment results in **Table 18** identify that a longer storage length will shorten queue delay for the southbound through and left-turn lanes as fewer vehicles will be blocked by vehicles waiting to enter the southbound right-turn lane, thus improving the overall intersection operation. Details of assessment results are in the **Appendix H**.

9. Multi-Modal Level of Service Analysis

9.1 Existing Conditions (2021)

Multi-Modal Level of Service (MMLOS) analysis is an effective way to capture the levels of service encountered by different users of a particular transportation corridor, including the constituent intersections and segments. This assessment was completed using the MMLOS Guidelines (2022) published by the Ontario Traffic Council (OTC).

The OTC MMLOS guideline categorizes transportation modes into the following 5 categories and sets out distinct Level of Service (LOS) targets for each, depending on the type of facility: pedestrian, bicycle, transit, trucks, and cars.

The target LOS grades are described in the OTC Guide[6] as follows:

- LOS A = Provides the highest quality experience for a given mode;
- LOS B = Provides a high-quality experience for a given mode;
- LOS C = Provides a good-quality experience for a given mode;
- LOS D = Provides a moderate quality experience for a given mode;
- LOS E = Provides just above the minimal targeted standard for a given mode;
- LOS F = Provides the minimal targeted standard for a given mode.

The selected target LOS aims to help create transportation corridors that are less car centric, adding to the traditional operational evaluations which prioritize reducing vehicular delays. Each type of assessment (i.e., road segment, unsignalized intersection, or signalized intersection) and transportation mode have explicit performance measures that dictate their expected LOS. This provides a framework to check the LOS of existing (or proposed) facilities and identify deficiencies that can be addressed in the future (or in future planning documents), to meet the identified targets.

For both the existing and future conditions assessments, the target LOS grades for the Western Road and Sarnia Road corridors are based on the Urban Boulevard facility type. As defined in the OTC MMLOS Guideline[7], and Urban Boulevard incorporates the following features:

- A multimodal corridor through an urban neighbourhood
- Moves moderate volumes of pedestrian, cycling, transit and vehicular traffic
- Balances priority between all modes
- Adjacent land uses vary including residential, light commercial, schools, parks and community centre

The target LOS for each transportation mode for this facility type is as follows:

- Pedestrian = LOS C,
- Bicycle = LOS B,
- Transit = LOS D
- Trucks = not applicable (the OTC Guide does not identify a target LOS for truck in an Urban Boulevard)
- Cars = LOS E

To complete the existing conditions MMLOS analysis the following information was considered:

- No adjustments were made to the target LOS defined for Urban Boulevard in the OTC Guideline in this assessment.
- The existing base plan was used to calculate radius and distance measurements.
- Operating speeds are assumed to be similar to posted speeds, the posted speed limit is 50 km/h.

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[6] *Multi-Modal Level of Service Guideline, Ontario Traffic Council (20-3587), Dillon Consulting, February 2022, Table 3.1, pg. 18*
[7] *Multi-Modal Level of Service Guideline, Ontario Traffic Council (20-3587), Dillon Consulting, February 2022, pg. 20*

- The assessment covers both the AM and PM peak periods. For the total delay and volume to capacity ratio values required in the intersection analysis, an average of the AM and PM Synchro model was used.
- Existing bus stop designs, and locations were considered for "Transit Passenger Amenities".
- The existing conditions Average Daily Traffic Volume is 28,500 vehicles/day for Western Road and 24,000 vehicles/day for Sarnia Road (noted in **Section 4.8** of this report).

The results of the MMLOS analysis for the existing conditions of the identified intersections and road segments in this study area are summarized in **Table 18**. Within the table, items in red text have not met the target, items in black text met the target, and items in green text have exceeded the target LOS. The truck category is shaded grey as it did not have a specified target for this area type, although the assessment results are still shown for this category. Items listed as "no facility" means the existing facility did not meet the minimum requirements for analysis, and therefore did not meet the target LOS. The full analysis report for each segment and intersection can be found in **Appendix I**.

Table 18: Summary of Existing Conditions MMLOS

Area Type: Urban Boulevard					
Mode:	Pedestrians	Bicycles	Transit	Trucks	Cars
Target:	C	B	D	n/a	E
Intersections					
Western Rd/Sarnia Rd/Philip Aziz Ave	E	No facility	E	C	C
Western Rd/Brescia Lane/Lambton Dre	D	No facility	D	C	B
Western Rd/Huron College	D	No facility	D	C	B
Western Rd/Althouse Lot	C	No facility	D	D	B
Coombs Ave/Sarnia Rd	No facility	No facility	D	D	D
Segments					
Western Rd from Sarnia Rd to Brescia Lane/Lambton Dr	E	No facility	D	D	E
Western Rd from Brescia Lane/Lambton Dr to Huron College	C	No facility	F	D	E
Western Rd from Sarnia Rd to Althouse Lot	E	No facility	D	D	E
Western Rd from Althouse Lot to Platt's Lane	E	E	E	D	D
Philip Aziz Ave from Western Rd to start of Huron Dr	No facility	No facility	F	D	C
Sarnia Rd from Western Rd to Coombs Ave	D	No facility	C	D	C
Sarnia Rd from Coombs Ave to Sleightholme Ave/Castlegrove Blvd	E	No facility	D	C	C

From the results, cars are experience the highest LOS of all the modes considered in this analysis, meeting or exceeding the target at every intersection and within every segment. This high vehicular LOS reflects the existing prioritization of car travel. With a posted speed limit of 50 km/h and the existing AADT, separate bicycle facilities are a minimum requirement for assessment. It should be noted that Western Road from Brescia Lane/Lambton Drive to Huron College does have a partial southbound bicycle lane; however, the bike lane terminates mid-segment and thus it was not considered the same as "no facility". Finally, pedestrian LOS was poor along the road segments due to long distances between controlled crossings, often times more than 320 m away. The poor LOS for pedestrians at the intersections is generally attributed to long signal cycle lengths and the number of uncontrolled conflicts at each approach.

9.2 Future Conditions (2032)

In accordance with the City of London Official Plan (2016) and London Complete Streets Manual (2018), select improvements will be incorporated within the study area to prioritize pedestrian, cycle and transit movements. The goal is to accommodate medium to high volumes of cycle, transit, vehicular traffic and pedestrians and meet or exceed the standards set out by the OTC MMLOS Guidelines as well as conform City of London standards. This includes adding bicycle facilities along all segments of the study area, more specifically physically separated bicycle lanes with a buffer (as recommended for roadways with multiple lanes per direction in Section 6.12 of the OTC MMLOS Guidelines). In addition, sidewalks will be widened, crosswalks widened, and landing areas at signalized intersection crossings will be larger to accommodate more pedestrians, all improving the pedestrian experience and thus improving the pedestrian LOS. Improved pedestrian LOS is also linked to better transit LOS. Further, transit LOS is improved through enhancing the existing passenger amenities available to transit users and adding bus bays to the bus stops. The result of the MMLOS Assessment of the preliminary design improvements to the study (future conditions) are summarized in **Table 19**.

Table 19: Summary of Future Conditions MMLOS

Area Type: Urban Boulevard					
Mode:	**Pedestrians**	**Bicycles**	**Transit**	**Trucks**	**Cars**
Target:	**C**	**B**	**D**	**n/a**	**E**
Intersections					
Western Rd/Sarnia Rd/Philip Aziz Ave	D	D	E	D	D
Western Rd/Brescia Lane/Lambton Dr	C	B	D	D	C
Western Rd/Huron College	B	C	D	C	C
Western Rd/Althouse Lot	B	B	C	D	B
Coombs Ave/Sarnia Rd	No facility	No facility	C	E	D
Segments					
Western Rd from Sarnia Rd to Brescia Lane/Lambton Dr	D	B	C	E	D
Western Rd from Brescia Lane/Lambton Dr to Huron College	C	B	C	D	C
Western Rd from Sarnia Rd to Althouse Lot	D	B	C	E	D
Western Rd from Althouse Lot to Platt's Lane	C	B	C	D	C
Philip Aziz Ave from Western Rd to start of Huron Dr	C	B	E	D	B
Sarnia Rd from Western Rd to Coombs Ave	D	B	C	D	C
Sarnia Rd from Coombs Ave to Sleightholme Ave/Castlegrove Blvd	D	B	C	E	E

The assumptions from the existing conditions MMLOS analysis discussed in **Section 9.1** remain the same for the future conditions analysis with the exception of the plan used to calculate radius and distance measurements; this analysis used the recommended preliminary plan including pavement marking drawings.

From the analysis of the future conditions, the planned improvements allow the different facility types to perform at a LOS that meets or exceeding the target LOS or is an improvement from the existing conditions MMLOS. There are only two exceptions: the pedestrian facilities in the segment of Sarnia Road from Western Road to Coombs Avenue is still below the target LOS and did not show an improved LOS over existing conditions for pedestrians;

and the transit services at the Western Road / Sarnia Road and Phillip Aziz Avenue intersection did not meet the target LOS or show improvement over existing conditions.

For all road segments to meet the target LOS C for pedestrian facilities, the maximum distance between controlled crossings must be between 231 to 260 m and the pedestrian facility width should be between 2.1-2.5 m. Four road segments have distances between controlled crossings that are greater than 291 m and a pedestrian facility width of 1.8-2.0 m. However, five of the seven road segments show improvement over the existing conditions for pedestrian accommodations.

As noted previously, there are no existing bicycle facilities, so the future conditions show significant improvement over existing conditions with the addition of bicycle facilities. Only the Coombs Avenue / Sarnia Road intersection does not include facilities on all approaches, and therefore is not assessed in the future conditions.

The intersection of Western Road and Sarnia Road/Philip Aziz Avenue did not meet the target LOS for pedestrians, cyclists and transit users for several reasons. One of the main reasons is due to the long signal cycle length. Any signal cycle length over 120 seconds scores a LOS F for pedestrian facilities and the anticipated signal cycle length for this intersection is 130 seconds. A high number of uncontrolled conflicts related to turning movements at all approaches also contributes to a lower pedestrian LOS. At this high-volume intersection, there are no transit priority measures at any of the approaches, meaning at peak times when certain movements become critical, transit services will also be delayed. LOS for pedestrians, bicycles and transit did improve from existing conditions; however, the LOS for trucks and cars degraded from LOS C to LOS D from existing to future conditions.

The full reports for each road segment and intersection can be found **Appendix J.**

10. Conclusions and Recommendations

10.1 Summary of Assessment Results

Traffic analysis shows that Western Road/Sarnia Road intersection is predicted to operate over capacity in the future horizon year 2032 under all four alternatives analyzed in **Section 8**. Although double left-turn lanes along the northbound approach improve the individual movements' v/c ratios and delays, the improvement is minor. Multi modal level of service (MMLOS) assessment was conducted to observe if there is any potential pedestrian benefit with a dual left turn or scramble pedestrian crosswalk.

The outcome of the assessment shows dual left turn will make the pedestrian operations poor as pedestrians will have to cross additional walking distance if a dual left turn is implemented. Adding the scramble pedestrian crossing phase with or without a dual left turn (Alternatives 2 and 4) doesn't improve the intersection operation, particularly for vehicles movements; rather it is predicted to make the overall intersection operation worse with heavy delay, over capacity and LOS F for both AM and PM peak hour even after optimizing for the best possible operation (cycle length of 150 seconds).The scramble pedestrian crossing phase does operate well for pedestrians, but not sufficiently to justify the increased delay to the overall intersection operations.

Although double left turn lanes for the northbound approach and maintaining a typical pedestrian crossing (Alternative 3) improves the individual movements v/c ratios and delays, the overall intersection is still predicted to operate at LOS F and above capacity during AM peak hour; and at LOS E and above capacity during PM peak hour. However, among all of the alternatives, Alternative 3 (optimized cycle length of 120 seconds) is predicted to operate better when compared to rest of the alternatives proposed for vehicles because of the dual northbound left-turn lane, but it is not an improvement for pedestrian movements over Alternative 1.

Extending the storage lane for the southbound right-turn lane does not change pedestrian crossing delay, and it does improve overall intersection operations.

10.2 Recommended Mitigation Measures

Based on the traffic analysis, it is recommended that the single northbound left turn is maintained for the future horizon year with the typical pedestrian crossings that exist today. This recommendation considers that a dual-left turn lane although beneficial for the northbound left-turn movement alone will further degrade the pedestrian crossing operations at the intersection and does not significantly benefit the overall intersection operations; as well, a scramble-pedestrian phase although beneficial to pedestrians would significantly degrade vehicle travel through the intersection.

A longer southbound right turning lane with 150-meter storage length is recommended for the Western Road/Sarnia Road intersection as it will enhance the overall intersection operation by reducing the queue delay for the southbound through and left-turn lanes as fewer vehicles will be blocked by vehicles waiting to enter the southbound right-turn lane.

The Western Road/Huron College intersection is predicted to operate at overcapacity during both AM and PM peak hours in the future horizon year 2032. The Western Road/Brescia Lane intersection is predicted to operate at overcapacity during AM peak hours in the future horizon year 2032. An alternative exit from the Springett Parking Lot should be considered along with future University and College developments. The alternate exit has the potential to reduce the congestion at Huron College and Brescia lane intersection at Western Road by diverting some of the traffic. This can also contribute to reduced traffic volumes at the southbound right turn and eastbound left-turn of the Western Road/Sarnia Road intersection resulting in better intersection operation and level of service.

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Appendix I

MMLOS Existing Condition (2021) Reports

Intersection of Sarnia Road and Coombs Avenue

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	C	D	D	D
SCENARIO:	*Exisiting Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	UNSIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	C	D	D	D

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	No
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	No
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	No
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	No

MMLOS Evaluation

Measure 1	Average Crossing Distance (m)	Presence of Bicycle Facilities	Transit Movement Delay (s)	Average Effective Turning Radius (m)	Intersection Delay (s)
	Greater than 11	No bike facility	0 - 10	11 - 12	0 - 10
Measure 2	Marked Crossings	Requirement to stop	Pedestrian Level of Service	Car Level of Service	-
	Less than 50% of movements	0 - 15 %		D	
Measure 3	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	-	-	-
	11.0 - 12.9	11.0 - 12.9			
Measure 4		-	-	-	-

Intersection of Western Road and Althouse Lot

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	C	D	D	B
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	C	D	D	B

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	No
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	No
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0	No transit priority measures at any approaches for transit	Less than 11	35 - 59%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	Less than 9	Less than 9	11 - 20	B	11 - 20
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	61 - 75	61 - 75	C		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	1.6 - 2.0	1.6 - 2.0			

Intersection of Western Road and Brescia Lane/Lambton Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	D	D	C	B
SCENARIO:	*Exisiting Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	D	D	C	B

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	No
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	No
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0	No transit priority measures at any approaches for transit	11 - 12	35 - 59%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	11.0 - 12.9	11.0 - 12.9	21 - 35	B	11 - 20
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	76 - 90	76 - 90	D		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	2.1 - 2.5			

Intersection of Western Road and Huron College

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	D	D	C	B
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	D	D	C	B

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	No
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0.01 - 0.25	No transit priority measures at any approaches for transit	13 - 14	60 - 84%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	13.0 - 14.9	13.0 - 14.9	21 - 35	B	21 - 35
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	76 - 90	76 - 90	D		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	1.1 - 1.5	1.6 - 2.0			

Intersection of Western Road and Sarnia Road/Philip Aziz Avenue

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	E	E	C	C
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	E	E	C	C

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	No
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	No
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0	No transit priority measures at any approaches for transit	13 - 14	60 - 84%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	13.0 - 14.9	13.0 - 14.9	36 - 55	C	36 - 55
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	Greater than 120	Greater than 120	D		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	2.6 - 3.0			

Philip Aziz Avenue from Western Road to start of Huron Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	F	F	D	C
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	F	F	D	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	No
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.5 - 1.7	Less than 1.2	Mixed traffic with 1 lane per direction	Less than 3.4	0.70 - 0.79
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.6 - 2.0	Has no physical measures and buffer width is < 0.5	No presence of passenger amenities such as shelters, seating, shade trees, etc.	C	5-6
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	201 - 230	One "moderate" conflict indicator and one "high" conflict indicator			
Measure 4		-	-	-	-

Sarnia Road from Coombs Avenue to Sleightholme Avenue/Castlegrove Boulevard

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	E	D	C	C
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	E	D	C	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.5 - 1.7	Less than 1.2	Mixed traffic with > 1 lane per direction	3.4 - 3.6	0.80 - 0.89
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.3 - 1.5	Has no physical measures and buffer width is < 0.5	Low presence of passenger amenities such as shelters, seating, shade trees, etc.	C	3-4
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	One "low" conflict indicator and one "high" conflict indicator	E		
Measure 4		-	-	-	-

Sarnia Road from Western Road to Coombs Avenue

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	F	C	D	C
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	F	C	D	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.5 - 1.7	Less than 1.2	Mixed traffic with > 1 lane per direction	Less than 3.4	0.70 - 0.79
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	Greater than 2.5	Has no physical measures and buffer width is < 0.5	Moderate presence of passenger amenities such as shelters, seating, shade trees, etc.	C	5-6
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	One "moderate" conflict indicator and one "high" conflict indicator	D		
Measure 4		-	-	-	-

Western Road from Althouse Lot to Platt's Lane

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	E	E	D	D
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	E	E	D	D

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.5 - 1.7	1.2 - 1.5	Mixed traffic with > 1 lane per direction	3.4 - 3.6	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.3 - 1.5	Has no physical measures and buffer width is < 0.5	No presence of passenger amenities such as shelters, seating, shade trees, etc.	D	5-6
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	291 - 320	One "moderate" conflict indicator and one "high" conflict indicator	E		
Measure 4		-	-	-	-

Western Road from Brescia Lane/Lambton Drive to Huron College

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	E	F	D	E
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	E	F	D	E

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.2 - 1.5	Mixed traffic with > 1 lane per direction	3.4 - 3.6	Greater than 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.6 - 2.0	Has no physical measures and buffer width is < 0.5	No presence of passenger amenities such as shelters, seating, shade trees, etc.	E	5-6
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	200	One "low" conflict indicator and one "high" conflict indicator			
Measure 4		-	-	-	-

Western Road from Sarnia Road to Althouse Lot

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	E	D	D	E
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	E	D	D	E

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.5 - 1.7	Less than 1.2	Mixed traffic with > 1 lane per direction	3.4 - 3.6	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.0 - 1.2	Has physical measures AND buffer width is 0.5 - 1	Moderate presence of passenger amenities such as shelters, seating, shade trees, etc.	E	9+
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	Two "high" conflict indicators	E		
Measure 4		-	-	-	-

Western Road from Sarnia Road to Brescia Lane/Lambton Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	F	D	D	E
SCENARIO:	*Existing Conditions*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	F	D	D	E

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	No

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	Less than 1.2	Mixed traffic with > 1 lane per direction	3.4 - 3.6	Greater than 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	1.0 - 1.2	Has no physical measures and buffer width is < 0.5	Low presence of passenger amenities such as shelters, seating, shade trees, etc.	E	5-6
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	One "moderate" conflict indicator and one "high" conflict indicator	E		
Measure 4		-	-	-	-

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Appendix J

MMLOS Future Condition (2032) Reports

Intersection of Coombs Avenue and Sarnia Road

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	B	C	E	D
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	UNSIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	B	C	E	D

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	No
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	Yes
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	No
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Average Crossing Distance (m)	Presence of Bicycle Facilities	Transit Movement Delay (s)	Average Effective Turning Radius (m)	Intersection Delay (s)
	Greater than 11	Bike facility on 3/4 or 2/3 approaches	0 - 10	Less than 11	0 - 10
Measure 2	Marked Crossings	Requirement to stop	Pedestrian Level of Service	Car Level of Service	-
	Less than 50% of movements	0 - 15 %	E	D	
Measure 3	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	-	-	-
	9.0 - 10.9	9.0 - 10.9			
Measure 4		-	-	-	-

Intersection of Western Road and Althouse Lot

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	B	B	C	D	B
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	B	B	C	D	B

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	Yes
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	Yes
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0.76 - 1	0.76 - 1	No transit priority measures at any approaches for transit	Less than 11	60 - 84%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	Less than 9	Less than 9	0 - 10	B	11 - 20
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	61 - 75	61 - 75	B		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	1.6 - 2.0	1.6 - 2.0			

Intersection of Western Road and Brescia Lane/Lambton Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	B	D	D	C
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	B	D	D	C

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	Yes
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	Yes
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	> 1	> 1	No transit priority measures at any approaches for transit	Less than 11	10 - 34%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	9.0 - 10.9	9.0 - 10.9	11 - 20	C	21 - 35
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	76 - 90	76 - 90	C		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	2.1 - 2.5			

Intersection of Western Road and Huron College

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	B	C	D	C	C
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	B	C	D	C	C

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	Yes
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	Yes
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	> 1	0.76 - 1	No transit priority measures at any approaches for transit	13 - 14	60 - 84%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	11.0 - 12.9	11.0 - 12.9	36 - 55	C	36 - 55
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	76 - 90	76 - 90	B		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	1.6 - 2.0	2.1 - 2.5			

Intersection of Western Road and Sarnia Road/Philip Aziz Avenue

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	D	E	D	D
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SIGNALIZED INTERSECTIONS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	D	E	D	D

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	Yes
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	Yes
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	Yes
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	Yes
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	Yes

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	> 1	> 1	No transit priority measures at any approaches for transit	13 - 14	60 - 84%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	11.0 - 12.9	11.0 - 12.9	56 - 80	D	Greater than 80
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	Greater than 120	Greater than 120	D		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	Greater than 3			

Philip Aziz Avenue from Western Road to start of Huron Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	B	E	D	B
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	B	E	D	B

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.9 - 2.1	Mixed traffic with 1 lane per direction	Less than 3.4	0.60 - 0.69
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	2.1 - 2.5	Has physical measures AND buffer width is 0.5 - 1	No presence of passenger amenities such as shelters, seating, shade trees, etc.	B	1-2
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	201 - 230	Two "low" conflict indicators	C		
Measure 4		-	-	-	-

Sarnia Road from Coombs Avenue to Sleightholme Avenue/Castlegrove Boulevard

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	B	C	E	E
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	B	C	E	E

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.6 - 1.8	Mixed traffic with > 1 lane per direction	Less than 3.4	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	Greater than 2.5	Has physical measures AND buffer width > 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	E	7-8
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	One "low" conflict indicator and one "moderate" conflict indicator	D		
Measure 4		-	-	-	-

Sarnia Road from Western Road to Coombs Avenue

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	B	C	D	C
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	B	C	D	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.6 - 1.8	Mixed traffic with > 1 lane per direction	Less than 3.4	0.80 - 0.89
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	Greater than 2.5	Has physical measures AND buffer width > 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	C	3-4
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	Two "low" conflict indicators	D		
Measure 4		-	-	-	-

Western Road from Althouse Lot to Platt's Lane

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	B	C	D	C
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	B	C	D	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.9 - 2.1	Mixed traffic with > 1 lane per direction	Less than 3.4	0.80 - 0.89
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	2.1 - 2.5	Has physical measures AND buffer width is 0.5 - 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	C	1-2
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	231 - 260	Two "low" conflict indicators	C		
Measure 4		-	-	-	-

Western Road from Brescia Lane/Lambton Drive to Huron College

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	C	B	C	D	C
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	C	B	C	D	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.9 - 2.1	Mixed traffic with > 1 lane per direction	Less than 3.4	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	2.1 - 2.5	Has physical measures AND buffer width is 0.5 - 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	C	1-2
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	261 - 290	Two "low" conflict indicators	C		
Measure 4		-	-	-	-

Western Road from Sarnia Road to Althouse Lot

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	B	C	E	D
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	B	C	E	D

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.9 - 2.1	Mixed traffic with > 1 lane per direction	Less than 3.4	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	2.1 - 2.5	Has physical measures AND buffer width is 0.5 - 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	D	3-4
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	291 - 320	Two "low" conflict indicators	D		
Measure 4		-	-	-	-

Western Road from Sarnia Road to Brescia Lane/Lambton Drive

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	D	B	C	E	D
SCENARIO:	*Future Alternative with EA Improvements*				
Area Type:	*Urban Boulevard*				
MODE					
Type	SEGMENTS				
Target (Custom if necessary)	C	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	D	B	C	E	D

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	Yes
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	Yes

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	1.8 - 2.0	1.9 - 2.1	Mixed traffic with > 1 lane per direction	Less than 3.4	0.90 - 1.00
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	2.1 - 2.5	Has physical measures AND buffer width is 0.5 - 1	Abundance of passenger amenities such as shelters, seating, shade trees, etc.	D	3-4
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	Two "low" conflict indicators	D		
Measure 4		-	-	-	-

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Appendix B

B.2 Environmental Impact Study

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Western Road and Sarnia Road / Philip Aziz Avenue Improvements

Schedule ‘C’ Class Environmental Assessment

The Corporation of the City of London

60661402

February 2023

Delivering a better world

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Corporation of the City of London ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

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Executive Summary

AECOM Canada Ltd. (AECOM) has been retained by the City of London (hereafter referred to as 'the City') to complete an Environmental Impact Study (EIS) in support of the Environmental Study Report (ESR) as part of the Municipal Class Environmental Assessment for the infrastructure improvements along Western Road and Sarnia Road / Philip Aziz Avenue in London, Ontario. The proposed works includes improvements to Sarnia Road, Philip Aziz Avenue East, Western Road and the intersection of Western Road and Sarnia Road, as well as the construction of a new stormwater outfall at the Thames River on Philip Aziz Avenue East. This EIS report provides study background and context for the Project, describes the existing environmental conditions (based on information collected through background information review and ecological field investigations), evaluates and identifies significant natural heritage features, describes the proposed project works, assesses potential environmental impacts, and outlines a preliminary Environmental Management Plan to achieve no net negative impacts.

The Project Limits extend along Western Road from Platts Lane northerly to Huron College and the Sarnia Road/Philip Aziz Avenue corridor, extending from Coombs Avenue easterly to the Thames River. The Project Limits also extends north of Sarnia Road into the University of Western Ontario campus. The Study Area includes a 120 m around the Project Limits.

Existing aquatic and terrestrial conditions were identified through a background review of secondary sources and field investigations. A Species at Risk (SAR) and Significant Wildlife Habitat (SWH) screening were completed based on the existing conditions data and species records identified. The existing natural heritage features identified within the Study Area for the Project through the comprehensive natural heritage background review and field program include the following:

Municipally/Provincially recognized natural heritage features:

- Significant Valleylands;
- Significant Groundwater Recharge Areas; and
- Highly Vulnerable Aquifers.

SWH

- Confirmed
  - Seasonal Concentration Areas: Turtle Nesting Area and Amphibian Breeding;
  - Specialized Habitat for Wildlife: Habitat for Species of Conservation Concern (SOCC) including Snapping Turtle (*Chelydra serpentina*), Northern Sunfish (*Lepomis peltastes)*, and Northern Map Turtle (*Graptemys geographica*); and,
  - Provincially rare Fresh – Moist Black Walnut Lowland Deciduous Forest (FOD7-4) and Dry Fresh Hickory Deciduous Forest Type (FOD2-3) vegetation communities.
- Candidate
  - Seasonal Concentration Areas: Bat Maternity Colonies and Turtle Wintering Areas;
  - Specialized Habitat for Wildlife: Habitat for SOCC including bald eagle (*Haliaeetus leucocephalus*), barn swallow (*Hirundo riparia*), common nighthawk (*Chordeiles minor*), eastern wood-pewee (*Contopus virens*), golden-winged warbler (*Vermivora chrysoptera*), peregrine falcon (*Falco peregrinus*), wood thrush (*Hylocichla mustelina*) and monarch (*Danaus plexippus*).
  - Animal movement corridor was identified as Amphibian Movement Corridors.

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SAR Habitat

- Confirmed
  - Black Redhorse (*Moxostoma duquesnei*; Critical Habitat).
  - Silver Shiner (*Notropis photogenis*; Critical Habitat).
  - Wavy-rayed Lampmussel (*Lampsilis Fasciola*).
  - Spiny Softshell (*Apalone spinifera*).
- Candidate (i.e., potential)
  - Little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), tri-colored bat (*Perimyotis subflavus*), and eastern small-footed myotis (*Myotis leibii*), queensnake (*Regina septemvittata*), American chestnut (*Castanea dentata)* and eastern false rue-anemone *(Enemion biternatum)*.

Potential impacts from the proposed works include damage and disturbance to adjacent natural features, disturbance to terrestrial wildlife, including SAR and SOCC, increased sedimentation and erosion potential, and disturbance to fish and mussel species and their habitat. Avoidance measures, such as the work limit restrictions designed (i.e., relocating the proposed outfall 50 m downstream of the existing outfall to avoid impacts to turtle habitat) for the Project and compliance with restriction of construction activities to outside of sensitive periods for local or significant wildlife species, in addition to incorporation of mitigation measures such as installation of tree protection fencing, wildlife exclusion measures, erosion and sediment control measures, machinery and equipment practices, and invasive species control strategies can aid in addressing these potential impacts.

The anticipated permits and approvals required to complete the Project prior to the commencement of rehabilitation activities include a Request for Review submission to Fisheries and Oceans Canada (DFO) for Project review under the *Fisheries Act* and *Species at Risk Act* (SARA), SARA permit for the handling of fish and mussel SAR during relocation from in-water work areas, authorizations under the ESA for aquatic SAR habitat and handling of aquatic SAR during relocation, as well as turtle SAR habitat and potential bat SAR habitat if these cannot be avoided, and submission of an Application for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses to the Upper Thames Conservation Authority (UTRCA) under Ontario Regulation 157/06 of the *Conservation Authorities Act*.

The following additional field studies may be required during detail design:

- Update SAR habitat screening as protection statuses of species under the ESA or SARA may change over time.
- Potential SAR presence/absence surveys following Ministry of the Environment, Conservation and Park's approved protocols and guidelines that may be required during Detail Design, which are subject to change based on the updated SAR habitat screening and design-related impacts to suitable SAR, include but are not limited to the following:
  - Bat leaf-off cavity tree and acoustic surveys;
  - Visual encounter and basking surveys for queensnake and spiny softshell.
  - Anuran nocturnal calling surveys following the Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (BSC *et al.* 2009).
- A tree inventory to document required removals based on the construction footprint and for use in consideration of replacement plantings.
- A fluvial geomorphological assessment with review of the hydraulic properties (HEC RAS hydraulic model output) of the Thames River and the outlet channel to understand the sediment deposition processes contributing to turtle habitat at the existing outfall if it is to be plugged and non-functional.

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- An Environmental Management Plan is to be prepared during the detail design prior to issuance of contract drawings where the mitigation measures are tailored to the site based on the recommendations identified in this EIS report and shall include the following supporting documents/plans:
  - The Clean Equipment Protocol for Industry (Halloran et al., 2013)
  - Spill Response Plan
  - Invasive Species Management Plan
  - Construction Monitoring and Inspection Plan
  - Species at Risk and General Wildlife Handling Protocol

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1. Introduction

AECOM has been retained by the City of London (hereafter referred to as 'the City') to complete an Environmental Impact Study (EIS) in support of the Environmental Study Report (ESR) as part of the Municipal Class Environmental Assessment (MCEA) for the infrastructure improvements along Western Road and Sarnia Road / Philip Aziz Avenue in London, Ontario (i.e., the Project).

This EIS report provides study background and context for the Project, describes the existing environmental conditions (based on information collected through background information review and ecological field investigations), evaluates and identifies significant natural heritage features, describes the proposed project works, assesses potential environmental impacts, and outlines a preliminary Environmental Management Plan (EMP) to achieve no net negative impacts.

This document is intended to fulfill the requirements for an EIS in accordance with the City of London Official Plan policies (City of London, 2022), *Conservation Authorities Act* Section 28 permit requirements, the Provincial Policy Statement, 2020 (PPS)'s Natural Heritage policies (Ontario Ministry of Municipal Affairs and Housing [MMAH], 2020), and the Natural Heritage Reference Manual's (NHRM) guidelines (Ontario Ministry of Natural Resources and Forestry [MNRF], 2010).

The EMP section of this report is based on conceptual design that has been developed and provides avoidance, mitigation, compensation, and monitoring requirements for incorporation into engineering contract drawings and specifications during the detail design phase to ensure implementation of the recommendations of this report.

Where information from this report has been incorporated into other reports, documents, drawings or applications, this report should be referenced in its entirety to provide context and to facilitate the comprehensive implementation of recommendations.

1.1 Project Background

In 2015 AECOM initiated consultation and conceptual design work as part of a MCEA for the Western Road and Sarnia Road / Philip Aziz Avenue study area. The project was placed on hold in 2016 when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). Given that the north and west routes for RT were deferred for future discussion and after the next update of the Transportation Master Plan in 2030, the City has chosen to reactivate the project. Prior to the project being placed on hold, AECOM completed an Existing Conditions Report (hereafter "*2015 Existing Conditions Report*") which included a desktop background review, Ecological Land Classification (ELC), tree inventory, and a review of Species at Risk (SAR) records in the area (AECOM, 2015a).

1.2 Study Area

The Construction Disturbance Area (CDA) is the outermost area that will be disturbed from construction based on conceptual design. The Study Area and CDA for this EIS Report extends along Western Road from Platts Lane northerly to Huron College and the Sarnia Road/Philip Aziz Avenue corridor, extending from Coombs Avenue easterly to the Thames River. The Study Area also extends north of Sarnia Road into a potential new parking lot entrance and connection to existing parking lots on the University of Western Ontario campus. An additional 120 metres (m) was included to allow for the identification of natural heritage features on adjacent Lands as defined by the Natural Heritage Reference Manual (MNRF, 2010). **Figure 1** below shows the extent of the Study Area and CDA.

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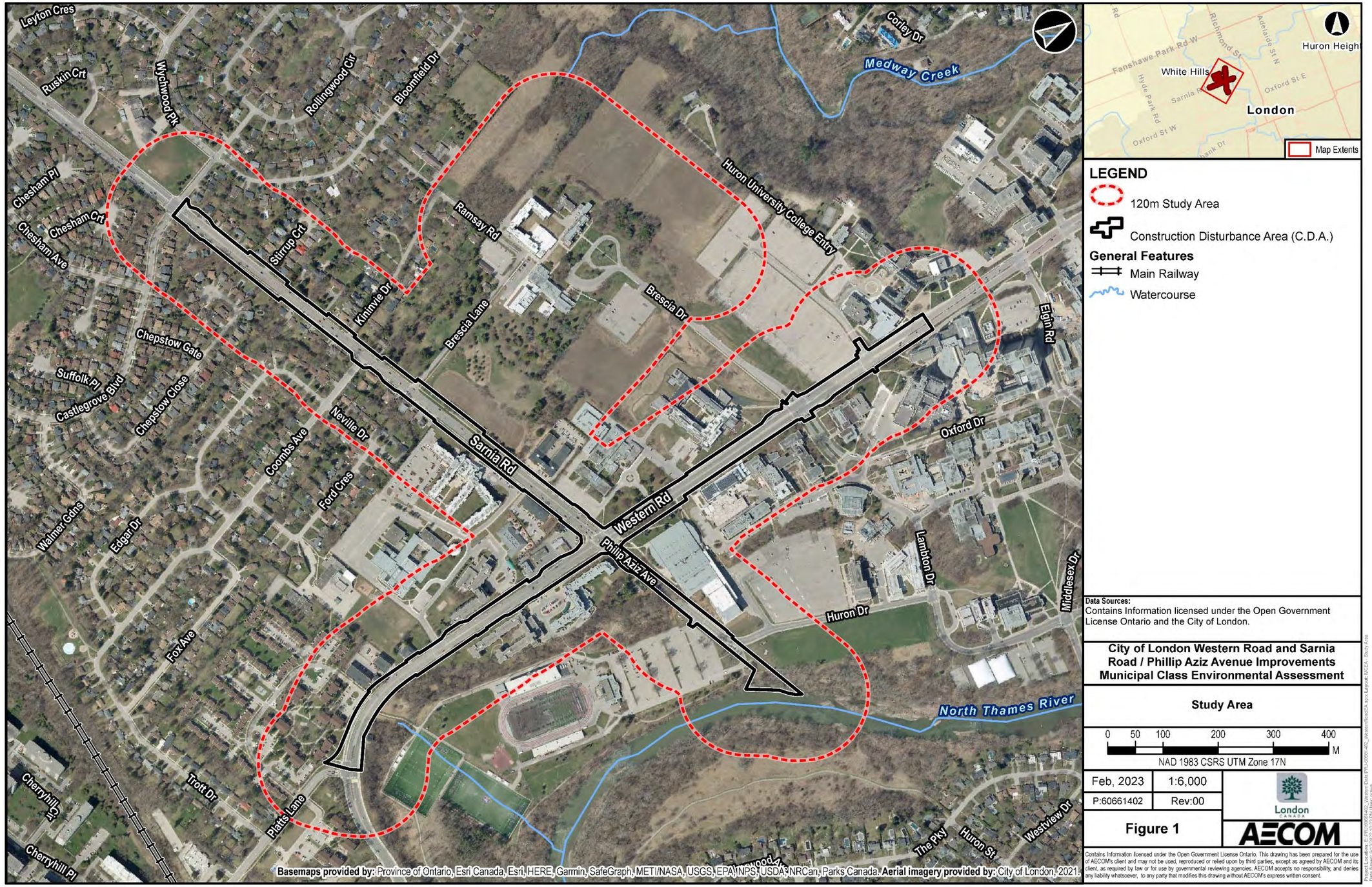
Figure 1: Study Area



1.3 Environmental Policy Context

The Project triggers requirements under, and consideration for, legislation with municipal, and federal jurisdictions. The requirements and considerations for each level of government are outlined in **Table 1-1**.

1.4 Scope of Work

The scope of work for this EIS was prepared in consultation with City Ecologist, UTRCA staff, and the Environmental and Ecological Planning Advisory Committee (EEPAC). The natural environment component of the MCEA was prepared in accordance with *The London Plan* (City of London, 2022) and the *City of London Environmental Management Guidelines* (City of London, 2021). An EIS checklist was submitted to the City on June 10, 2021 to initiate a scoping consultation meeting for the EIS and was confirmed with the City, UTRCA and EEPAC during the EIS scope consultation meeting on August 6, 2021. The EIS Checklist and a record of meeting minutes from the scope consultation meeting is provided in **Appendix A**. Based on the EIS scoping meeting, the scope of work and work plan were agreed upon and included the following tasks:

- Background Review;
- Agency consultation and information requests;
- Confirmatory SAR screening and habitat assessment;
- Confirmatory Significant Wildlife Habitat (SWH) screening;
- Field Investigations:
  - Breeding Bird Surveys
  - Aquatic habitat assessment;
  - Confirmatory ELC delineation;
  - Three season floral inventory; and,
  - Identification of suitable ELC communities for roosting bat SAR.
- Assessment of Potential Impacts; and
- Preliminary EMP preparation.

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Table 1-1: Environmental Policies and Legislation

Level of Government	Legislation	Governing Authority	Relevant Information
Federal	*Fisheries Act, 1985*	Fisheries and Oceans Canada (DFO)	■ The *Fisheries Act* habitat protection provisions under Section 35 prohibit any work, undertaking, or activity that results in the harmful alteration, disruption, or destruction (HADD) of fish habitat. ■ Section 34.4 prohibit any works the result in the death of fish. ■ If project proponents are unable to reduce the risk of the death of fish or HADD of fish habitat through the implementation of DFO's Measures to Protect Fish and Fish Habitat, applicable Standards and Codes of Practice, or fall under the exclusion criteria presented on DFO's Work Near Water website, they must submit a Request for Review to DFO. ■ If the works can avoid the death of fish or HADD of fish habitat, DFO may issue a letter that outlines the implementation of measures to avoid and mitigate impacts to fish and fish habitat; if not, they will request an application for Authorization under Paragraph 35(2) of the *Fisheries Act* that may include the need for plans to offset the impacts to fish and fish habitat.
Federal	*Migratory Birds Convention Act, 1994* (MBCA)	Environment and Climate Change Canada (ECCC)	■ The MBCA is intended to protect migratory birds, their eggs, and their active nests. ■ The Act includes protections for more than 700 species of birds. ■ The MBCA prohibits the possession, destruction, and harm of migratory birds and/or their nests while there is a live bird or a viable egg in it for most migratory birds except for 18 species that have site fidelity and reuse their nests from year to year and receive year-round nest protection whether there are eggs or live birds in there or not.
Federal	*Species at Risk Act, 2002* (SARA)	Environment and Climate Change Canada - Canadian Wildlife Services (ECCC – CWS), DFO	■ SARA protects and ensures the recovery of Species at Risk (SAR) listed on Schedule 1 as Extirpated, Endangered, and Threatened, and their Critical Habitats at a federal level. These species are protected on federal lands (First Nations reserves, national parks, etc.). SARA classifies SAR as follows: ■ Extirpated - a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild ■ Endangered - a wildlife species that is facing imminent extirpation or extinction ■ Threatened - a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction ■ Special Concern - a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (SARA, 2002). ■ SARA also manages species of Special Concern by identifying proactive measures to prevent them from becoming Endangered or Threatened. ■ This Act includes prohibitions against killing, harming, harassing, capturing, or taking an individual of a SAR, prohibits the destruction of their Critical Habitats and can impose restrictions on development and construction projects. ■ Species listed as Extirpated, Endangered, or Threatened under SARA are only protected on federal lands unless they are aquatic species or migratory birds listed on Schedule 1. The Governor and Council may issue an order for additional species listed as SAR under SARA to be protected on non-federal lands where Critical Habitat has been identified and other provincial or municipal legislation does not adequately protect the species. ■ DFO administers provisions of SARA related to aquatic species, except where the species are located in waters managed by Parks Canada.
Provincial	*Endangered Species Act, 2007* (ESA)	Ontario Ministry of Environment, Conservation and Parks (MECP)	■ Under the ESA, species are listed as Extirpated, Endangered, Threatened, and Special Concern. ■ The ESA prohibits the killing, harming, or harassment of Endangered or Threatened species and the damage or destruction of their habitat. ■ MECP may grant a permit, or other authorization, for activities that would otherwise not be allowable under the ESA. ■ For the purposes of this report, Special Concern species are considered *Species of Conservation Concern (SOCC)*.
Provincial	*Fish and Wildlife Conservation Act, 1997*	Ontario Ministry of Natural Resources and Forestry (MNRF)	■ Provides protection and regulation (e.g., ownership and possession, sale, facilities, administrative, import/export, transportation, habitat, for fish and wildlife in Ontario. ■ Includes protection for raptors and other bird species not protected under the MBCA. Nests of these bird species can only be removed if a permit is obtained from the MNRF
Provincial	*Planning Act, 1990* and Provincial Policy Statement, 2020 (PPS)	Ministry of Municipal Affairs and Housing (MMAH)	■ The PPS was issued under Section 3 of the *Ontario Planning Act, 1990*. ■ The PPS identifies seven types of natural heritage features to be protected: – Significant habitat of endangered or threatened species; – Significant wetlands; – Coastal wetlands; – Significant woodlands in Ecoregions 6E and 7E; – Significant valley lands in Ecoregions 6E and 7E; – Significant wildlife habitat (including habitat of SOCC); and, – Significant Areas of Natural and Scientific Interest (ANSI). ■ Policies in the PPS are used to guide decision making in the *Class EA for Provincial Transportation Facilities* process. Under the PPS, development and site alteration are prohibited in significant wetlands. In addition, development and site alteration are not permitted within the remaining natural heritage features or adjacent lands (50 m to 120 m), including adjacent lands to significant wetlands, unless it can be shown that there will be no negative impact through a natural environment evaluation.
Municipal	*The London Plan (2022)*	City of London	■ *The London Plan* was adopted by City Council on June 23, 2016 and was approved by the Minister on December 28, 2016 (City of London, 2016). *The London Plan* establishes a policy framework to guide the City's growth and development. The objectives and policies of *The London* Plan direct Council's decisions for the physical development of the Municipality while having regard for relevant social, economic, and environmental matters. All decisions of the Municipality must be consistent with the policies of *The London Plan*. Several environmental Policies and Maps of The London Plan are under appeal before the Local Planning Appeal Tribunal (LPAT; formerly the Ontario Municipal Board). ■ General requirements for an EIS are detailed in The London Plan (2022) under Environmental Policies. Policy 1438 of the London Plan states: "*When an Environmental Assessment of a proposal is carried out under the Environmental Assessment Act or relevant federal legislation, the requirements for an EIS will be scoped to include issues that have not been adequately addressed through the Environmental Assessment process. Alternatives involving activities that create or maintain infrastructure proposed within the Natural Heritage System will be considered only after evaluating options that would avoid development and site alteration within the Natural Heritage System*" (City of London, 2022). The guidelines for applying those policies are further articulated in the City's Environmental Management Guidelines (City of London, 2021), which outline the EIS review process and reporting requirements.

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Level of Government	Legislation	Governing Authority	Relevant Information
Municipal	*London Invasive Plant Management Strategy (2017)*	City of London	■ The *City of London implemented the London Invasive Plant Management Strategy (LIPMS)* to support the natural heritage policies of the London Plan. This document provides a framework for controlling and eliminating invasive species within the City to aid in preserving and enhancing the City's Natural Heritage System. Six species have been identified as Priority Species, including the following: – Common reed (*Phragmites australis* ssp. *australis*), – Japanese knotweed (*Reynoutria japonica*), – Common buckthorn (*Rhamnus cathartica*), – Glossy buckthorn (*Frangula alnus*), – Dog-strangling vine (*Vincetoxicum rossicum*), and – Giant hogweed (*Heracleum mantegazzianum*). ■ The LIPMS Strategic process includes the following: – Inventory/Mapping of existing priority invasive plants; – Early Detection and Rapid Response to new invasions; – Management of established invasive plant colonies (using containment, eradication control measures); – Restoration of native communities; and ■ Prevention of new invasions.
Local	*O.Reg. 157/06: UTRCA Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*	Upper Thames River Conservation Authority (UTRCA)	■ The Regulation prohibits development in or on the areas within the jurisdiction of UTRCA – delineated as the "Regulation Limit" – described in subsection 2(1). ■ The UTRCA may grant permission for development if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development. ■ An application for permission to undertake development must be filed with UTRCA, containing the information detailed in Section 4, for all works within the UTRCA Regulation Limit.

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2. Methods

2.1 Background Information Review

A desktop review of natural heritage information, including SAR and SOCC occurrences and natural features, was conducted from the following publicly available sources:

- MNRF's Natural Heritage Information Centre (NHIC): Make-a-map feature (2022a) and MNRF's Land Information Ontario GeoHub base (2022b) for:
  - Designated natural areas (e.g., Areas of Natural and Scientific Interest, wooded areas, Provincially Significant Wetlands/Locally Significant Wetlands [LSWs] / unevaluated wetlands, provincial parks);
  - Aquatic Resource Areas;
  - Dam Inventory,
  - Watershed mapping;
  - Wildlife habitats;
  - Aerial Photography; and
  - NHIC provincially tracked species.
- Wildlife Atlases:
  - Ontario Breeding Bird Atlas (OBBA; Bird Studies Canada et al., 2006);
  - Ontario Reptile and Amphibian Atlas (ORAA; Ontario Nature, 2019);
  - Ontario Butterfly Atlas (OBA; Toronto Entomologists' Association [TEA], 2022);
  - Bat Conservation International (BCI) Species Profile and Range Maps (2022);
  - Fisheries and Oceans Canada (DFO) Aquatic Species at Risk (SAR) map (DFO, 2022);
  - eBird (2022); and
  - iNaturalist (2022).
- Planning Documents and Guidelines:
  - *Natural Heritage Reference Manual* (MNRF, 2010);
  - Species at Risk Public Registry (ECCC, 2023);
  - Species at Risk in Ontario (SARO) List (MECP, 2018).
  - *Significant Wildlife Habitat Technical Guide* (Ministry of Natural Resources and Forestry, 2000);
  - *Significant Wildlife Habitat Criteria Schedules For Ecoregion 7E* (Ministry of Natural Resources and Forestry, 2015a);
  - *2017 Watershed Report Card – The Forks* (UTRCA, 2017);
  - The *London Plan* (2022);
  - *London Invasive Plant Management Strategy (2017);* and,
  - *City of London Environmental Management Guidelines* (2021).
- Reports:
  - *Western Road, Sarnia Road/Philip Aziz Avenue Improvements Class EA* (AECOM, 2015a);
  - *Western Road, Sarnia Road/Philip Aziz Avenue Tree Assessment and Inventory* (AECOM, 2015b); and,
  - *Huron Street Watermain Crossing Municipal Class EA Scoped Environmental Impact Study* (Stantec Consulting Ltd., 2012).
- Aerial photographic Imagery (City of London, 2021).

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2.1.1 Agency Consultation

In addition to the desktop review conducted using the secondary sources outlined in **Section 2.1**, data requests were sent to relevant agencies to obtain and confirm natural heritage data that was not publicly available from online sources as well as a site visit was completed with UTRCA**. Table 2-1** below provides a summary of agency consultation completed for this Project and the information received from each agency to date.

Table 2-1: Natural Heritage Data Received from Agencies

Agency	Correspondence Date	Information Received / Comments
City of London	September 15, 2021	■ Flood hazard Mapping
City of London	August 6, 2021	■ UTRCA Huronwatermain SAR Habitat Memo ■ UTRCA *per. comms.* for Huronwatermain SAR Habitat June 23, 2021
UTRCA	August 18, 2021	■ Site visit with UTRCA staff (Scott Gillingwater) to discuss SAR habitat
MECP	August 24, 2022	■ MECP *per. comms.* for SAR records January 30, 2023

2.2 Field Investigations

Table 2-2 summarizes all aquatic and terrestrial investigations relevant to the Study Area that have been completed to date, including those investigations completed in support of the *2015 Existing Conditions Report*. The following sections document the detailed methods and the results of these investigations.

A separate tree inventory and assessment was completed in 2015 by AECOM Arborists which is provided under a separate cover titled "*Western Road and Sarnia Road/Philip Aziz Avenue Tree Assessment and Inventory*" (AECOM, 2015b). An updated arborist report will be produced to document any updates to the tree inventory and assessment during the detail design phase.

Table 2-2: Summary of Field Surveys Conducted for the Study Area

Survey Type	AECOM Field Staff	Survey Dates	Notes
ELC Survey and Floral Inventory	■ Jillian deMan ■ Tom Shorney	August 28, 2015	■ Completed in support of the 2015 Existing Conditions Report.
SAR and SWH Screening	■ Jillian deMan ■ Tom Shorney	August 28, 2015	■ Completed in support of the 2015 Existing Conditions Report.
Incidental Observations	■ Jillian deMan ■ Tom Shorney	August 28, 2015	■ Completed in support of the 2015 Existing Conditions Report.
Tree Inventory	■ Jessica Walker, ISA Certified Arborist ON-1849A	2015	■ Completed in support of the Western Road and Sarnia Road/Philip Aziz Avenue Tree Assessment and ■ Inventory (AECOM, 2015b).
Fish Habitat Assessment	■ Adam Egan, Aquatic Ecologist	August 18, 2021	■ Refer to **Section 2.2.1** for method details.
Confirmatory ELC Survey and Floral Inventory	■ Heather Hughes, Terrestrial Ecologist	August 18, 2021 October 1, 2021 May 19, 2022	■ Refer to **Section 2.2.2** for method details.
Bat SAR Leaf-off Cavity Search	■ Heather Hughes	October 1, 2021	■ Completed in conjunction with the above surveys.
SWH and SAR Habitat Screenings	■ Heather Hughes ■ Adam Egan	August 18, 2021 October 1, 2021 May 19, 2022	■ Completed in conjunction with the above surveys.
Incidental Wildlife Observations	■ Heather Hughes ■ Adam Egan	August 18, 2021 October 1, 2021 May 19, 2022	■ Completed in conjunction with the above surveys.

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2.2.1 Fish Habitat Assessment

A field assessment was completed by AECOM ecologists of the aquatic habitat and existing features of the unnamed tributary and associated Thames River confluence on August 18, 2021. The locations and boundaries of the aquatic features and potential fish habitat, initially identified through a background information review and aerial imagery review, was confirmed with ground truthing. Any additional potential aquatic features, not previously identified, were also captured.

Detailed notes from the field assessment included photographic evidence, habitat sketches, functionality, and suitability of existing areas as fish habitat. Specialized habitat and other notable features, such as suitable spawning habitat for fish, evidence of erosion, sources of pollution, substrate percentage and location, cover percentage and location, vascular macrophytic and algae presence and distribution, riparian vegetation, potential fish passage barriers, and incidental fish observations, were also documented. Aquatic features that were determined through background review and the site assessment to not support fish were included.

Substrate was recorded by percent composition for the following substrate type:

- Bedrock (continuous rock that may be only partly exposed);
- Boulders (separate, often embedded, over 250 mm diameter);
- Cobble (65 mm to 250 mm in diameter);
- Gravel (2 mm to 65 mm in diameter);
- Sand (0.06 mm – 2 mm in diameter, and gritty);
- Silt (0.02 mm – 0.06 mm in diameter, and floury);
- Clay (<0.02 mm in diameter, smooth and plastic);
- Muck (mix of detritus and silt, sand and/or clay); and,
- Detritus – organic matter.

In-water cover was documented based on the presence and distribution through the water column of material for fish to seek refuge, provided by:

- Woody debris;
- Boulders (>250 mm diameter);
- Cobble (65-250 mm diameter);
- Aquatic vegetation; and,
- Other materials (i.e., man-made structures) and/or undercut banks.

Availability of in-water cover was classified as:

- High (76-100% of stream surface area);
- Moderate (31-75% of stream surface area); and,
- Low (0-30% of stream surface area).

Overhead canopy cover, which is based on shade and cover provided by the presence and distribution of material hanging over the water (i.e., trees, shrubs, grasses, herbaceous, man-made structures or other) was estimated and classified as:

- Closed (90%-100%);
- High (61-90%);
- Moderate (31-60%);
- Low (1-30%); or,
- None.

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Aquatic vegetation was described by type (floating, emergent, or submergent). Species predominance of algae and vascular macrophytes were noted. Adjacent land uses were noted for potential influences or impacts to aquatic habitat function. This included observation of residential and commercial properties and wetland features.

Channel measurements were taken at multiple locations, and mean values calculated in the field were documented by:

- Mean wetted depth (MWD);
- Mean wetted width (MWW);
- Mean bankfull depth (MBD); and,
- Mean bankfull width (MBW).

Multiple depth measurements were taken randomly, where access was possible. These measurements were depicted on the habitat sketch to illustrate the depth/shoreline profile and used to estimate the section's mean depth. Stream morphology was assessed during the field assessments to describe potential areas of habitat, including:

- Runs (typically deep, fast-flowing water with little to no turbulence of water);
- Riffles (shallow, fast-flowing water typically running over rocks where the surface turbulence aerates the water);
- Flats (slow-flowing water with a smooth un-agitated surface); and,
- Pools (pockets of slow-moving water).

Fish community surveys were not required for the Study Area as the fish community information obtained through the background review was found to be sufficient for the purposes of this assessment.

2.2.2 Confirmatory Ecological Land Classification

AECOM conducted ELC assessments and floral inventory of sites within the Study Area on August 28th, 2015. As per the *City of London's Environmental Management Guidelines* (2021), ecological data older than five (5) years must be confirmed by current field investigations because, there is the potential for ecological succession and/or land use change to have occurred since the previous assessment.

A detailed background review was completed prior to field investigations. During the background review, vegetation communities within the Study Area were identified and delineated using a combination of the vegetation community boundaries provided in the *2015 Existing Conditions Report* as well as updated aerial photo interpretation. Vegetation community classification and mapping confirmation followed protocol outlined in the *Ecological Land Classification (ELC) Manual for Southern Ontario* (Lee *et al*., 1998) to Ecosite or Vegetation Type. This approach was chosen to maintain consistency with the ELC methodology used in 2015. A confirmatory ELC assessment and a three-season floral inventory was conducted by AECOM on August 18 and October 1, 2021 and May 19, 2022.

Vegetation community sensitivity was based on the calculation of the mean Coefficient of Conservatism (CC), the Floristic Quality Index (FQI) and the Weediness Index for all vegetation communities present within the Study Area. These three parameters are intended to be used together to assign an ecological community's sensitivity ranking based on plant species composition. The ranking is not intended to measure the overall value of a community, but rather reflects the community's sensitivity to disturbance based on the grouping of plants present within the community.

Coefficient of Conservatism

These values range from 0 (low) to 10 (high) and are based on species tolerance of disturbance and fidelity to a specific habitat. Vegetation species and community sensitivity were assessed through the application of CC values

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assigned to each native species in southern Ontario (Oldham et al., 1995). The occurrence of species with a CC of 9 or 10 can be indicators of undisturbed habitats such as mature forests, fens, or bogs. General habitat values associated with CC values are broken down as follows:

- 0 – 3: Species found in a wide variety of communities, including disturbed sites;
- 4 – 6: Species associated with a specific community, but tolerate moderate disturbance;
- 7 – 8: Species associated with a community in an advanced successional stage, tolerant of minor disturbance; and
- 9 – 10: Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index

The FQI of an area is reflected in the mean value of CC. For example, an old field or grazed woodlot would likely have a low mean CC; these habitats are dominated by opportunistic species that occur in a wide range of site conditions and are tolerant of disturbance. A bog, prairie, or intact forest would likely have a higher value, reflecting the specific habitat requirements of many of the species and the general absence of disturbance. Generally speaking, communities with an FQI of 1 - 19 are considered low vegetative quality; communities with an FQI of 20 - 35 are considered high vegetative quality and communities with an FQI above 35 are considered "Natural Area" quality.

Coefficient of Wetness

All plants in southern Ontario have been assigned a wetland category, based on the designations developed for use by the United States Fish and Wildlife Service. Plants are designated into the following categories:

- Obligate Wetland: occurs almost always in wetlands under natural conditions (estimated >99% probability);
- Facultative Wetland: usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability);
- Facultative: equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability);
- Facultative Upland: occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability); and
- Upland: occurs almost never in wetlands under natural conditions (estimated <1% probability).

2.2.3 Breeding Bird Surveys

Breeding bird surveys were completed following the protocols from the *Ontario Breeding Bird Atlas (OBBA) Guide for Participants* (2001). In accordance with the protocols, surveys were conducted twice during the breeding season (May 24 to July 7), separated by at least fifteen days. Breeding bird surveys were conducted in various habitats representative of the Study Area, including forest, woodland, thicket and meadow. A total of four breeding bird survey stations were established within the Study Area. AECOM ecologists conducted the first and second rounds of surveys on June 17 and June 30, 2021, respectively. Each survey was conducted on calm mornings with little or no precipitation and minimal winds (1-3 on the Beaufort scale), between sunrise and 10:00 (OBBA, 2001). The surveys consisted of five-minute point counts where the weather, time, species, breeding evidence and individual bird movement within a 100 m radius were recorded. Species heard outside of the 100 m radius or observed outside of their breeding habitat within the 100 m radius (i.e., flyovers) were recorded separately.

In addition to breeding bird surveys, incidental avian observations were also recorded (with breeding evidence codes during the breeding season) and are described in **Section 3.5.2.2**.

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2.2.4 Confirmatory Significant Wildlife Habitat and Species at Risk Screening

SWH and SAR habitat assessments were completed concurrently with other field investigations during preparation of the *2015 Existing Conditions Report*. A confirmatory assessment of SWH and SAR habitat was conducted by AECOM on August 18, 2021 and May 19, 2022 in conjunction with ELC assessments. The potential for SAR and SOCC to occur within the Study Area was determined by comparing species habitat requirements to the habitat conditions present on-site and using the results of the background information review (**Section 2.1**) to apply the following rankings:

- Low Probability: neither species nor suitable habitat observed through field investigations but there is a known species record in the general area;
- Medium Probability: species not observed; however, potentially suitable habitat identified through field investigations and there is a known species record in the general area; and,
- High Probability/Confirmed: good quality Species at Risk habitat identified (e.g., sufficiently large areas of suitable vegetation and presence of key features such as nesting sites), and known species record in the Study Area (either through current or previous field investigations).

For the purpose of this report, SOCC as defined in the *Natural Heritage Reference Manual* (MNRF, 2010) are those species that are listed as Special Concern under the ESA, assessed as Threatened or Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that are not considered SAR under the ESA, or have a sub-national (S-Rank) of S1 – S3. SAR are those species listed as Threatened, Endangered, or Extirpated under the ESA and those aquatic species listed as Threatened, Endangered, or Extirpated under SARA.

2.2.5 Species at Risk Surveys

2.2.5.1 Amphibian and Reptile Assessments

Assessment of suitable reptile and amphibian habitat within the Study Area was completed in consultation with Scott Gillingwater of the UTRCA on August 18, 2021. Targeted surveys for amphibians in accordance with the Marsh Monitoring Program (Bird Studies Canada, 2009) and reptile surveys in accordance with relevant MNRF protocols, will be complete during detail design.

2.2.5.2 Barn Swallow (*Hirundo rustica*) Nest Searches

Barn swallows often live in close association with humans, building their cup-shaped mud nests, which are often reused from year to year, almost exclusively on human-made structures such as open barns, under bridges and in culverts (MECP, 2019). Suitable nest attachment sites for barn swallow can be found on buildings with sheltered areas (i.e., under eaves, porches or balconies), ledges (e.g., on doorways and windows), and rough surfaced vertical walls (e.g., brick walls) or broken windows that may allow interior access (MNRF, 2017a).

AECOM ecologists conducted nest searches within the Study Area concurrently with breeding bird surveys. Nest searches of the culverts adjacent to the Thames River occurred during peak breeding season for the bulk of the species in southern Ontario, between May 24 and July 10, 2021. The visible interior of the stormwater outlet was searched for the presence of active and/or past barn swallow nests. Targeted nest searches were not completed on University of Western buildings as they will not be altered or removed for the proposed undertakings.

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3. Existing Conditions

3.1 Physical Environment

3.1.1 Soil and Geology

The surficial geology of southern Ontario consists largely of varying types and thicknesses of deposits emplaced primarily during the Quaternary period, these surficial deposits overly a bedrock terrain (MNRF, 2012b). The MNRF has mapped southern Ontario's surficial geology, which illustrates surficial deposit types, geological features and general bedrock types (MNRF, 2012b). Map units are numbers that correlate with surficial deposit and material types as follows:

Fill:	21
Organic Materials:	20
Silt & Clay:	8, 8a, 9b, 10, 12, 13, 15, 18, 19
Sand & Gravel:	6, 7,9, 11, 12, 14, 16, 18, 19
Till (Diamicton):	5, 5a, 5b, 5c, 5d, 5e
Sedimentary Bedrock:	3, 4
Precambrian bedrock:	1, 2

Surficial soil within the Study Area predominantly consists of unconfining materials (MNRF, 2012b). The surficial soil located along the Thames River is primarily modern alluvial deposits (clay, silt, sand, gravel, and organic materials) (19). Glacial fluvial deposits (7) of sandy and gravel materials makes up a large portion of the Study Area where it extends along Sarnia Road from Brescia Lane to Western Road and comprises the southwestern portion of the Study Area located south of the Sarnia Road and Western Road intersection. Coarse-textured glaciolacustrine deposits (9) occur along the northeast portion of the Study Area where it extends along Western Road and continues north towards Huron University College. The Potential New Parking Lot Entrance is mostly comprised of stone-poor, carbonate derived sandy silt to silty sand till (5b) as well as glacial fluvial deposits (7) and coarse-textured glaciolacustrine deposits (9). Northwest of Sarnia Road and Brescia Lane is mainly consisted of fine-textured glaciolacustrine deposits (silt and clay with minor deposits of sand and gravel) (8a) with pockets of foreshore-basinal deposits (9c) and sandy silt to silty sand till (5b). Surficial geology based on map units are mapped on **Figure 2** below.

3.1.2 Surface Water and Drainage

The reach of the North Thames River within the Study Area is located within the larger Forks Watershed. The Forks watershed has a drainage area of 88 km^2 comprised predominantly (80%) of urban/built-up land use, with only 13% natural land use and 2% water, and was within MNRF Fisheries Management Zone 16 (UTRCA, 2017; MNRF 2021a). The Forks watershed consists of the confluence of two branches of the Thames River, the South Thames River – which extends from Highbury Avenue to the confluence with the North Thames River – and the North Thames River, which extends from the Fanshawe Reservoir dam to the Boler Road bridge crossing. The Thames River through this section flows East to West. Refer to **Figure 3** for mapped locations.

3.1.3 Hydrogeology

Shallow unconfined aquifers (<15 m deep) are located within the vicinity of the Thames River (UTRCA, 2004). Such aquifers are typical within the sandy unconfining surficial soil layers present within the sand plain area of Northern London (UTRCA, 2004; City of London 2015b). Significant groundwater recharging areas can be found beneath the modern alluvial deposit surficial soil and extends to the Thames River (City of London, 2021; MNRF, 2012). Refer to **Figure 3** for mapped locations.

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Figure 2: Surficial Geology

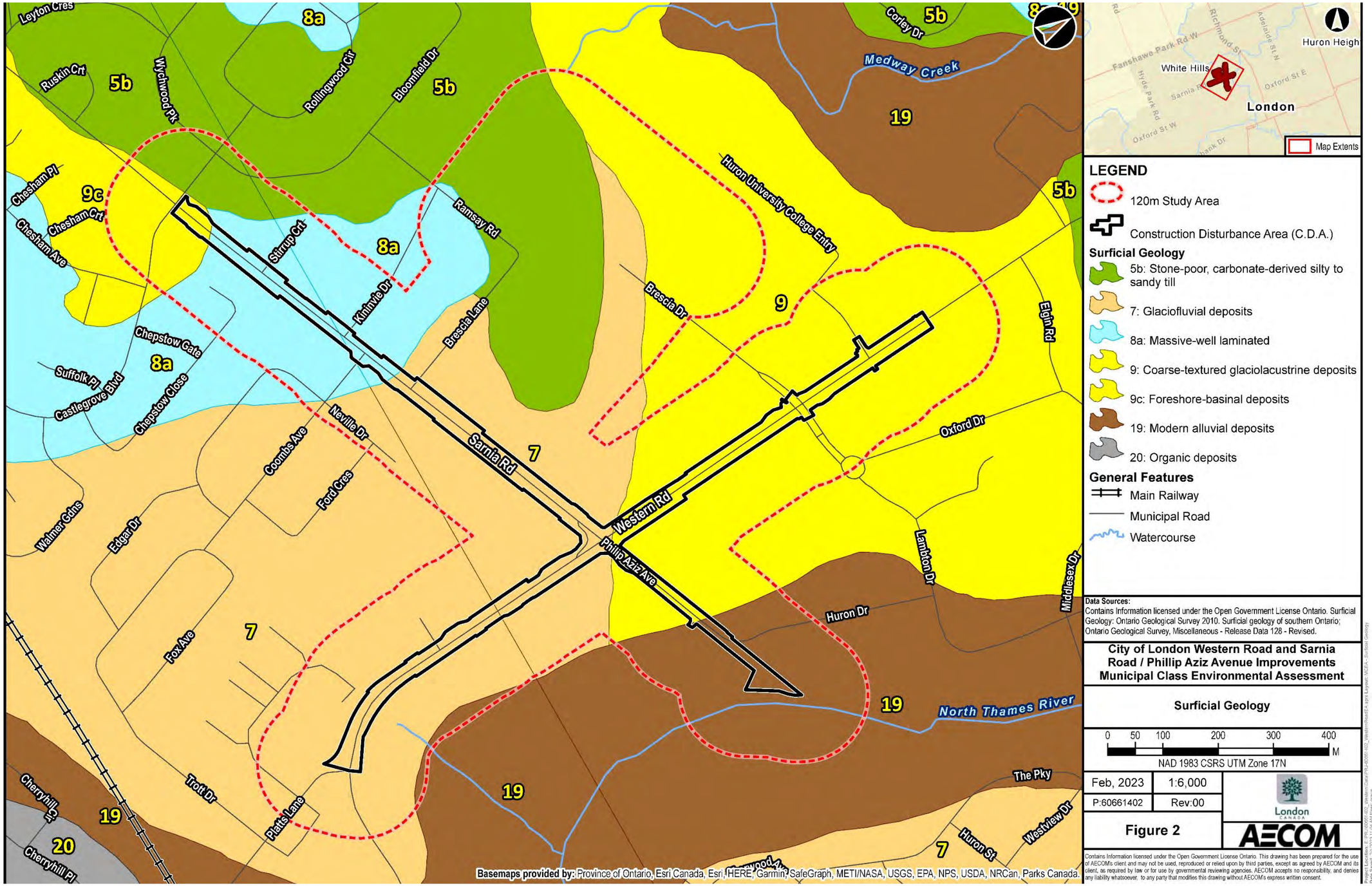
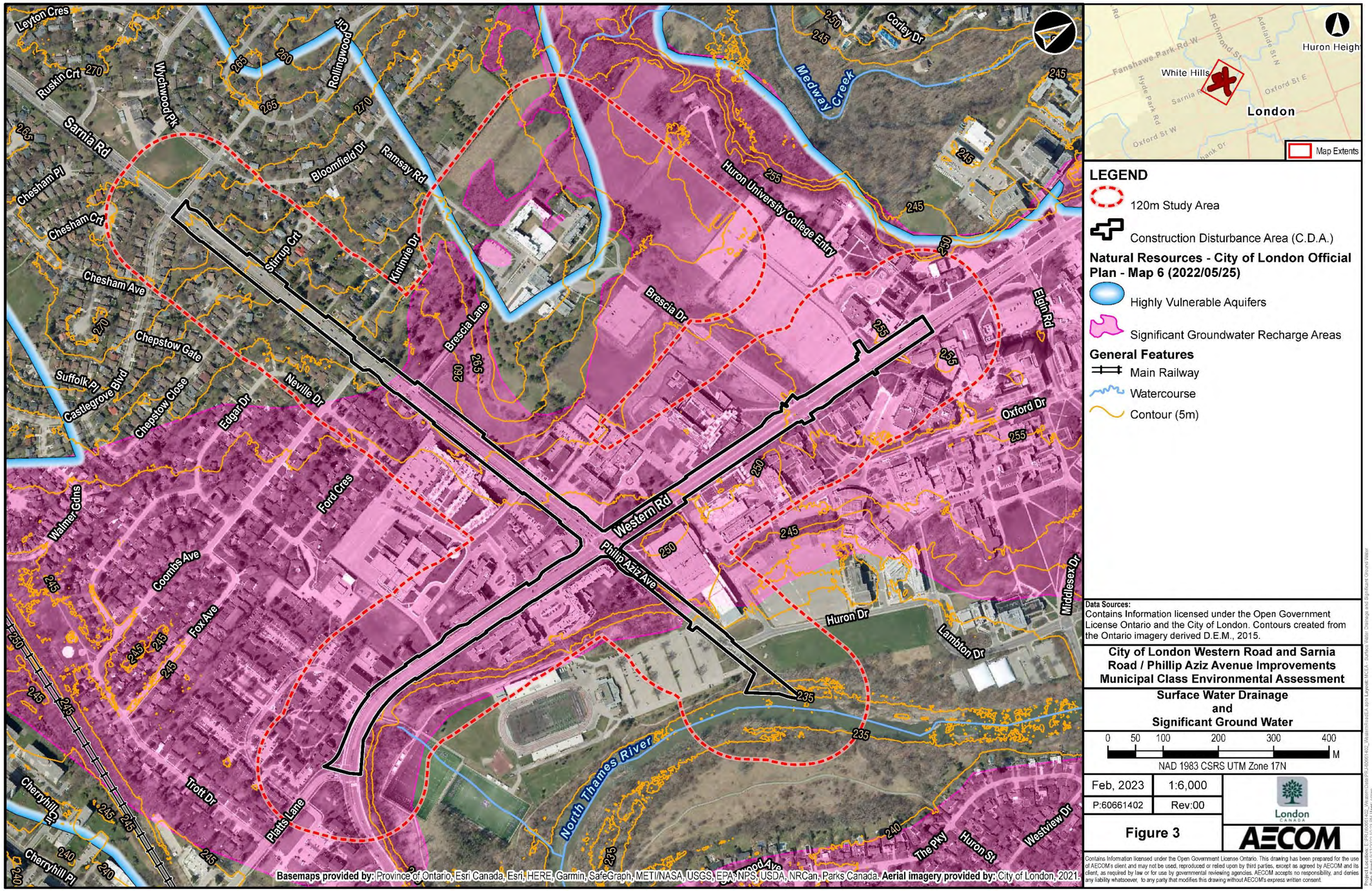


Figure 3: Surface Water Drainage and Significant Groundwater



3.2 Natural Heritage Features and Policies

As identified in Map 1 of the London Plan (City of London, 2022), the majority of the Study Area is designated as Institutional lands with other land use designated as Green Space and Neighbourhoods. Within the Study Area, were pockets of natural cover, particularly associated with the Significant Valleylands along the Thames River and fragmented forest patches within the Institutional Lands south of Phillip Aziz Avenue and east of Western Road.

Natural features and areas identified for protection in the PPS, 2020 and other legislation that are collectively referred to as "Designated Natural Areas"; these include, but are not limited to significant wetlands, SWH, etc. and may be identified by the planning authorities (e.g., province, municipality, conservation authority). A summary of designated natural areas identified within the Study Area through the background review are provided in **Table 3-1** below.

Table 3-1: Natural Heritage Features

Designated Natural Area	Source
Significant Valleylands	*The London Plan- Map 5* (City of London, 2022)
Confirmed SWH for Rare Vegetation Communities – Two provincially rare vegetation communities were identified within the Study Area and are outlined in Section 3.6	*Western Road, Sarnia Road/Philip Aziz Avenue Improvements Class EA* (AECOM, 2015);

Additionally, the Study Area and CDA were also found to fall within the UTRCA's Regulated Area. Policy areas and natural heritage features within and in the vicinity of the Study Area are illustrated on **Figure 4**.

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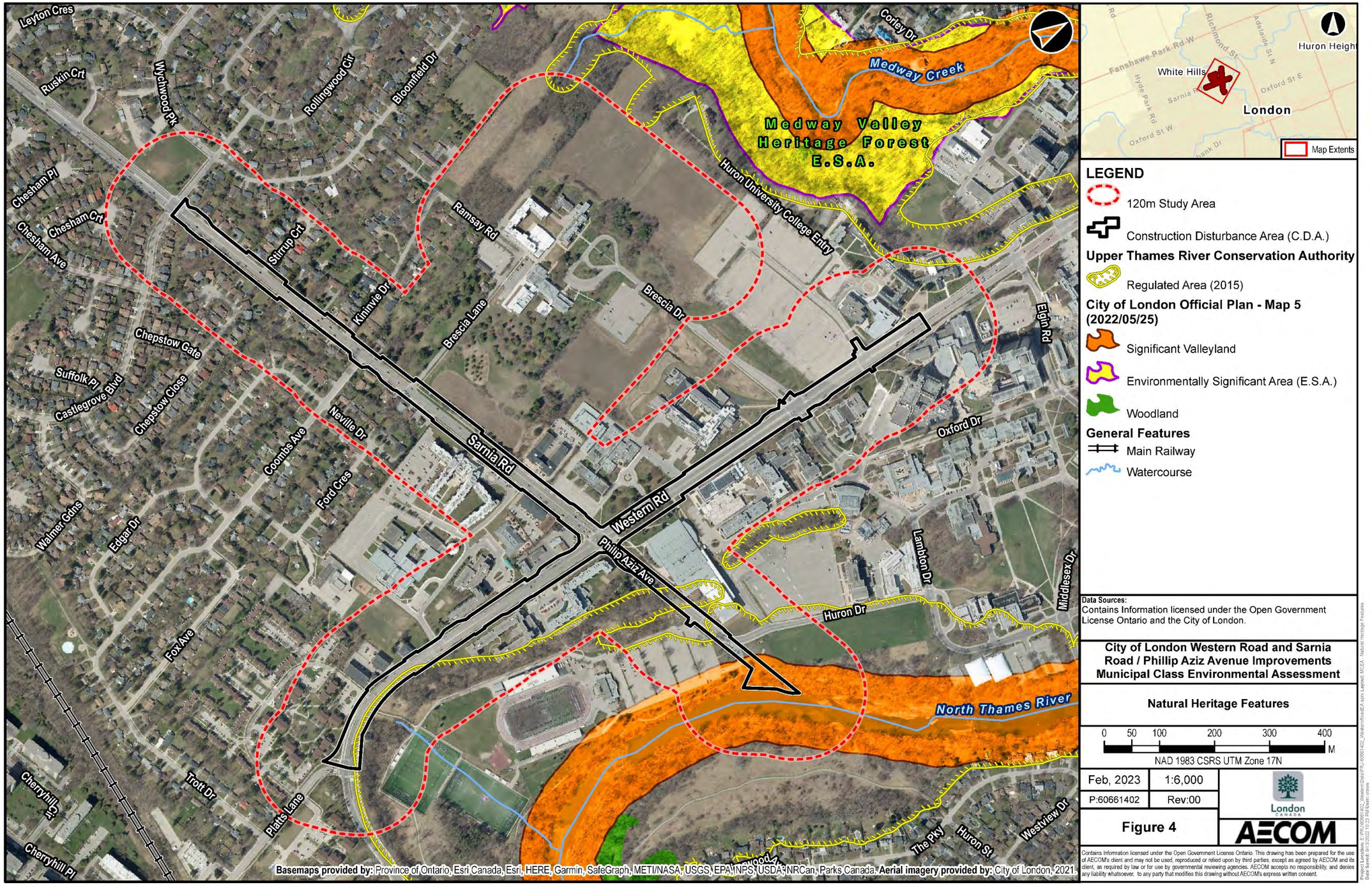
Figure 4: Natural Heritage Features and Policies



3.3 Aquatic Habitat

The following section documents the existing aquatic conditions within the Study Area. Aquatic ecosystems are those associated with bodies of water such as, but not limited to, pools, ponds, lakes, rivers, streams and wetlands. This report identified two aquatic ecosystem sites in question, an unnamed tributary to the Thames River, and the associated Thames River confluence. Aquatic ecosystems provide habitat for a variety of wildlife species, some of which are rare or sensitive. Aquatic ecosystems and the species within the Study Area were identified through background review of secondary sources and the completion of a field investigation. An unnamed tributary to Medway Creek is mapped beginning at the northern limit of the Study Area but does not fall within the limits of the Study Area or Project limits. This tributary was therefore not captured in this assessment.

3.3.1 Background Information

The Thames River is part of the North Lake Erie Watershed (UTRCA, 2017). Its headwaters originate to the east of Lake Huron and the Town of Seaforth, Ontario, and continues southeasterly, mainly through agricultural landscapes and through the Municipalities of Chatham-Kent, London and St. Marys before draining into Lake St. Clair. This section of the Thames River, known as the North Thames River, is part of the Forks local watershed and the greater North Lake Eerie watershed (UTRCA, 2017). The Thames River within the Forks watershed is a sinuous channel with generally flat morphology. The influences of human activities, particularly agriculture and industry, over time have resulted in significant impacts and changes to the Thames River. Such impacts include: erosion, chemical inputs such as industrial waste and fertilizers, introduction of non-native and invasive species and changes to the fish and wildlife community and populations. Regulatory agencies such as the UTRCA have since implemented environmental monitoring plans, management plans, species recovery strategies and legislation (such as the ESA, 2007) to halt and reverse these negative trends.

The section of the North Thames River which flows through the Study Area in the City of London is mostly vegetated with a buffer strip of riparian trees. Adjacent land use includes transportation infrastructure (roadways, parking lots, bridges, bicycle paths, etc.) and recreation. Despite these impacts, the North Thames River remains a significant river system which supports numerous tributaries, habitat types and wetlands throughout its drainage. An extensive list of fish are known to inhabit the Thames River watershed including within the Study Area (**Table 3-2**). Numerous species of mussels also distributed within the Study Area (**Table 3-3**). SAR include any aquatic species designated as Threatened or Endangered under the federal SARA, 2002 or the provincial ESA, 2007. SAR are addressed further in **Section 3.7**.

Table 3-2: Thames River Watershed Fish Community

Common Name	Scientific Name	SARA Status[1]	ESA Status[2]	Source[3]
Black Bullhead	*Ameiurus melas*	N/A	N/A	UTRCA, iNaturalist
Black Redhorse	*Moxostoma duquesnei*	THR	THR	DFO, UTRCA
Blacknose Dace	*Rhinichthys atratulus*	N/A	N/A	UTRCA, iNaturalist
Brown Bullhead	*Ameiurus nebulosus*	N/A	N/A	UTRCA, iNaturalist
Channel Catfish	*Ictalurus punctatus*	N/A	N/A	UTRCA, iNaturalist
Common Carp	*Cyprinus carpio*	N/A	N/A	UTRCA, iNaturalist
Common Shiner	*Luxilus cornutus*	N/A	N/A	UTRCA, iNaturalist
Creek Chub	*Semotilus atromaculatus*	N/A	N/A	UTRCA, iNaturalist
Freshwater Drum	*Aplodinotus grunniens*	N/A	N/A	UTRCA, iNaturalist
Golden Redhorse	*Moxostoma erythrurum*	N/A	N/A	UTRCA, iNaturalist
Green Sunfish	*Lepomis cyanellus*	N/A	N/A	UTRCA, iNaturalist
Greenside Darter	*Etheostoma blennioides*	N/A	N/A	UTRCA, iNaturalist
Largemouth Bass	*Micropterus salmoides*	N/A	N/A	UTRCA, iNaturalist
Logperch	*Percina caprodes*	N/A	N/A	UTRCA, iNaturalist
Longnose Gar	*Lepisosteus osseus*	N/A	N/A	UTRCA, iNaturalist
Northern Hog Sucker	*Hypentelium nigricans*	N/A	N/A	UTRCA, iNaturalist

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Table 3-2: Thames River Watershed Fish Community

Common Name	Scientific Name	SARA Status[1]	ESA Status[2]	Source[3]
Northern Sunfish	*Lepomis peltastes*	SC	SC	DFO
Pumpkinseed	*Lepomis gibbosus*	N/A	N/A	UTRCA, iNaturalist
Rainbow Darter	*Etheostoma caeruleum*	N/A	N/A	UTRCA, iNaturalist
Rock Bass	*Ambloplites rupestris*	N/A	N/A	UTRCA, iNaturalist
Shorthead Redhorse	*Moxostoma macrolepidotum*	N/A	N/A	UTRCA, iNaturalist
Silver Redhorse	*Moxostoma anisurum*	N/A	N/A	UTRCA, iNaturalist
Silver Shiner	*Notropis photogenis*	THR	THR	NHIC, DFO, UTRCA, iNaturalist
Smallmouth Bass	*Micropterus dolomieu*	N/A	N/A	UTRCA, iNaturalist
Spotfin Shiner	*Cyprinella spiloptera*	N/A	N/A	UTRCA, iNaturalist
Striped Shiner	*Luxilus chrysocephalus*	N/A	N/A	UTRCA, iNaturalist
Walleye	*Sander vitreus*	N/A	N/A	UTRCA, iNaturalist
Yellow Perch	*Perca flavescens*	N/A	N/A	UTRCA, iNaturalist

Notes: 1. SARA Sched. 1 Status: The SARA protects and ensures the recovery of SAR listed on Schedule 1 as Extirpated, Endangered and Threatened, and their critical habitats at a federal level. Schedule 1 of the SARA classifies SAR as follows:

***Extirpated (EXP)** – a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild (SARA Registry, 2012).*

***Endangered (END)** – a wildlife species that is facing imminent extirpation or extinction (SARA Registry, 2012).*

***Threatened (THR)** – a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction (SARA Registry, 2012).*

***Special Concern (SC)** – a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (SARA Registry, 2012).*

*Notes: 2. **ESA Status**: The Endangered Species Act 2007 (ESA) protects species listed as Threatened and Endangered on the Species at Risk in Ontario (SARO) List on provincial and private land. The Minister lists species on the SARO list based on recommendations from the Committee on the Status of Species at Risk in Ontario (COSSARO), which evaluates the conservation status of species occurring in Ontario. The following are the categories of at risk:*

***END** (Endangered) – A species facing imminent extinction or extirpation in Ontario.*

***THR** (Threatened) – Any native species that, on the basis of the best available scientific evidence, is at risk of becoming Endangered throughout all or a large portion of its Ontario range if the limiting factors are not reversed.*

***SC** (Special Concern) – A species that may become Threatened or Endangered due to a combination of biological characteristics and identified threats.*

*Notes: 3. **Sources:** ORAA – (ORAA, 2019); eBird – (eBird, 2022); OBBA – (BSC et al. 2006); NHIC – (MNRF, 2015); BCI – (BCI, 2022); iNaturalist – (iNaturalist, 2022)*

Table 3-3: Mussel Communities within the Study Area

Common Name	Scientific Name	SARA Status[1]	ESA Status[2]	Source[3]
Creeper	*Strophitus undulatus*	N/A	N/A	iNaturalist
Elktoe	*Alasmidonta margiNaturalista*	N/A	N/A	iNaturalist
Fluted-shell	*Lasmigona costata*	N/A	N/A	iNaturalist
Fragile Papershell	*Leptodea fragilis*	N/A	N/A	iNaturalist
Giant Floater	*Pyganodon grandis*	N/A	N/A	iNaturalist
Mucket	*Actinonaias ligamentina*	N/A	N/A	iNaturalist
Plain Pocketbook	*Lampsilis cardium*	N/A	N/A	iNaturalist
Quagga Mussel	*Dreissena bugensis*	N/A	N/A	iNaturalist
Spike	*Elliptio dilatata*	N/A	N/A	iNaturalist
Wabash Pigtoe	*Fusconaia flava*	N/A	N/A	iNaturalist
Wavy-rayed Lampmussel	*Lampsilis fasciola*	SC	THR	NHIC, DFO, UTRCA
White Heelsplitter	*Lasmigona complanata*	N/A	N/A	iNaturalist
Zebra Mussel	*Dreissena polymorpha*	N/A	N/A	iNaturalist

Notes: 1, 2, 3 – refer to definitions under Table 3-2

3.3.2 Field Investigations

Assessments of aquatic features occurring within the Study Area were completed on August 18, 2021. **Table 3-4** summarizes the aquatic habitat features of the Thames River and the unnamed tributary to the North Thames River respectively as observed during field investigations. Habitat features are mapped on **Figure 5** and photographs taken during aquatic habitat field investigations can be found in **Appendix B**.

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Table 3-4: Summary of Thames River Aquatic Habitat Assessment

Feature	Description and Notes	Habitat Features	Dimensions and Morphology	Notable Features
North Thames River	■ Western University sports field and city streets may be sources of pollution. ■ No migration barriers were observed ■ West bank (left upstream) was slightly unstable, and the east bank (right upstream) was moderately unstable. ■ Permanent flow regime ■ Warmwater thermal regime ■ The stormwater inputs have deposited sediment at the outlet to the Thames River	■ The dominant types of substrates (in order of dominance) were gravel, sand, cobble, and boulder in the runs, silt, sand, gravel, and boulder in the pools, and cobble, gravel, boulder, and sand in riffles. ■ Deciduous forest along both banks of the Thames River ■ Aquatic vegetation was present but scarce (5% of available in-water cover), and included ■ Eurasian water-milfoil (*Myriophyllum spicatum*) and green algae. Eurasian water-milfoil is a non-native, invasive species. ■ Canopy cover and shade over the river was low. ■ In-stream cover for fish was moderate and provided mainly by cobble (50%), and boulders (25%)	■ Morphology was mainly runs (70%), though it was divided by three pools (20%), and one riffle (10%). ■ The mean channel dimensions were: – Mean Wetted Width (MWW): 44.3 m – Mean Bankfull Width (MBW): 46.6 m – Mean Wetted Depth (MWD): 0.46 m – Mean Bankfull Depth (MBD) : 2.3 m	■ Background review identified habitat for SAR in this reach of the Thames River. Field assessment confirmed suitable conditions for the following SAR, all identified in background review: ■ Black Redhorse, including Critical Habitat (Threatened under both SARA and ESA) ■ Silver Shiner, including Critical Habitat (Threatened under both SARA and ESA) ■ Wavy-rayed Lampmussel (Special Concern under SARA, Threatened under ESA), and Northern Sunfish (Special Concern under both SARA and ESA). ■ Iron staining observed near the drain outlet, which is an indicator of possible groundwater discharge.
Unnamed Tributary/Drain to the Thames River	■ The unnamed tributary to the Thames River is a constructed drain visible for approximately 30 m within the Study Area east of Western Road, before once again flowing through a pipe under the University of Western Ontario Alumni Field and Mustang Field. ■ Dense riparian vegetation and trees shaded the drain. ■ Drained from a perched municipal drain outlet approximately 500 m downstream of the Study Area to the Thames River Deposited sediment observed at the outlet to the Thames River. ■ Western University parking lot and sports field may be sources of pollution. ■ South bank (left upstream) was unstable, and the North bank (right upstream) was moderately unstable. ■ Fed by city drainage and flows downstream under Western University sports fields to the Thames River. ■ Warmwater thermal regime.	■ The dominant types of substrates (in order of dominance) were silt, sand, cobble, and boulder in the run. ■ Aquatic vegetation was present (10% of available in-stream cover) and consisted solely of Cattails (*Typha sp.*). ■ Shade and overhanging cover was abundant, and provided by a mix of riparian vegetation and deciduous trees. ■ In-stream cover provided by a mix of (in order of dominance) boulders, cobble, undercut banks, overhanging woody debris, and cattails.	■ Morphology consisted of runs throughout the reach. ■ The mean channel dimensions were as follows: – **MWW:** 0.45 m – **MBW:** 0.65 m – **MWD:** 0.06 m – **MBD:** 0.4 m	■ The perched city drain outlet prevents upstream fish access from the Thames River. ■ No connectivity to fish-bearing waterbodies or access for fish from upstream habitat was evident through field assessment or background review. ■ Channel dimensions, flow at time of assessment, and aquatic vegetation suggest possible permanent flow regime. ■ Considered to be indirect fish habitat

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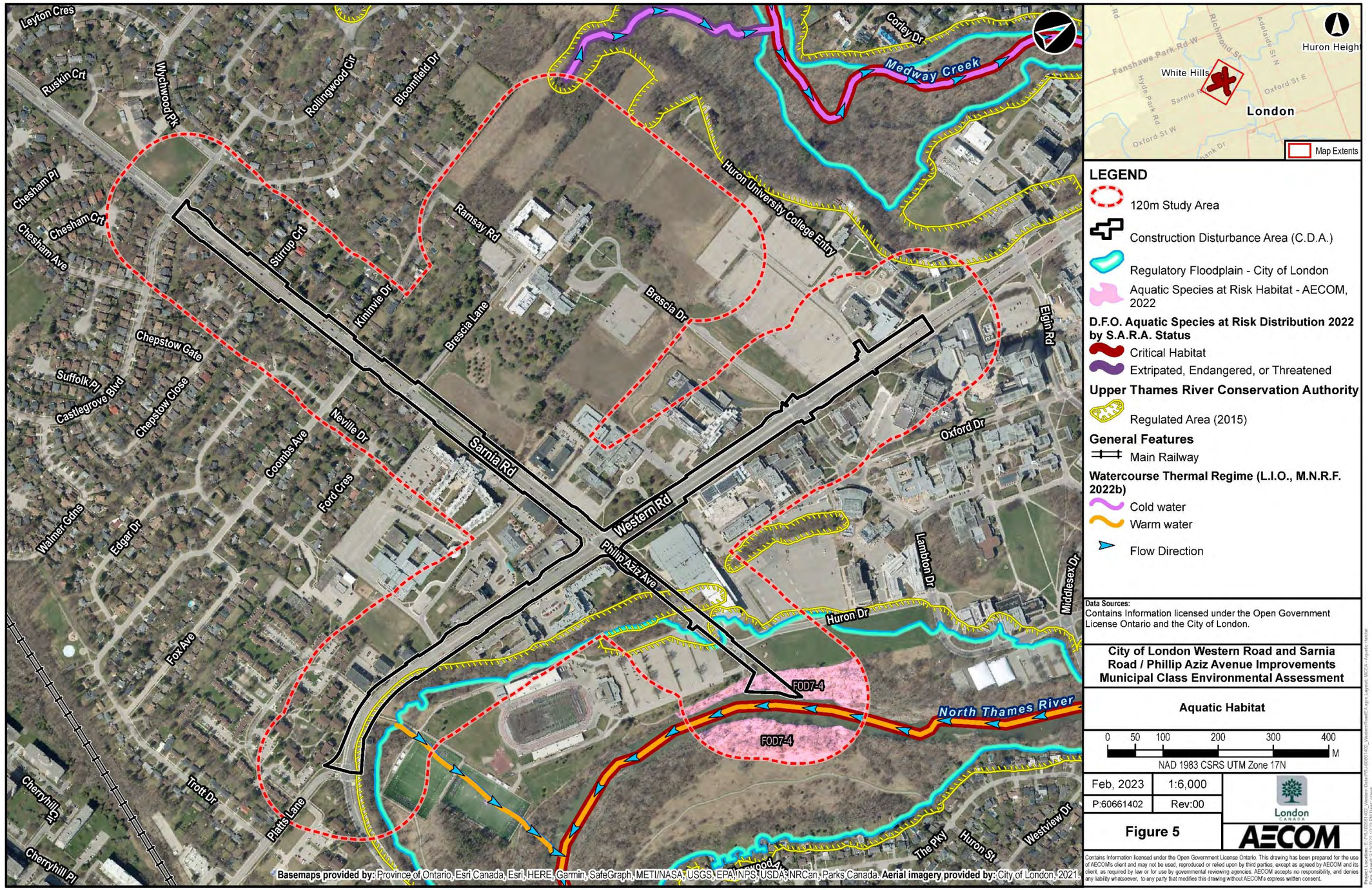
Figure 5: Aquatic Habitat



3.4 Vegetation Communities and Plants

3.4.1 Background Information

The *2015 Existing Conditions Report* identified that terrestrial conditions were comprised of anthropogenically influenced communities that were cultural in nature with the exception of a naturalized forest that occurred along the west end of the Study Area. A total of four ELC community types were delineated during 2015 field investigations within the Study Area which included the following:

- **Mineral Cultural Woodland Ecosite (CUW1)** - This community was delineated in three areas within the Study Area and were all adjacent to Brescia College and comprised a total area of 3.17 ha. No SAR or rare plants were observed within this community, all were considered common and widespread throughout the region.
  - There was one CUW1 located within the southwest portion of the Study Area which was primarily dominated by patches of mid-aged bitternut hickory (*Carya cordiformis*), basswood (*Tilia americana)* and red oak *(Quercus* rubra). There was a shrub layer of common buckthorn (*Rhamnus cathartica*), Tartian honeysuckle (*Lonicera taterica*) as well as young bitternut hickory and American beech (*Fagus grandifolia*) trees. The herbaceous layer is dominated by graceful sedge (*Carex gracillima)* and young common buckthorn.
  - There were two CUW1 communities with similar community compositions located on the east side of the Study Area and appeared to have undergone anthropogenic plantings and contained a collection of deciduous and coniferous trees. The canopy was dominated by white pine (*Pinus strobus*), sugar maple (*Acer saccharum*) and Scots pine (*Pinus sylvestris).* Below the mixed canopy there were manicured grass trails and small Tartian honeysuckle and common buckthorn shrubs.
  - A total of 11 plant species were observed within the delineated vegetation communities, of which 27%, were considered non-native and 72% were considered native. The FQI for the community as a whole was 3.46 with 67% of the species observed falling within the lowest sensitivity (0-3) ranking, 33% within the moderate sensitivity (4-6) ranking and 0% represented within the high sensitivity (7-8) ranking. No species were observed within the high category.

- **Dry- Moist Old Field Meadow Type (CUM1-1)** - This community was found as a single pocket within the CUW1 and FOD2-3. The patch consisted of a total area of 0.75 ha and appeared to have once connected to the large meadow directly adjacent. Dominant species observed were common buckthorn, tall goldenrod (*Solidago altissima*), Canada goldenrod (*Solidago canadensis*)*,* smooth brome grass, and Kentucky bluegrass (Poa pratensis). Young black walnut trees (*Juglans nigra*) surround the meadow and are irregularly interspersed within it. No SAR or rare plants were observed within this community, all were considered common and widespread throughout the region.
  - A total of 16 plant species were observed within the delineated vegetation community, of which more than half, 63%, were considered non-native and 37% were considered native. The FQI for the community as a whole was 6.96 with 70% of the species observed falling within the lowest sensitivity (0-3) ranking, 30% within the moderate sensitivity (4-6) ranking and 0% represented within the high sensitivity (7-8) ranking. No species were observed within the high category.

- **Dry Fresh Hickory Deciduous Forest Type (FOD2-3**) - This community was delineated as one large polygon on the northwestern edge of the Study Area. The community contained bitternut hickory, basswood and red oak. The shrub layer was comprised of common buckthorn, Tatarian honeysuckle, as well as young bitternut hickory and American beech trees. The herbaceous layer was dominated by

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graceful sedge and young common buckthorn. No SAR or rare plants were observed within this community, all were considered common and widespread throughout the region.

  - A total of 25 plant species were observed within the delineated vegetation community, of which more than half, 64%, were considered non-native and 36% were considered native. The FQI for the community as a whole was 16.50 with 37.5% of the species observed falling within the lowest sensitivity (0-3) ranking, 56.25% within the moderate sensitivity (4-6) ranking and 6.25% represented within the high sensitivity (7-8) ranking. The only species observed within the high category includes Black Maple (*Acer nigrum*) and was only observed in one small clump within a CUW1 inclusion.

- **Mineral Cultural Thicket Type (CUT1)** – The community was split into two sections, both of which were adjacent to the agricultural field located north of Brescia College and comprised as thicket hedgerows. The communities covered a total area of 0.21 ha. The community was primarily dominated by common buckthorn with some wild carrot (*Daucus carota*) and smooth brome grass (*Bromus inermis*) present in the herbaceous layer. No SAR or rare plants were observed within this community, all were considered common and widespread throughout the region.
  - A total of 16 plant species were observed within the delineated vegetation community, of which 37%, were considered non-native and 63% were considered native. The FQI for the community as a whole was 4.9 with 67% of the species observed falling within the lowest sensitivity (0-3) ranking, 33% within the moderate sensitivity (4-6) ranking and 0% represented within the high sensitivity (7-8) ranking.

No plant SAR, locally rare plants were identified during 2015 field investigations. According to the *Significant Wildlife Habitat Technical Guide* (MNRF, 2000), the FOD2-3 community is considered provincially rare and is outlined further in **Section 3.6**.

A review of background data from secondary sources listed in **Section 2.1**, identified a total 309 plant species of which, two species were considered SAR and three species were considered SOCC. These SAR and SOCC are discussed further in **Sections 3.6** and **3.7**.

3.4.2 Field Investigations

The ELC vegetation communities as documented in the *2015 Existing Conditions Report* were refined based on the findings of the field reconnaissance visits on August 18, October 1, 2021 and May 19, 2022. Given the urban location of the Study Area, majority of the vegetation communities were confirmed to be cultural in nature. AECOM confirmed the ELC classifications and descriptions were largely consistent with the 2015 surveys; however, several refinements to the vegetation communities and delineation limits were made. Refinements to vegetation communities were limited to the forested area located north of Ramsay Road on the west side of the Study Area. New vegetation communities were also delineated within the Study Area. In 2015, three vegetation communities were delineated in the treed area located east of Brescia College. The treed area was delineated as Dry-Fresh Hickory Deciduous Forest Type (FOD2-3) in the north end and delineated as Mineral Cultural Meadow (CUM1-1) and Mineral Cultural Woodland (CUW1a) towards the south end. During field investigations in 2021 it was identified that the open area was planted to try and expand the FOD2-3 community, however in spring of 2022 it was found that the previously observed planted material had died back and been removed through maintenance activities including mowing of the area, returning it to a CUM1-1. In 2015, the CUW1a community canopy was noted to be dominated by patches of basswood and bitternut hickory, with three species of maples noted in the plant list without an indication of abundance. In 2021, the CUW1a was determined to be more representative of a Dry – Fresh Sugar Maple – Hickory Deciduous Forest Type (FOD5-5) as canopy cover had increased since 2015 and community composition was noted to be dominated by sugar maple with associated species including bitternut hickory, basswood and common hackberry. The boundary of the FOD2-3 community was refined in 2021 as a large portion

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of the community adjacent to the CUM1-1 was more consistent with the community composition of the FOD5-5 community, reflecting an increase in cover by sugar maple as compared to other species.

Vegetation communities are described in **Table 3-5** below and shown on **Figure 6**. No SAR plants or regionally rare species were observed during field investigations however, the FOD2-3 and Fresh – Moist Black Walnut Lowland Deciduous Forest (FOD7-4) communities are provincially rare and discussed further in **Section 3.6**.

A comprehensive plant list is provided in **Appendix C**. A total of 75 plant species were recorded, of which 39 (52%) were native, and 36 (48%) were non-native. Of the non-native species, 19 (25%) were considered invasive including but not limited to Norway maple (*Acer platanoides*), Tree-of-Heaven (*Ailanthus altissima*), garlic mustard (*Alliaria petiolata),* European common reed (*Phragmites australis ssp. australis)* and common buckthorn. The majority of the plant species recorded had a low to moderate sensitivity to disturbance. There were no SAR, SOCC, Provincially Significant or Regionally Rare plant species recorded within Study Area.

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Table 3-5: Ecological Land Classification within the Study Area

ELC Code	Dominant Species								
	S-Rank[1]	Inclusion	Vegetation or Ecosite Name	Community Age	Canopy	Sub-canopy	Understorey	Ground Layer	Floristic Quality Index
Cultural Communities (CU)									
CUM1-1	S5	MAS2 – Mineral Shallow Marsh	Dry – Moist Old Field Meadow Type	Young	N/A.	N/A	N/A	Species include tall goldenrod, Kentucky blue grass, aster species *(Aster sp),* New England aster (*Symphyotrichum novae-angliae),* chicory *(Cichorium intybus),* wild carrot*,* and common burdock *(Arctium minus).*	■ CC: 0.28 ■ CW: 2.78 ■ Non-native species (%): 71.4 ■ FQI:0.81 ■ No SAR, SOCC or locally rare plants observed.
CUW1	S5	None	Mineral Cultural Woodland	Young	Cultural community with between 30-60% canopy cover and evidence of ongoing management with planted trees. Species observed include the following: black locust *(Robinia pseudoacacia)*, Scots pine*,* blue spruce *(Picea pungens)*, and white oak *(Quercus alba).*	Manitoba maple, black walnut, Siberian elm, and black locust	Common buckthorn*,* Hawthorn *(Crataegus sp),*	Kentucky blue grass, wild carrot, black medick *(Medicago lupulina),* red clover *(Trifolium pratense),* Philadelphia fleabane *(Erigeron philadelphicus),* tall goldenrod, chicory*,* fuller's teasel *(Dipsacus fullonum*), English plantain *(Plantago lanceolata),* common plantain *(Plantago major),* and smooth bedstraw *(Galium mollugo).*	■ CC: 1.28 ■ CW: 2.32 ■ Non-native species (%): 60 ■ FQI:4.05 ■ No SAR, SOCC or locally rare plants observed.
Forested Communities (FO)									
FOD2-3	S3S4	None	Dry – Fresh Hickory Deciduous Forest	Mature	Species observed include: bitternut hickory, sugar maple (*Acer saccharum*), basswood *(Tilia americana)*, hop hornbeam (*Ostrya virginiana*), green ash (*Fraxinus pensylvanica*)	Green ash, common buckthorn, chokecherry (*Prunus virginiana),* alternate leaf dogwood (*Cornus alternifolia*)	Common buckthorn, green ash, alternate leaf dogwood.	American red raspberry (*Rubus idaeus*), drooping wood sedge (*Carex arctata*), Canada mayapple (*Podophyllum peltatum)* and garlic mustard.	■ CC: 2.88 ■ CW: 1.61 ■ Non-native species: 27.8% ■ FQI: 10.42 ■ No SAR, SOCC or locally rare plants observed.
FOD5-5	S4	None	Dry – Fresh Sugar Maple – Hickory Deciduous Forest	Mature	Species observed include: sugar maple, basswood, common hackberry (*Celtis* occidentalis), and bitternut hickory.	Sugar maple, green ash, alternate leaf dogwood common hackberry.	Common buckthorn, American red raspberry, Tatarian honeysuckle.	American red raspberry, garlic mustard, drooping wood sedge,	■ CC: 2.68 ■ CW: 1.94 ■ Non-native species (%): 31.5 ■ FQI: 9.68 ■ No SAR, SOCC or locally rare plants observed.
FOD7-4	S2S3	MAM2-9 Jewelweed Mineral Meadow Marsh - and MAS2-1 Cattail Mineral Shallow Marsh	Fresh – Moist Black Walnut Lowland Deciduous Forest	Mature	Species observed include the following: black walnut, hybrid crack willow (*Salix X rubens*), Eastern cottonwood (*Populus deltoides*), and green ash.	Black walnut, Manitoba maple (*Acer negundo*), green ash, and Siberian elm (*Ulmus pumila*)	Common buckthorn, green ash, and garlic mustard.	Kentucky blue grass, creeping Charlie (*Glechoma hederacea*), spotted jewelweed (*impatiens capensis*), and garlic mustard.	■ CC: 1.89 ■ CW: 1.65 ■ Non-native species (%): 43.5 ■ FQI: 9.64 ■ No SAR, SOCC or locally rare plants observed.

Notes: 1. S3 – Vulnerable—Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 – Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 – Secure—Common, widespread, and abundant in the nation or state/province.
SNR – Unranked—Province conservation status not yet assessed.
SU – Unrankable—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA – Not Applicable —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S# - Range Rank —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
S#? – Inexact Rank.
S? – Not Ranked/ under review.

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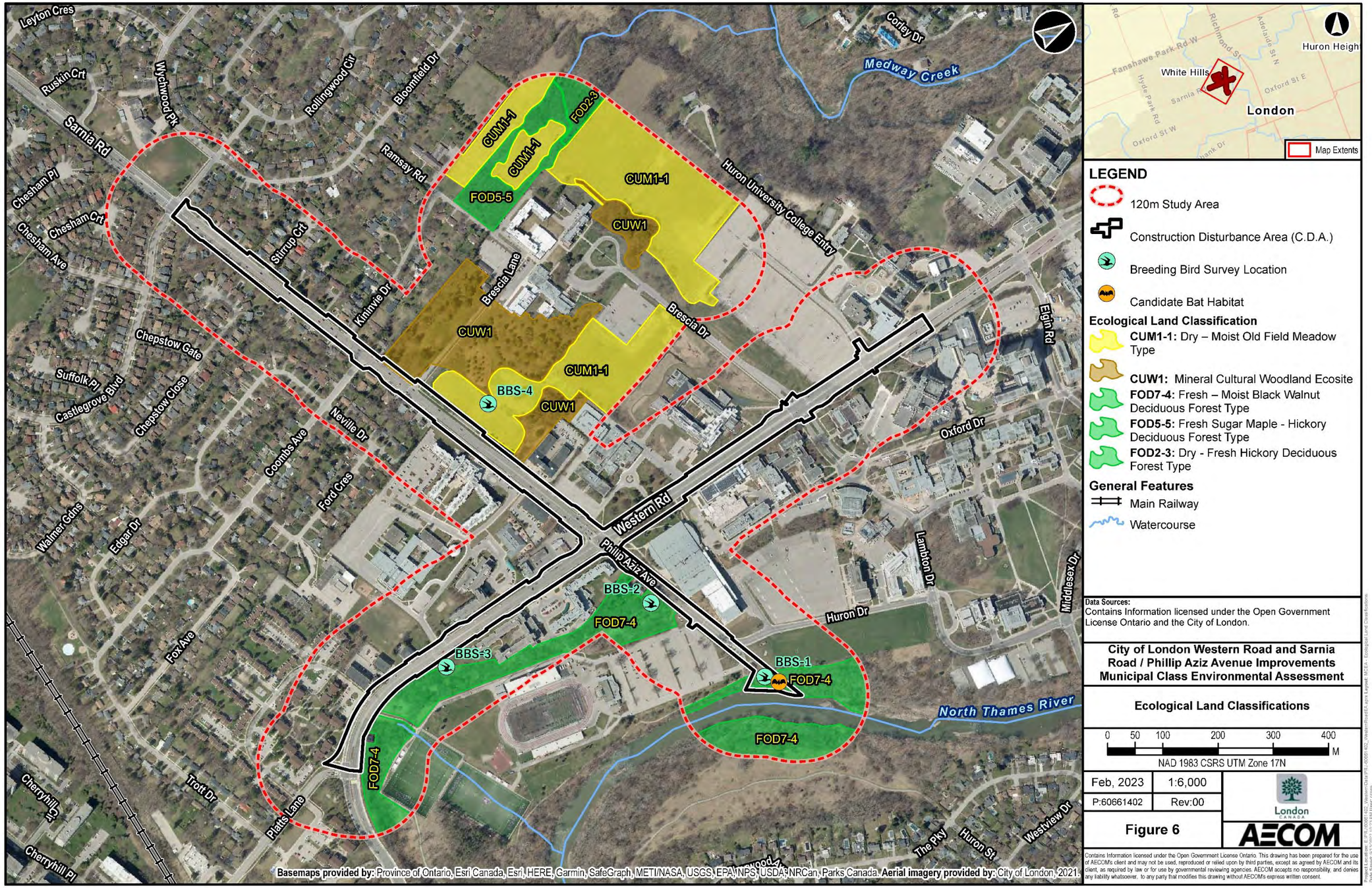
Figure 6: Ecological Land Classification



3.5 Wildlife

Majority of the Study Area is limited to urban streetscapes and lacked many naturalized communities. As a result, habitat for wildlife was limited, especially within the CDA where wildlife habitat was limited to disturbed edge habitat along existing infrastructure. Due to the urbanized nature of the Study Area, most wildlife species that occur in the Study Area are considered common and typical of urban environments. While the CDA mostly overlaps with streetscapes, it should be noted that a number of protected species are also known to occur in urban environments by utilizing anthropogenic structures (i.e., nesting on buildings or bridges), fragmented and cultural vegetation communities as well as lone trees and shrubs.

While majority of the CDA is along streetscapes with limited potential for wildlife habitat, the east end of the CDA overlaps the Thames River where a riparian forest (FOD7-4) has been delineated along the banks of the river. The forested community presents more opportunities for wildlife habitat as well as connectivity through the landscape. Furthermore, the Thames River is known to provide habitat for many wildlife species, including protected species and habitat.

3.5.1 Background Information

The *2015 Existing Conditions Report* used a combination of background review and incidental wildlife observations to determine habitat suitability for wildlife. Targeted wildlife surveys were not completed; however, habitat suitability for SAR and SOCC identified in the background review was noted in conjunction with surveys carried out on August 28, 2015. SAR and SOCC identified in the *2015 Existing Conditions Report* are discussed further in **Section 3.6** and **Section 3.7**.

The *2015 Existing Conditions Report* determined vegetation communities identified within the Study Area were likely to support habitat for a variety of disturbance-tolerant bird and mammal species. No rare wildlife was recorded during 2015 field investigations and species observed incidentally were considered common and widespread throughout the region. Incidental observations included White-tailed deer (*Odocoileus virginianus),* Wild Turkey (*Meleagris gallopavo*) and Eastern gartersnake (*Thamnophis sirtalis)*.

Background data collected in 2022 from the secondary sources listed in **Section 2.1**, identified records of general and rare wildlife known to occur within the Study Area. A summary of species records by taxon is provided in **Table 3-6**. SAR and SOCC records are discussed further in **Sections 3.6** and **3.7**

Table 3-6: Summary of Wildlife Species Records within the Study Area

Taxon	Total Number of Species	Total Number of SAR	Total Number of SOCC	Source(s)[1]
Amphibians	14	0	0	ORAA, iNat, NHIC
Birds	150	7	7	OBBA, eBird, iNat, AECOM (2015)
Fish	17	2	1	DFO, iNat
Insects	263	0	0	OBA, iNat
Mammals	22	4	0	BCI, iNat
Molluscs	9	1	2	DFO, iNat
Reptiles	13	2	3	ORAA, iNat, NHIC, AECOM (2015)

Notes: 1. NHIC: Natural Heritage Information Centre
iNat: iNaturalist (2022)
ORAA: Ontario Reptile and Amphibian Atlas
OBA: Ontario Butterfly Atlas
BCI: Bat Conservation International
AECOM (2015): Western Road, Sarnia Road/Philip Aziz Avenue Tree Assessment and Inventory (AECOM, 2015)

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3.5.2 Field Investigations

3.5.2.1 Breeding Bird Surveys

Breeding bird surveys were conducted on June 17 and 30, 2021 at four breeding bird point count stations and incidental observations were recorded between June 2021 – May 2022. **Figure 6** shows the locations of the breeding bird point count stations. A total of 25 bird species were recorded during field investigations, including incidental observations. Of these species, breeding evidence was recorded as 'probable' for 10 species, 'possible' for 11 species, and 'observed' (i.e., no breeding evidence) for four species. The complete detailed breeding bird list with breeding evidence is included in **Appendix D.** Survey conditions are outlined in **Table 3-7** below.

Table 3-7: Breeding Bird Survey Conditions

Round	Point Count Station ID	Date	Start Time/ End Time	Temperature (°C)	Wind (Beaufort Scale)	Cloud Cover (%)	Precipitation
1	BBS–01	June 17, 2021	8:37 to 8:42	12	0	0	None
	BBS-02	June 17, 2021	8:27 to 8:32	12	0	40	None
	BBS-03	June 17, 2021	7:37 to 7:42	7	0	40	None
	BBS-04	June 17, 2021	8:12 to 8:17	12	0	40	None
2	BBS–01	June 30, 2021	5:53 to 5:58	22	1	100	None
	BBS-02	June 30, 2021	6:04 to :069	22	0-1	100	None
	BBS-03	June 30, 2021	6:17 to 6:22	22	0-1	100	None
	BBS-04	June 30, 2021	6:50 to 6:55	24	0-1	100	None

There were two avian SAR recorded during breeding bird surveys and as incidentals. Barn swallows were observed incidentally near BBS-01 on June 17, 2021. The barn swallows were observed foraging over the Thames River and associated riparian communities. Barn Swallows have since been down-listed from Threatened to Special Concern (as of January 26, 2023) and are now considered a SOCC. Three chimney swifts (*Chaetura pelagica*) were observed during breeding bird surveys at BBS-03 on June 17, 2021. During this observation, chimney swift individuals were actively foraging for insects over the meadow during the breeding bird window. These species are discussed further in **Section 3.7**. The majority of the remaining species recorded during field investigations are considered common and widespread in Ontario and adaptable to early successional, forest edge or human-altered habitats. Additionally, majority of the species observed receive protection under the MBCA.

3.5.2.2 Bird Nest Searches

As mentioned in **Section 3.5.2.1**, AECOM ecologists observed MBCA-protected birds and SAR birds within the Study Area however, nest searches found no evidence of nesting within the CDA. It was noted that suitable structures (i.e., buildings, culverts) were present in both the CDA and larger Study Area.

3.5.2.3 Incidental Wildlife Observations

Incidental wildlife observations as well as the identification of preferred wildlife habitat conditions were documented during the field investigations conducted by AECOM Ecologists. The majority of species observations were considered common and tolerant of urban disturbances and many bird species observed are also protected under the MBCA. Although the sites have been anthropogenically disturbed and fragmented, vegetation present still provides potential nesting opportunities for migratory birds. Isolated trees, shrubs, vegetation communities and anthropogenic structures (e.g., buildings and bridges) can provide nesting habitat for migratory birds protected under the MBCA. As mentioned in **Section 3.5.2.1**, there were 19 MBCA-protected species observed during breeding bird surveys which have been included in the bird species list in **Appendix D**. All incidental wildlife observations are outlined in **Table 3-8** below.

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Table 3-8: Incidental Wildlife Observations

Taxon	Common Name	Scientific Name	S-Rank[1]	ESA Status[2]	COSEWIC Status[3]
Bird	American Crow	*Corvus brachyrhynchos*	S5B	N/A	N/A
Bird	Brown Creeper	*Certhia americana*	S5B	N/A	N/A
Bird	Belted Kingfisher	*Megaceryle alcyon*	S5B	N/A	N/A
Bird	Mallard	*Anas platyrhynchos*	S5	N/A	N/A
Bird	Great Blue Heron	*Ardea Herodias*	S4	N/A	N/A
Bird	Osprey	*Pandion haliaetus*	S5B	N/A	N/A
Amphibian	American Toad	*Anaxyrus americanus*	S5	N/A	N/A
Mammal	Northern Raccoon	*Procyon lotor*	S5	N/A	N/A
Mammal	Meadow vole	*Microtus pennsylvanicus*	S5	N/A	N/A
Mammal	Eastern Gray Squirrel	*Sciurus carolinensis*	S5	N/A	N/A
Mammal	Eastern Chipmunk	*Tamias striatus*	S5	N/A	N/A

*Note: 1. **S rank:** The natural heritage provincial ranking system (provincial S-rank) is used by the MNRF Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities. The following status definitions were taken from NatureServe Explorer's (2015) National and Subnational Conservation Status Definitions available at http://explorer.natureserve.org/nsranks.htm:*

***S3** – Vulnerable—Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.*

***S4** – Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.*

***S5** – Secure—Common, widespread, and abundant in the nation or state/province.*

***SNR** – Unranked—Province conservation status not yet assessed.*

***SU** – Unrankable—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.*

***SNA** – Not Applicable —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.*

***S#S#** - Range Rank —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).*

Breeding Status Qualifiers

***B** – Breeding—Conservation status refers to the breeding population of the species in the province.*

***N** – Nonbreeding—Conservation status refers to the non-breeding population of the species in the province.*

*Note: 2. **ESA Status**: The Endangered Species Act 2007 (ESA) protects species listed as Threatened and Endangered on the Species at Risk in Ontario (SARO) List on provincial and private land. The Minister lists species on the SARO list based on recommendations from the Committee on the Status of Species at Risk in Ontario (COSSARO), which evaluates the conservation status of species occurring in Ontario. The following are the categories of at risk:*

***END** (Endangered) – A species facing imminent extinction or extirpation in Ontario.*

***THR** (Threatened) – Any native species that, on the basis of the best available scientific evidence, is at risk of becoming Endangered throughout all or a large portion of its Ontario range if the limiting factors are not reversed.*

***SC (Special Concern)** – A species that may become Threatened or Endangered due to a combination of biological characteristics and identified threats.*

***N/A** – not applicable as species is not protected under ESA.*

*Note: 3. **COSEWIC:** The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assess and designates recommended protection statuses under SARA as follows:*

***Extirpated (EXP)** – a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild (SARA Registry, 2012).*

***Endangered (END)** – a wildlife species that is facing imminent extirpation or extinction (SARA Registry, 2012).*

***Threatened (THR)** – a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction (SARA Registry, 2012).*

***Special Concern (SC)** – a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (SARA Registry, 2012).*

***N/A** – not applicable as species has not been assessed by COSEWIC.*

3.6 Significant Wildlife Habitat

3.6.1 Background Information

The results of the SWH screening were mostly consistent with the *2015 Existing Conditions Report*, which identified candidate SWH for snake hibernaculum, amphibian woodland breeding habitat and habitat for SOCC. The *2015 Existing Conditions Report* included the potential for eastern milksnake (*Lampropeltis triangulum*) to occur within

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the Study Area. Eastern milksnake was designated as Special Concern under the ESA when the *2015 Existing Conditions Report* was published. The eastern milksnake has not been included in the updated SOCC habitat screening as this species has since been down-listed from Special Concern to Not at Risk in Ontario. Barn Swallow was designated as Threatened under the ESA when the *2015 Existing Conditions Report* was published and field investigations for this report were started; however, this species has been down-listed to Special Concern under the ESA as recently as January 26, 2023 and no longer receives individual or habitat protection under this Act. Furthermore, potential for Louisiana waterthrush (*Parkesia motacilla*) and eastern ribbonsnake (*Thamnophis sauritus*) were included in the *2015 Existing Conditions Report*. These species have been excluded from the updated 2022 SOCC screening provided in **Appendix E** of this report as species records are considered historical, dating back over 20 years. These species were determined unlikely to still persist in the Study Area due to the historical nature of their records and rate of urban development since their last observation date. The use of additional online atlases outlined in **Section 2.1** has identified the records for additional SOCC that were not outlined in the *2015 Existing Conditions Report*.[1] Field investigations by AECOM and UTRCA in 2021 also identified additional SWHs which are discussed in **Section 3.6.2** below.

Based on a review of the background information sources listed in **Section 2.1**, records of 17 SOCC were identified within the vicinity of the Study Area. These species and their associated S-Ranks, status under the ESA and status assigned by the COSEWIC are shown in **Table 3-9** below. As mentioned above, a detailed habitat screening for SOCC has been provided in **Appendix E**. The results of the SOCC screening are summarized in **Section 3.6.2** below.

Table 3-9: SOCC Records in the Vicinity of the Study Area

Taxon	Common Name	Scientific Name	S-Rank[1]	ESA Status[2]	COSEWIC Status[3]	Source[4]	Latest Year[4]
Bird	Bald Eagle	*Haliaeetus leucocephalus*	S2N,S4B	SC	NAR	eBird, iNaturalist	2022
Bird	Barn Swallow	*Hirundo rustica*	S5B	SC	SC	eBird, iNaturalist, NHIC, OBBA, AECOM (2015)	2022
Bird	Canada Warbler	*Cardellina canadensis*	S4B	SC	THR	eBird, iNaturalist	2022
Bird	Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	eBird, iNaturalist, AECOM (2015)	2022
Bird	Eastern Wood-Pewee	*Contopus virens*	S4B	SC	SC	eBird, iNaturalist, OBBA	2021
Bird	Golden-winged Warbler	*Vermivora chrysoptera*	S4B	SC	THR	eBird, iNaturalist	2022
Bird	Peregrine Falcon	*Falco peregrinus*	S3B	SC	NAR	eBird	2014
Bird	Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR	eBird, iNaturalist, NHIC, OBBA	2022
Fish	Northern Sunfish (Great Lakes - Upper St. Lawrence populations)	*Lepomis peltastes pop. 2*	S3	SC	SC	DFO	N/A
Insect	Differential Grasshopper	*Melanoplus differentialis*	S3	-	-	NHIC, iNaturalist	2019
Insect	Hackberry Emperor	*Asterocampa celtis*	S3	-	-	OBA, iNaturalist	2021
Insect	Monarch	*Danaus plexippus*	S2N,S4B	SC	END	OBA, iNaturalist	2022
Plant	Chinese Hemlock-parsley	*Conioselinum chinense*	S2	-	-	NHIC	N/A
Plant	Green Dragon	*Arisaema dracontium*	S3	SC	SC	NHIC	N/A
Plant	Striped Cream Violet	*Viola striata*	S3	-	-	NHIC	N/A
Reptile	Northern Map Turtle	*Graptemys geographica*	S3	SC	SC	ORAA	2019
Reptile	Snapping Turtle	*Chelydra serpentina*	S4	SC	SC	UTRCA Correspondence, ORAA	2021

Notes: 1, 2, 3 are provided under Table 3-8.

3.6.2 Significant Wildlife Habitat Assessment Results

The SWH Assessment and screening exercise based on the 2021-2022 field investigations identified the following candidate and confirmed SWH within the Study Area:

1. *Records of bird species were only considered for those that were recorded during the peak breeding bird season (May 25 – July 10) when birds are actively breeding in or in the vicinity of the Study Area as opposed to flying over the Study Area during the migration season.*

Candidate

- **Seasonal Concentration Areas**
  - Turtle Wintering Areas - The Thames River may have deep-water pools within the Study Area that would provide suitable overwintering habitat. The Thames River is confirmed habitat for northern map turtles and snapping turtles as documented by the UTRCA on June 8, 2021; and,
  - Bat Maternity Colonies within the FOD7-4, FOD2-3 and FOD5-5 vegetation communities.
- **Specialized Habitat for Wildlife**
  - Habitats of SOCC – potentially suitable habitat was identified for Bald Eagle, Barn Swallow, Common Nighthawk, Eastern Wood-pewee, Golden-winged Warbler, Peregrine Falcon, Wood Thrush and Monarch. A detailed SOCC habitat screening is provided in **Appendix E**.
- **Animal Movement Corridors**
  - Amphibian Movement Corridor – Vegetation communities along the Thames River may provide movement corridors for amphibians between their terrestrial habitats and breeding habitat. Amphibian breeding pools were identified by UTRCA along the floodplain of the Thames River north of the Study Area on June 8, 2021. The forested communities along the Thames River also provides wildlife movement and provides connectivity through the landscape.

Confirmed:

- **Specialized Habitat for Wildlife**
  - Turtle Nesting Areas – UTRCA confirmed nesting Snapping Turtles along the shoreline within the northern limits of the Study Area. The existing stormwater outfall (refer to **Section 5**) provides preferable habitat conditions for a number of turtle species known to occur along Thames River. The existing stormwater outfall is in an area where natural deposition occurs in the Thames River, deposition of soft, muddy substrates is further amplified by the rapid deceleration of the stormwater flows as it joins the main channel. This has created preferable conditions for turtle species to carry out essential life stages by providing nesting habitat, cover and resting habitat.
  - Habitats of SOCC – Snapping Turtle, Northern Sunfish and Northern Map Turtle were confirmed in the Study Area. Suitable habitat for nesting, cover and thermoregulation was observed. A detailed SOCC habitat screening is provided in **Appendix E**.
- **Specialized Habitat for Wildlife**
  - Rare Vegetation Communities – FOD7-4 community was identified during ELC surveys on August 18, 2021, and the FOD2-3 community was confirmed to still be present in the northern extent of the Study Area. These communities have a provincial S-Rank of S3S4, this ranking indicates the community is rare but insufficient information exists to accurately assign a single rank (MNRF, 2000).

3.7 Species at Risk

3.7.1 Background Information

Henslow Sparrow (*Ammodramus henslowii*) and Eastern Hognose Snake (*Heterodon platirhinos*), identified in the *2015 Existing Conditions Report,* were not carried over to the updated 2022 SAR Screening (refer to **Appendix E**) because these species were last observed more than 20 years ago and are considered to be historical records and unlikely to still persist in the Study Area due to the rate of urban development since their last observation date. Cerulean Warbler (*Setophaga cerulea*) was also identified in the *2015 Existing Conditions Report* and was not

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carried over to the updated 2022 SAR Screening. An observation was made of the species during the second week of May in 2021, which is during migration, with no subsequent observations to indicate the species are breeding in the area. The use of online atlases outlined in **Section 2.1** has identified the potential for additional SAR that were not outlined in the *2015 Existing Conditions Report*. Furthermore, Black Ash (*Fraxinus* nigra) and Red-headed Woodpecker (*Melanerpes erythrocephalus*) were added to the updated 2022 SAR screening as a result of being up-listed to Endangered in Ontario on January 26, 2022. These additional SAR are outlined in **Appendix E**.

Based on a review of the background information sources listed in **Section 2.1**, records of 21 SAR were identified within the vicinity of the Study Area. These species and their associated S-Ranks, status under the ESA and status assigned by the COSEWIC are shown in **Table 3-10** below.

Table 3-10: SAR Records in the Vicinity of the Study Area

Taxon	Common Name	Scientific Name	S-Rank[1]	COSEWIC Status[2]	ESA Status[2]	Source[3]	Latest Year[4]
Bird	Bank Swallow	*Riparia riparia*	S4B	THR	THR	eBird, OBBA	2021
Bird	Cerulean Warbler	*Setophaga cerulea*	S3B	END	THR	eBird	2021
Bird	Chimney Swift	*Chaetura pelagica*	S4B,S4N	THR	THR	eBird, iNaturalist, NHIC, OBBA, AECOM (2015)	2022
Bird	Eastern Meadowlark	*Sturnella magna*	S4B	THR	THR	eBird	2013
Bird	Louisiana Waterthrush	*Parkesia motacilla*	S3B	THR	THR	AECOM (2015)	N/A
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*	S4B	END	END	eBird	2022
Fish	Black Redhorse	*Moxostoma duquesnei*	S2	THR	THR	DFO, UTRCA (2014)	N/A
Fish	Silver Shiner	*Notropis photogenis*	S2S3	THR	THR	NHIC, DFO, UTRCA (2014), iNaturalist	2021
Mammal	Eastern small-footed myotis	*Myotis leibii*	S2S3	-	END	BCI	N/A
Mammal	Little Brown Myotis	*Myotis lucifugus*	S3	END	END	BCI	N/A
Mammal	Northern Myotis	*Myotis septentrionalis*	S3	END	END	BCI	N/A
Mammal	Tricolored bat	*Perimyotis subflavus*	S3?	END	END	BCI	N/A
Mollusc	Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	SC	THR	NHIC, DFO, UTRCA	N/A
Plant	American Chestnut	*Castanea dentata*	S2	END	END	MECP	N/A
Plant	Butternut	*Juglans cinerea*	S2?	END	END	NHIC, iNaturalist	2022
Plant	Black Ash	*Fraxinus nigra*	S3	THR	END	iNaturalist	2022
Plant	Eastern False Rue-anemone	*Enemion biternatum*	S2	THR	THR	MECP	N/A
Plant	Kentucky Coffee Tree	*Gymnocladus dioicus*	S2	THR	THR	MECP	N/A
Reptile	Eastern Foxsnake	*Pantherophis gloydi*	S3	END	END	MECP	N/A
Reptile	Queensnake	*Regina septemvittata*	S2	END	END	UTRCA Correspondence	N/A
Reptile	Spiny Softshell	*Apalone spinifera*	S2	END	END	UTRCA Correspondence, ORAA	2021

Notes: 1, 2, 3, 4 – refer to definitions under Table 3-6.

3.7.2 Species at Risk Habitat Assessment results

The SAR Habitat Assessment and screening exercise is presented in **Appendix E**. Of the 21 SAR outlined in **Table 3-10**, five SAR designated as Threatened and eight SAR designated Endangered were determined to have high or medium potential to occur within the Study Area based on the presence of suitable habitat as well as confirmation of presence through field investigations, agency correspondence and background review. The remaining SAR outlined in **Table 3-10** were determined to have a low potential to occur within the Study Area due to lack of suitable habitat.

The following SAR were determined to have a high potential to occur within the Study Area:

- **Chimney Swift**
  Chimney Swifts are aerial insectivores and are typically concentrated in urban settlements where there are suitable chimneys for nesting and roosting (Steeves et al., 2014). This species was observed foraging over meadows within the Study Area on June 17, 2021. These individuals were likely nesting

within the Huron University building located in the north end of the Study Area, south of Elgin Drive. Nature London has been monitoring Chimney Swift use at the Huron University building as part of the Chimney Swift Initiative since 2018 (Wake, 2021). Additionally, data from eBird indicates hundreds of individuals use this chimney to roost (Wake, 2018; Wake, 2021).

- **Spiny Softshell**
  The presence of Spiny Softshell within the Thames River was confirmed through correspondence with the UTRCA's SAR Biologist, Scott Gillingwater during a joint site walk with AECOM ecologists. Known locations of Spiny Softshells in Ontario are considered to be sensitive and confidential information and therefore are not detailed further in this Report; however, potential effects and appropriate mitigation measures on turtle species in general are discussed in **Sections 6** and **7**.
- **Black Redhorse**
  In Canada, Black Redhorse is only found in southwestern Ontario at a few locations which includes the Thames River watershed. Species presence as well as Critical Habitat (designated under SARA and defined in a species' respective recovery strategy, where available) was identified within the Study Area using DFO's Aquatic SAR Mapping (2022). Black Redhorse mainly reside within shallow (<2 m deep) pools and riffle areas of medium-sized rivers that possess a sandy or gravel bottom substrate (Committee on the Status of Species at Risk in Ontario [COSSARO], 2016). Suitable habitat was confirmed in the Thames River within the Study Area. The adults mainly feed upon benthic invertebrates while young feed on plankton.
- **Silver Shiner**
  In Ontario, Silver Shiner is found within the Thames River where it prefers moderate to large size streams with swift currents that are free of weeds and have clean gravel or boulder bottoms (MECP, 2017). Species presence as well as Critical Habitat was identified in the Thames River and riparian vegetation in the Study Area using DFO's Aquatic SAR Mapping (2022), and suitable conditions confirmed during field investigations. Many records from iNaturalist (2022) indicates the frequent occurrence of this species in the Study Area. The most recent observation for this species was recorded on iNaturalist in 2022.

The following SAR were determined to have a medium potential to occur within the Study Area:

- **Red-headed Woodpecker**
  The Mineral Cultural Woodland Ecosite Type (CUW1) may contain suitable cavity trees for nesting. While this species was not recorded during breeding bird surveys, there is potential for future nesting within the Study Area.
- **Wavy-rayed Lampmussel**
  The habitat range of Wavy-rayed Lampmussel was identified using DFO Aquatic SAR Mapping (2022) in the Medway Creek system, near the northern boundary (but outside of) the Study Area. Species presence was also identified in the Thames River using DFO Aquatic SAR Mapping (2022). The Wavy-rayed Lampmussel typically prefers lotic systems with clear water, in shallow riffle areas with clean sand or gravel substrate (MNRF 2015b). Suitable conditions confirmed during field investigations.
- **Bat SAR (Eastern Small-footed Myotis, Northern Myotis, Little Brown Myotis and Tricoloured Bat)**
  Candidate habitat for bat SAR was identified within the Fresh – Moist Black Walnut Deciduous Forest Type (FOD7-4) during ELC surveys. Three snags (DBH>10 cm) were incidentally recorded and possessed suitable cavities and peeling bark that may be suitable for roosting bats. The three snags were observed in a cluster along the shoreline of the Thames River and is mapped on **Figure 6**. Maple trees > 25 cm DBH are present in all forested and woodland communities within the Study Area. No rock piles were identified for use by Eastern Small-footed Myotis.

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- **American Chestnut**

  The Dry-Fresh Hickory Deciduous Forest (FOD2-3) and Dry-Fresh Sugar Maple-Hickory Deciduous Forest (FOD5-5) may contain suitable soil conditions for the species. While this species was not recorded during plant surveys, there is potential for it to occur within the communities beyond the road right of way.

- **Eastern False Rue-anemone**

  Eastern False Rue-anemone occur along forest floors with moist soil regimes including riparian forest communities. While this species was not recorded during plant surveys, suitable conditions exist for this species to occur within the Fresh-Moist Black Walnut Lowland Deciduous Forest (FOD7-4) along the Thames River.

- **Queensnake**

  Queensnake is a semi-aquatic species that is seldom found more than a few metres from the water. It prefers rivers, streams and lakes with clear water, rocky or gravel bottoms, lots of places to hide and an abundance of crayfish (MNRF, 2017b). On June 8, 2021, the UTRCA identified suitable open rocky habitat with an abundance of crayfish along the Thames River. Conditions along the Thames within the Study Area are dominated by soft substrates along the shoreline; however, individuals may pass through the Study Area to reach hibernacula or disperse to other suitable habitats. No individuals of the species were observed during field investigations however species specific surveys were not conducted to appropriately confirm the presence of this species.

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4. Evaluation of Significance

The species and features found in the Study Area have been assessed using federal, provincial and municipal ranking and evaluation systems outlined by the MECP, COSEWIC, UTRCA and the City. A summary of the identified significant features found within the Study Area are outlined below.

4.1 Federally Recognized Features & Species

Six federally ranked aquatic species listed on Schedule 1 of the SARA, including Critical Habitat for two of the six species, were identified within the Thames River watershed and Study Area (**Table 4-1**).

Table 4-1: Federally Ranked Species within the Thames River Watershed and Study Area

Taxon	Common Name	Scientific Name	S-Rank	SARA (Sch. 1) Status[1]	Source[2]
Fishes	Black Redhorse*	*Moxostoma duquesnei*	S2	THR	DFO, UTRCA
	Silver Shiner*	*Notropis photogenis*	S2S3	THR	NHIC, DFO, UTRCA, iNaturalist
Molluscs	Wavy-rayed Lampmussel	*Lampsilis fasciola*	S1	SC	NHIC, DFO, UTRCA

*Notes: * Critical Habitat*
1, 2, – refer to definitions under Table 3-2

As there are no federally regulated lands found within the Study Area, the SARA generally does not apply to the terrestrial SAR with candidate or confirmed habitat within the Study Area; however, these species are addressed under provincial legislation in **Section 4.2**.

4.2 Provincially Recognized Features & Species

The following summarizes the provincially recognized features and species that have the potential to occur within the Study Area and are afforded protection under the PPS:

- Significant Valleylands;
  - Confirmed habitat for two terrestrial SAR including Chimney Swift and Spiny Softshell;
  - Confirmed habitat for three aquatic SAR, including Wavy-rayed Lampmussel, Black Redhorse, and Silver Shiner;
  - Candidate (i.e., potential) SAR Habitat for seven SAR including: Little Brown Myotis, Northern Myotis, Tri-colored Bat, Eastern Small-footed Myotis, Queensnake, American Chestnut and Eastern False Rue-anemone;
  - Confirmed SWH for Turtle Nesting Areas, Amphibian Breeding Habitat and confirmed habitat for Snapping Turtle, Northern Sunfish, and Northern Map Turtle;
  - Confirmed SWH for provincially rare FOD7-4 and FOD2-3 communities; and,
  - Candidate SWH habitat including seasonal concentration areas, specialized wildlife habitat, candidate SOCC habitat and animal movement corridors detailed in **Section 3.6**.

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4.3 Municipally and Conservation Authority Recognized Features & Species

Municipally recognized natural heritage features and policy areas were identified within the Study Area. According to Map 5 and Map 6 of *The London Plan* (City of London, 2022) these include:

- Significant Valleylands;
- Highly Vulnerable Aquifers;
- Significant Groundwater Recharge Areas; and,
- Portions of the Study Area fall within the Regulatory Flood Line, Maximum Hazard Limits, and UTRCA Regulation Limits.

Additionally, three invasive plant species recorded in the Study are considered priority species under the *London Invasive Plant Management Strategy (2017)* and included the following:

- Common buckthorn was present within all woodland and forested communities (CUW1, FOD2-3, FOD5-5 and FOD7-4);
- Glossy buckthorn was present within the FOD7-4 community; and,
- Common reed was present within the CUM1-1 community.

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5. Proposed Project Works

5.1 Project Description and Design

The proposed works includes improvements to Sarnia Road, Western Road, Philip Aziz Avenue and the intersection of Western Road / Sarnia Road / Philip Aziz Avenue. The details of proposed design work is provided in **Section 5.2.**

5.2 Project Components

The proposed works are as follows:

- **Sarnia Road**
  - Maintain a 4 lane configuration, with sidewalks and raised bicycle lanes.
  - Extend bicycle lanes (from Western Rd to Sleightholme Ave. to connect to the existing lanes west of Sleightholme Avenue).
  - No major utility relocation, except for minor work involving relocation of guy poles.
  - Minor general regrading and minor reconstruction of retaining walls on north side.
  - Some (minor) loss of trees along the corridor.
  - Small property taking area on north side.
  - Partial storm sewer replacement and catchbasin modifications along corridor.
  - Reconstruction of bus stops (with bus pads).
  - Minor property requirements.
- **Western Road**
  - Maintain a 4 lane configuration, with turn lanes sidewalks and raised bicycle lanes.
  - Extend bicycle lanes (from Platts Lane to Huron College to connect to the existing lanes).
  - Extended southbound turn lane at Sarnia Road.
  - Construction of dedicated bus bays and maintaining other bus stops.
  - Median planters south of Lambton Drive.
  - Relocation of numerous street light poles and guy poles/wires along entire length.
  - Partial storm sewer replacement and catchbasin modifications along corridor.
  - Watermain replacement from Platts Lane to Sarnia Road.
  - Re-grading along east side of road, north of Platts Lane.
  - Intersection improvements at Brescia Lane / Lambton Drive.
  - Hydro pole relocation on east side (from Essex Hall to Philip Aziz Ave).
  - Property required throughout the corridor.
- **Philip Aziz Avenue**
  - Develop urban Cross-section with 2 lanes including increased length of westbound turn lane with sidewalks and raised bicycle lanes.
  - Construct retaining walls with fence along both sides of road.
  - Relocation of overhead services on east side.
  - New stormwater sewer and new Stormwater Outfall (relocated to 50 m downstream from the existing outfall along the Thames River).
  - New sanitary sewer forcemain from pump station to Western Rd. intersection.

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  - Loss of vegetation along both sides of the road
  - Reconstruction of property entrance to 150 Philip Aziz Ave.
  - Property requirements including north and south sides, as well as area at Thames River
  - Reconstruct bus stop (just east of Western Rd)

- **Intersection of Western/Sarnia/Philip Aziz**
  - General reconstruction of intersection with wider pedestrian crossings, improved bicycle lane connectivity and larger waiting areas.

The construction of the potential new parking lot entrances to the Western University campus are not included as a component of this Project and therefore the impacts of which will no be addressed in the subsequent sections but have been included within the Study Area to document existing conditions.

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6. Assessment of Potential Impacts

6.1 Existing Impacts

It is recognized that many, if not all, natural areas within Southern Ontario have been affected by human disturbance. In order to assess the potential impacts of the Project it is necessary to consider existing impacts that are present within the Study Area prior to the initiation of the work. Existing impacts should be documented in order to determine whether, following site alteration, impacts are a result of the work or a result of previous activities or events on the lands.

Based on AECOM's site investigations, the following existing impacts were identified within the Study Area:

- **Fragmentation of Natural Vegetation and Habitat**
  Natural heritage features within the Study Area and surrounding landscape have been influenced by clearing for predominantly residential and agricultural purposes, as well as for construction of municipal roads. Despite this fragmentation, the communities adjacent to the Thames River provide wildlife habitat and likely a movement corridor through the greater landscape.

- **Introduction of Horticultural and Invasive Plants** – Vegetation communities adjacent to urban areas are subject to the gradual invasion of weedy and horticultural species introduced from residential gardens, vehicle traffic and by natural dispersal. A heavy presence of non-native vegetation species was recorded in several of the delineated vegetation communities, which have been introduced into natural communities from the surrounding residential areas. As mentioned in **Section 3.4**, there were many invasive terrestrial plant species in the Study Area including but not limited to common buckthorn, glossy buckthorn, Norway maple, Manitoba maple, tree-of-heaven, garlic mustard and common reed. Of which, three species (common reed, common buckthorn and glossy buckthorn) are considered a priority species under the *London Invasive Plant Management Strategy (2017).* Invasive aquatic vegetation (*Eurasian water-milfoil*) was also identified in the Thames River.

- **Transportation and Stormwater Infrastructure**
  The Study Area mostly consist of urban streetscapes and infrastructure. Road salt, oil and gas, sediment, and other deleterious substances from the roads enter the Thames River via roadway runoff and stormwater drainage. Such inputs can have an impact on overall water quality, and physical habitat for aquatic species. Moderate traffic noise levels are evident throughout the Study Area. This noise may cause a reduction in the species abundance or richness of birds and other wildlife inhabiting natural areas in the vicinity of the Thames River. Some species may have acclimated to the noises generated by human activities.

6.2 Potential Impacts of the Proposed Works

The potential environmental impacts associated with the Project relate primarily to construction activities. Many of the potential impacts are commonly encountered with construction and have associated standard mitigation measures available to minimize or avoid potential impacts. These potential impacts can be prevented or negated if appropriate measures are implemented. If they are not managed and prevented through best management practices and avoidance or mitigation, they may lead to long-term impacts and significant damage to both ecological features and their functions. The following sections outline potential environmental impacts based on the CDA for the conceptual design available at the time of preparation of this EIS Report.

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6.2.1 Direct Potential Impacts:

Potential direct impacts to existing natural heritage features and functions associated with construction activities (e.g., excavation activities, machinery use) such as vegetation/habitat removal.

6.2.1.1 Construction Phase

Loss of Vegetation – Estimated vegetation removals by ELC community based on the CDA (as illustrated on **Figure 6**), are provided in **Table 6-1** below. Approximately 0.33 ha of vegetation communities will be cleared to accommodate the proposed works. This represents only 2.3% of the existing vegetation communities that will be permanently affected by removals. Vegetation removal will occur around existing infrastructure and is limited to edge habitat that is already disturbed by anthropogenic influences. Connectivity between vegetation communities is not anticipated to be impacted given the CDA occurs along the existing infrastructure. Vegetation removal may be compensated through native plantings and restoration measures.

Table 6-1: Summary of Impacts to Vegetation

ELC Community	ELC Vegetation Code	Sum of Total Area (ha) in Study Area	Sum of Total Impacted Area (ha)	Total Impacted Area (%)
Mineral Cultural Meadow	CUM1-1	4.016	0.016	0.403
Mineral Cultural Woodland Ecosite	CUW1	4.395	0.059	1.34
Fresh – Moist Black Walnut Deciduous Forest Type	FOD7-4	5.605	0.255	4.553
	Total	**14.016**	**0.33**	**2.354**

Loss of Candidate SWH including Habitat for Monarch – Candidate habitat for Monarch was identified within the CUM1-1 where common milkweed (*Asclepias syriaca*) was present. Impacts to candidate Monarch habitat is anticipated to be minimal as only 0.016 ha of the CUM1-1 will be removed and limited to disturbed edge habitat. Compensation plantings should include common milkweed to offset the loss of Monarch habitat.

Loss of Candidate SWH including Habitat for Bird SOCC – Candidate habitat for Bald Eagle, Eastern Wood-pewee, Golden-winged Warbler, Peregrine Falcon, Wood Thrush was identified within the forested and woodland vegetation communities (CUW1, FOD2-3, FOD5-5 and FOD7-4). Approximately 0.314 ha of vegetation removal is anticipated within forested and woodland communities. This represents only 3.1% of loss of candidate habitat in the Study Area. These impacts are considered minimal given the greater landscape outside of the CDA consists of continuous forested communities and woodland communities north of the Study Area in the Medway Environmentally Significant Area. Forested and woodland communities located along existing roads and infrastructure will be limited to edge habitat which is already subject to anthropogenic disturbances. Candidate habitat for Common Nighthawk was also identified within the Study Area, where this species may nest on flat gravel roof tops. No impacts to candidate Common Nighthawk habitat are anticipated as no building demolitions have been proposed.

Loss of Candidate SWH including Rare FOD7-4 Community– the FOD7-4 communities adjacent to the Thames River were already very fragmented and there is little opportunity to connect with the larger Environmentally Significant Area located north of the Study Area. The FOD7-4 communities extend outside of the Study Area and connect with other vegetated areas along the Thames River. Given the greater landscape, impacts from vegetation removal in the FOD7-4 are anticipated to be minimal provided that the appropriate mitigation and compensation measures are applied.

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Loss of Candidate Chimney Swift Habitat – Chimney Swift habitat was confirmed as they have been documented nesting in the Huron University building. No impacts to Chimney Swifts are anticipated as no building demolitions are proposed.

Loss of Candidate Queensnake Habitat – Suitable aquatic open rocky habitat with an abundance of crayfish was identified along the Thames River. The *Survey Protocol for Queensnake in Ontario* (MNRF, 2015c) should be used to confirm species presence. This aquatic habitat was identified outside of the Study Area and impacts are not anticipated however, individuals may occur in the Study Area to reach hibernacula and disperse to other suitable habitats. Best practices for *Reptile and Exclusion Fencing* (MECP, 2019) should be used to prevent individuals from entering the CDA.

Loss of Candidate Red-headed Woodpecker Habitat – Candidate habitat for Red-headed Woodpecker was identified in the Mineral Cultural Woodland Ecosite (CUW1). Injury/mortality to Red-headed Woodpecker is not anticipated as a result of construction activities because no nesting cavity trees in the CUW1 were identified within the CDA. If tree removal is scheduled outside of the breeding bird season (**April 1 to August 31**), then no impacts to Red-headed Woodpecker are anticipated. Furthermore, it is not anticipated that Red-headed Woodpeckers will use the edge habitat of the forested communities during the winter, as this species tends to use the inner parts of the forest during this time if it doesn't migrate south to the eastern half of the United States (ECCC, 2019).

Loss of Potential Bat SAR Habitat and Candidate Bat Maternity Colonies SWH – Candidate bat cavity trees and SWH for Bat Maternity Colonies were observed within the forested and woodland vegetation communities (FOD2-3, FOD5-5 and FOD7-4) in the Study Area, of which three candidate bat cavity trees were located within the CDA. Minimal impacts to candidate bat SAR habitat and SWH are anticipated as a result of vegetation removal within the forested communities. Approximately 0.255 ha of vegetation removal is anticipated within forested and woodland communities. This represents only 4.5% of loss of candidate bat SAR habitat as well as SWH in the Study Area. These impacts are considered minimal given the greater landscape outside of the CDA consists of continuous forested communities along the Thames River. Forested and woodland communities located along existing roads and infrastructure will be limited to edge habitat which is already subject to anthropogenic disturbances. Majority of candidate bat roost trees were located outside of the CDA and will not be impacted. Given candidate bat SAR habitat and SWH is not limited in the greater landscape, vegetation removal within the CDA is not anticipated to impair or eliminate the form and function of the remaining bat SAR habitat and SWH. Furthermore, if tree removal within bat habitat occurs outside of the bat roosting season **(April 1 - September 30),** potential impacts of injury or mortality of roosting bat SAR can be avoided such that authorization under the ESA is anticipated not be required.

Loss of Turtle Nesting Areas (including habitat for turtle SOCC and SAR) – turtle nesting habitat can occur wherever there are sun-exposed sand/gravel/soil substrates in proximity to an aquatic feature; including, for example, watercourse banks, gravel bars and islands, road shoulders and embankments, lawns, gardens and gravel laneways and lots (WSP, 2018). Proposed works along the banks of the Thames River to accommodate the new stormwater outlet may result in the removal of potential turtle nesting areas. The existing stormwater outfall is in an area where natural deposition occurs in the Thames River; deposition of soft, muddy substrates is further amplified by the rapid deceleration of the stormwater flows as it joins the main channel. This has created preferable conditions for turtle species to carry out essential life stages by providing nesting habitat, cover and resting habitat. Changes to the existing stormwater outfall that affect the rate of stormwater flow may result in the loss of suitable turtle habitat as sediment might not accumulate at the same rate. It is recommended to relocate the new outfall at least 50 m downstream from the existing outfall, which will remain in place but will be plugged and not functional, to avoid direct impacts to the sensitive turtle habitat. There is potential that the accumulation of deposited suitable substrates may erode over time if there is no water flow from the existing outfall; however, the potential effects are not well understood at this time and a fluvial geomorphological assessment with review of the hydraulic properties (HEC RAS hydraulic model output) of the Thames River and the outlet channel (if available) would be required during detail design.

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Loss of, Alteration, or Disturbance to Aquatic SAR Habitat – Riparian vegetation provides overhanging cover, shade, food and nutrient inputs that provide important function for fish habitat in general, but particularly for Silver Shiner that rely heavily on this habitat. For this reason, vegetated riparian areas are considered to be regulated habitat under the ESA as per the Silver Shiner General Habitat Description (MECP, 2017), and Critical Habitat as per the Silver Shiner Recovery Strategy and Action Plan (Proposed) (DFO, 2020). This SAR habitat was confirmed in the Study Area and CDA adjacent to the Thames River, where vegetation removal is proposed in the vegetation community FOD7-4. Removal of this vegetation or temporary disturbance during construction has the potential to impact the habitat features and function noted above.

Furthermore, the aquatic habitat on the banks and below the high water mark of the Thames River is confirmed habitat (including Critical Habitat) for Black Redhorse, Wavy-rayed Lampmussel, and aquatic habitat for Silver Shiner. This habitat could be altered or disturbed by the relocation of the stormwater outfall. These impacts can typically be mitigated by minimizing vegetation removal and implementing other vegetation protection and in-water work mitigation measures as outlined in **Table 7-1**, paired with measures to offset or compensate for the loss or disturbance of vegetation and bank restoration/re-stabilization through site restoration plans that include new plantings of native tree and shrub species in riparian areas.

Loss of Candidate Turtle Wintering Areas (including habitat for turtle SOCC) – The Thames River potentially provides turtle overwintering habitat. Proposed in-water works or works near water may disturb any turtles that may be overwintering during the brumation period of September 20 to May 1, resulting in injury or mortality. Furthermore, turtles travel several distances in search for resources (e.g., mates, nests, etc.) during the active season of typically April 1 to October 30 and may incidentally wander into the construction work area where they will be susceptible to injury/mortality as result of construction activities. In-water work is not anticipated to impede the movement of turtles throughout the Thames River during the active season as the watercourse will only be partially isolated.

6.2.2 Operational Phase

There are no direct potential effects anticipated during the operational phase, as all of the direct impacts would have occurred during the construction phase (e.g., removal of habitat).

6.3 Indirect Potential Impacts

Indirect impacts associated with planning and engineering are not immediately caused by the design (e.g., placement of Project components) but nevertheless cause an effect on the natural environment through one or more intervening variables.

6.3.1 Construction Phase

Damage and Disturbance to Adjacent Natural Features –Accidental intrusion from construction into the adjacent natural heritage features which provide candidate and confirmed SWH and SAR habitat as outlined in **Section 3.6 and 3.7**. Additionally, machinery use adjacent to natural heritage features can result in soil compaction and trampling of herbaceous vegetation. These impacts can limit a plant's ability to grow and absorb nutrients and water. These impacts can typically be mitigated for with the installation of tree protection fencing along the limits of work to exclude machinery and construction personnel.

Migratory Bird Nest and Egg Destruction – vegetation communities provide breeding habitat and movement corridors for a variety of wildlife, including SAR, SOCC and/or migratory birds protected under the MBCA. Furthermore, migratory and/or SAR birds may use manmade structures (e.g., bridges and buildings) for nesting. Vegetation (i.e., trees, shrubs and ground cover) removal or structure demolition/rehabilitation has the potential to destroy migratory bird nests and eggs, which are protected under the MBCA, if conducted during the overall bird nesting period of April 1 to August 31.

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Disturbance to Wildlife – Construction activities within the Study Area have the potential to disturb wildlife (e.g., birds, snakes and turtles) within adjacent natural features. Urban wildlife, including SOCC may enter the construction work area and may become susceptible to accidental injury or mortality associated with construction equipment or machinery if not properly mitigated. Wildlife encounters during construction within the active season may result in collisions with construction equipment or disruption of life cycle processes (e.g., nesting, hibernating, etc.) resulting in injury or mortality. Noise and vibrations from construction activities are anticipated to be temporary, short in duration and are not anticipated to substantially increase from daily existing road use. A certain degree of disturbance can be avoided by restricting rehabilitation activities to certain times of the day and outside of breeding periods for any bird species identified within the Study Area. Additionally, mitigation measures outlined in **Table 7-1** are anticipated to sufficiently address potential disturbances to wildlife.

Sediment and Erosion – Soil compaction and trampling of herbaceous vegetation can cause the exposure of soils, which can result in sediment runoff discharging into nearby natural heritage features, including the Thames River. Elevated levels of sediment and related turbidity can reduce the productivity of an aquatic system by clogging the gills of fish, covering fry and eggs within the substrate and reducing prey availability. Furthermore, increased sedimentation into the Thames River from the proposed works may impact aquatic SAR fish and mussel habitat including feeding requirements essential for multiple life stages. Sediment deposition within terrestrial natural features can also lead to suffocation of vegetation. Exposed soils can result in dust deposition within adjacent natural heritage features which may interrupt the ability of vegetation to photosynthesize.

Disturbance to Fish and Mussel Species and their Habitat – The use of construction equipment/machinery and vehicles on site in or near water could result in spills or leaks of oil, gasoline and other deleterious substances including, but not limited to, concrete dust/debris, sealants, degreasers, and de-rusting agents. An increase in the concentration of deleterious substances in sediment and water can exceed the acceptable range of chemical constituents within aquatic systems and affect fish and fish habitat. The ecological effects can include, but are not limited to, direct fatality to fish, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (i.e., bioaccumulation and biomagnification). Deformities, alterations in growth, reproductive success, and competitive abilities can also result. The work below the high water mark associated with the relocation of the stormwater outfall can result in fish and mussel mortality and disturbance by equipment operation in water, or by entrainment or impingement in pump intakes during dewatering of work areas (if required). The temporary footprint of the work area may result in the loss of access to that habitat during construction.

6.3.2 Operational Phase

Effects on Water Quality - Anticipated indirect potential effects associated with the long-term operation of the Project may include the potential for road salt loading in the Thames River as a result of increased impervious surfaces, which may indirectly affect fish and aquatic SAR habitat, including turtle habitat.

Wildlife Road Mortality – Although the road will be widened, it will mostly be limited within the existing road right-of-way and is not anticipated to increase road mortality from baseline conditions as there are limited opportunities for movement within the highly urbanized landscape.

Alteration to fish and mussel habitat – The footprint of the relocated stormwater outfall may result in alterations to bank habitat below the high water mark, as well as riparian habitat. Though the reconstructed stormwater drain and outfall will result in improvements to existing stormwater inputs to the river through design improvements, the bank and riparian alterations could alter or reduce food and nutrient inputs, overhanging shade and cover, and in-water substrate, structure and cover for fish.

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7. Avoidance, Mitigation, and Compensation Recommendations

In order to address the potential impacts identified for any proposed work associated with the Project, there are three general categories of measures:

1. **Avoidance** – Avoidance involves the design of a plan that protects natural heritage features and functions by keeping the works outside of natural heritage features wherever possible.
2. **Standard Mitigation** – Mitigation involves the implementation of measures designed to eliminate or reduce impacts by designing facilities or including natural elements that filter or prevent impacts.
3. **Compensation** – Compensation involves the replacement of a feature and/or function that may be lost as a result of the construction and long-term presence of the works.

The avoidance, mitigation and compensation recommendations are detailed in the Environmental Management Plan provided in **Appendix F**. A summary of these are also provided in **Table 7-1**.

7.1 Net Effects Assessment

The "*net effects*" of potential impacts were assessed based on the degree to which the recommended mitigation measures can prevent or minimize the potential environmental effects. In other words, net effects are those that remain after mitigation, avoidance and/or compensation measures have been implemented.

The following criteria were applied during the assignment of net effects from the design, construction, and existing land use related to the Project. The potential impacts caused by the proposed work for the Project were considered relative to the significance and sensitivity of the ecological features or their functions.

NO Net Effect..... indicates that no impact to the identified ecological features or functions is anticipated;

LOW Net Effect..... indicates loss of habitat possessing limited potential habitat value, or loss of a portion of habitat, which will not result in long-term impact to the remaining habitat, or reduction in associated key ecological functions;

MEDIUM Net Effect ..... indicates loss of habitat possessing moderate potential habitat value, or loss of a portion of habitat that may result in long term impact to the remaining habitat, or loss of associated key ecological functions; and,

HIGH Net Effect..... Indicates loss of habitat possessing significant potential habitat value, or loss of a portion of habitat that may result in long-term and potentially critical impacts to the remaining habitat, or significant loss of associated key ecological functions.

The anticipated net effects of the proposed work for the Project (**Section 5**) and the recommended mitigation measures (**Appendix F**) are shown on **Table 7-1**.

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Table 7-1: Net Effects Assessment

Item #.	Potential Areas Affected & Potential Effects	Avoidance, Mitigation and Compensation Recommendations	Monitoring Requirements	Net Effects & rationale
1.0	**Existing Impacts (where opportunities for net positive effects have been identified):**			
1.1	**Increase in Native Vegetation Cover** ■ Vegetation communities adjacent to urban areas are subject to the gradual invasion of weedy and horticultural species introduced from residential gardens, vehicle traffic and by natural dispersal. Invasive species such as common reed and common buckthorn were observed within vegetation communities.	■ Non-native vegetation will be removed where present within the CDA. This vegetation will be replaced with native tree, shrub, and seed mix to promote the development of native species.	■ None	(+) NET POSITIVE EFFECT ■ There will be the removal of non-native vegetation as a part of the projects clearing and grubbing process. These removed species will be replaced with native vegetation after the project is completed.
2.0	**Direct Impacts**			
2.1	**Construction - Direct Impacts**			
2.1.1	**Loss and Disturbance of Vegetation Communities including SWH** ■ A total of 0.33 ha of vegetation communities is anticipated to be removed. ■ 0.016 ha of candidate habitat for Monarch will be removed. ■ 0.314 ha of vegetation removal for Bald Eagle, Eastern Wood-pewee, Golden-winged Warbler, Peregrine Falcon and Wood Thrush. ■ 0.255 ha of vegetation removal for within rare FOD7-4	■ Limit vegetation removal to the extent possible. Clearly delineate vegetation clearing zones (i.e., using silt or tree protection fencing) on both construction drawings and in the field prior to clearing and grading. ■ Temporarily disturbed areas will be replanted with native trees, shrubs and seed mix. ■ Other enhancement measures such as Invasive Species Control (for common buckthorn) could be implemented to provide a benefit to the riparian communities along the Thames River. ■ Tree removals shall be replaced at a minimum rate of 1:1 for removals that do not fall within Significant Valley Lands and 3:1 for removals within the Significant Valley Lands.	■ Post-planting monitoring of vegetation	NO NET EFFECT ■ Anticipated tree removal is minimal and within already disturbed, low quality vegetation communities compared to the remaining natural areas along the Thames River. Habitat loss will be compensated for through new plantings and other enhancement or restoration measures. Plantings would consist of native trees, shrubs and seed mixes. No long-term effects are anticipated on the remaining vegetation communities.
2.1.2	**Loss of Turtle Nesting Areas (including habitat for SAR and SOCC)** ■ Changes to the existing stormwater outfall may reduce available turtle nesting habitat. Additionally, Vegetation removal along the riparian banks of the Thames River, including within manicured lawns, to accommodate the road widening and temporary laydown areas may remove potential turtle nesting areas	■ No in-water work to occur at the existing outfall. ■ A new outfall should be created at least 50 m downstream to avoid direct impacts to turtle habitat with the existing non-functional outfall to remain in place. ■ A fluvial geomorphological assessment with review of the hydraulic properties (HEC RAS hydraulic model output) of the Thames River and the outlet channel (if available) is required during detail design to understand the effects of plugging the existing outfall on the deposition of sedimentation contributing to turtle habitat. Information from this study will inform design changes. ■ Limit vegetation removal to the extent possible. Clearly delineate vegetation clearing zones (i.e., using silt or tree protection fencing) on both construction drawings and in the field prior to clearing and grading. ■ Temporarily disturbed areas will be replanted with native trees, shrubs and seed mix. Tree removal on the southeast bank, which will create more open habitat may inadvertently create turtle nesting habitat.	■ None	(-) LOW NET NEGATIVE EFFECT ■ This habitat loss is considered to be very minimal and there are other nesting habitats available elsewhere and nearby along the Thames River.
2.1.3	**Harmful Alteration, Disruption, or Destruction of Fish Habitat, Death of Fish, and alteration of Aquatic Species at Risk Individuals or Habitat** ■ The stormwater outfall relocation will require work below the high water mark. This could result in: ■ harm to fish or mussel individuals by equipment, or entrapment or impingement in pump intakes ■ Changes to access to habitat, including Critical Habitat and/or during sensitive life stages	■ Avoid work below the high water mark from March 15 to July 15 ■ Work below the high water mark should be done in isolation of flowing water ■ Fish and mussels should be removed from wetted work areas ■ Mussel relocation will be completed following the methods laid out in the *Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario – Great Lakes Area (OGLA)* (Mackie, Morris, & Ming, 2008) and in consultation with DFO. ■ Pump intakes in fish-bearing water should be screened ■ Follow any additional mitigations associated with the permits and authorizations required for the construction activities.	■ Post-relocation monitoring of SAR mussel survival is a mandatory requirement as per DFO protocols for SAR mussel relocation. Monitoring is to be completed one month, one year, and two years following relocation of any SAR mussels	(-) LOW NET NEGATIVE EFFECT ■ Removal of fish and mussels from wetted work areas following permit conditions and standard protocols will protect those individuals from harm. The relocation will be a temporary disturbance for those individuals.
2.1.4	**Loss of Bat SAR Habitat** ■ A total of 0.255 ha of forested and woodland communities is anticipated to be removed.	■ Same as Item 2.1.1. above. ■ The form and function of the remaining vegetation communities will be maintained for bat SAR.	■ Post-planting monitoring of vegetation and wildlife enhancement features	NO NET EFFECT ■ Tree removal is minimal at this location with the remainder of the treed riparian habitat along the Thames River as well as larger Study Area continuing to function as foraging and roosting habitat for bat SAR. Habitat loss will be compensated for through new plantings and other enhancement or restoration measures.
2.1.5	**Loss of Significant Valleyland** ■ There are no impacts anticipated to the Significant Valleyland associated with the Thames River as the CDA is limited to existing infrastructure and it will not impede the function of the valleyland to facilitate wildlife movement and connectivity within the Natural Heritage System.	■ Same as Item 2.1.1. above.	■ None	NO NET EFFECT ■ Minimal vegetation removal is not anticipated to alter the form or function of the significant valley. Habitat loss will be compensated for through new plantings and other enhancement or restoration measures.
2.1.6	**Loss of candidate Red-headed Woodpecker Habitat** ■ A total of 0.059 ha of treed habitat is anticipated to be removed.	■ See item 2.1.1 above.	■ Post-planting monitoring of vegetation	NO NET EFFECT ■ Tree removal is minimal and within already disturbed, low quality edge habitat within vegetation communities. Habitat loss will be compensated for through new plantings and other enhancement or restoration measures. Plantings would consist of native trees, shrubs and seed mixes. No long-term effects are anticipated on the remaining vegetation communities, of which the function and form to provide Red-headed Woodpecker habitat will not be eliminated or impaired.

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Item #.	Potential Areas Affected & Potential Effects	Avoidance, Mitigation and Compensation Recommendations	Monitoring Requirements	Net Effects & rationale
2.2	**Operational Phase – Direct Impacts**			
2.2.1	**There are no anticipated direct impacts resulting from the operation phase of the Project.**	▪ None	■ None	NO NET EFFECT ■ No direct impacts are anticipated.
3.0	**Indirect Impacts**			
3.1	**Construction Phase – Indirect Impacts**			
3.1.1	**Accidental intrusion into Vegetation Communities** ■ incidental intrusion into the adjacent vegetation communities from machinery, equipment, etc. ■ Damage to tree rooting zone immediately adjacent to areas of grading and excavation. ■ Soil compaction by machinery in areas adjacent to natural features affecting trees' ability to absorb nutrients and water. ■ Structural damage to adjacent vegetation by operation of heavy machinery (broken tree limbs etc.).	■ Clearly delineate vegetation clearing zones (i.e., using silt or tree protection fencing) on both construction drawings and in the field prior to clearing and grading. ■ Limiting tree removal to the extent possible. ■ Root pruning of adjacent trees during grading and excavation. ■ Installation of tree protection fencing.	■ Activity specific monitoring by construction group during any tree removal, excavation, or other heavy machinery activity near established tree protection fencing.	(-) LOW NET NEGATIVE EFFECT ■ Roots of retained trees may require pruning and fencing should limit impacts to rooting zones. Proper installation and monitoring of protective fencing, as well as restriction of access can reduce the risk of potential impacts.
3.1.2	**Migratory Bird and SAR/SOCC bird Nest and Egg Destruction** ■ Vegetation (i.e., trees, shrubs and ground cover) removal or structure demolition/rehabilitation has the potential to destroy migratory bird nests and eggs, which are protected under the MBCA, if conducted during the overall bird nesting period of April 1 to August 31.	■ Avoid vegetation removal or building demolitions within the active breeding bird period (April 1 – August 31) to avoid disturbing nesting birds and contravening the MBCA. ■ The slope of stockpiled substrates (gravel, sand, soil) should be reduced and maintained to 70 degrees or less during the breeding bird season (April 1 to August 31) to prevent burrowing MBCA protected and SAR birds from nesting in the stockpiled material. ■ Bird exclusion measures (i.e., tarps) should be installed at culverts prior to the beginning of the breeding bird season (April 1 to August 31) of any year in accordance with the *Best Management Practices for Excluding Barn Swallows and Chimney Swifts from Buildings and Structures* (MNRF, 2017a) .	■ None	NO NET EFFECT ■ Avoidance of vegetation removal within the breeding bird season will avoid impacts on MBCA protected birds.
3.1.3	**Incidental Wildlife Injury or Mortality** ■ Urban wildlife including SOCC/SAR may enter the construction work area and may become susceptible to accidental injury or mortality associated with construction equipment or machinery if not properly mitigated.	■ Contractor Wildlife Observation and Handling Protocol Protocols should be implemented to ensure that appropriate measures are in place for the identification, handling, translocation and reporting of wildlife, including SAR. A wildlife kit should be present on-site and made readily available. ■ Consultation with UTRCA, DFO and MECP will be undertaken during detail design to determine/develop appropriate avoidance and mitigation measures to avoid or minimize effects on all affected SAR. ■ On-site SAR training of construction crew is an industry standard Best Management Practice and will be administered by a qualified Biologist/Ecologist. ■ Installation of wildlife exclusionary fencing to prevent turtles and snakes from entering the area of construction. Fencing should be installed prior to construction. ■ Preclearance surveys should be completed to clear the limits of work and ensure wildlife are not enclosed within the area of work ■ Schedule vegetation removal to outside of the bird nesting period of April 1 to August 31. ■ Should vegetation removal be required in simple habitats (e.g., limited vegetation) within the bird nesting period, a nest survey will be conducted by a qualified ecologist or equivalent to determine the presence of nesting birds prior to removal. ■ Exclusionary measures to be installed prior to the active nesting season to prevent nesting in culverts, should repair activities that may affect nesting birds be required during the active nesting season. Installation of exclusionary measures should follow MNRF (2017) guidance. ■ Restrict tree removal to outside of the bat roosting period of April 1 to September 30. ■ Limit construction activity to a period after 7 am and before 7 pm daily.	■ None	NO NET EFFECT ■ Installation of exclusion fencing, and implementation of the Wildlife Observation and Handling Protocol will minimize or avoid injury/mortality of wildlife.
3.1.4	**Potential Injury/Mortality to Turtles** ■ Turtles in search of nests can also wander into the construction work area and be susceptible to injury/mortality during the period late May to mid July.	■ Any in-water works within the Thames River (i.e., installation of new stormwater outfall) should be completed outside of the turtle brumation period of September 20 to May 1, unless the work area is isolated prior to September 20. ■ Searches for turtles will be completed prior to any in-water works, in conjunction with the fish and mussel relocation and in consultation with the UTRCA ■ Installation of exclusion fencing around upland work area and suitable stockpiled material prior to April 1 will prevent turtles from entering the work area following the *MNRF's Reptile and Amphibian Fencing BMP* (2020).	■ Daily searches for turtles (and other wildlife) during the turtle active season (April 1 to September 20) within the construction work area.	NO NET EFFECT ■ Installation of exclusion fencing, in-water work timing restrictions, daily searches and implementation of the Wildlife Observation and Handling Protocol will minimize or avoid injury/mortality of turtles.
3.1.5	**Possible Injury/Mortality of Bat SAR** ■ Bat SAR may be inadvertently killed or injured as a result of the removal of or accidental damage to suitable maternity roost trees if vegetation clearing occurs during the bat roosting season between April 1 and September 30.	■ Avoid tree removal within the active bat roosting period (April 1– September 30)	■ None	NO NET EFFECT ■ Avoidance of vegetation removal within the bat active season will avoid impacts to bat SAR.

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Item #.	Potential Areas Affected & Potential Effects	Avoidance, Mitigation and Compensation Recommendations	Monitoring Requirements	Net Effects & rationale
3.1.6	**Potential Injury/Mortality to Red-headed Woodpecker** ■ There are no nesting cavity trees that will be removed. It is not anticipated that Red-headed Woodpeckers will use the edge habitat for these forests during the winter.	■ Avoid vegetation removal or building demolitions within the active breeding bird period (April 1 – August 31).	■ None	NO NET EFFECT ■ There are no effects anticipated on Red-headed Woodpecker provided that tree removal occurs outside the breeding bird season.
3.1.7	**Disturbance to Wildlife** ■ Wildlife may be disturbed or displaced temporarily due to construction noise/vibration or increased human activity.	■ Restrict construction activities to daytime hours (sunrise to sunset). ■ Restrict vegetation clearing to periods before and after the bird and bat active seasons of April 1 to September 30. ■ Limit access to the construction site which can be achieved through the installation of protective fencing that excludes wildlife.	■ No monitoring required	NO NET EFFECT ■ With the implementation of restrictions to the timing of construction disturbance to birds and other wildlife can be minimized. Construction is not anticipated to prevent wildlife movement.
3.1.8	**Sediment and Erosion** ■ Vegetation clearing, grubbing and grading can result in sediment runoff discharging into Thames River.	■ Develop an Erosion and Sediment Control Plan ■ Installation of erosion and sediment control measures (ESC), with particular emphasis to avoid sedimentation entering the Thames River. ■ The construction area should not overlap with the Maximum Hazard Line.	■ All fencing (silt, tree and wildlife exclusion) should be monitored during construction on a weekly basis and 24 hours after significant rain or wind events to ensure that all fencing is intact and functioning properly.	NO NET EFFECT ■ Proper installation and monitoring of ESC measures can reduce the risk of sediment deposition to the Natural Heritage Features and downhill slopes. Sediment flow is unlikely to reach Natural Heritage Features from the construction site with appropriate ESC measures in place.
3.1.9	**Dust Deposition** ■ Dust accumulation on vegetation within natural heritage features affecting plants ability to photosynthesize	■ To protect sensitive environmental receivers dust suppression methods are limited to the application of water. ■ Water adjacent vegetation if dust accumulation occurs	■ Daily monitoring by a trained ESC inspector	NO NET EFFECT ■ Use of dust suppressants can reduce the risk of dust accumulation in the Natural Heritage Features and associated functions.
3.1.10	**Soil or Water Contamination (including groundwater)** ■ The use of machinery/equipment and vehicles could result in inadvertent spills or leaks of deleterious substances (concrete, concrete wash water, oil, gasoline and hydraulic fluid) which could contaminate soils, waterbodies or groundwater.	■ Develop a Spills Response Plan. ■ Regular maintenance and inspection of machinery. ■ Perform refuelling and maintenance in designated areas at least 30 m away from Thames River. ■ Adherence to the *Clean Equipment Protocol for Industry* (Halloran et al., 2013).	■ Daily monitoring by construction group during all times when heavy machinery is being used.	NO NET EFFECT ■ With proper equipment maintenance and refuelling practices the risk of leaks and spills can be greatly reduced. Paired with appropriate emergency spill planning there is no expected impact to any adjacent Natural Heritage Features.
3.1.11	**Introduction or Spread of Invasive Species** ■ Vegetation clearing and grubbing or grading and movement of construction equipment may introduce or spread invasive species.	■ Stockpiles of off-site soil, sand, topsoil (if any) and dirty earth-moving equipment should be regularly inspected for invasive species. Any weeds growing from material stockpiles should be removed. ■ All machinery, construction equipment and vehicles arriving on site should be in clean condition (e.g., free of fluid leaks, or attached soil potentially containing seeds of plant material from invasive species) and be inspected and washed in accordance with the *Clean Equipment Protocol for Industry* (Halloran et al., 2013) prior to arriving and leaving the construction site. ■ Machinery, construction equipment and vehicles should be cleaned at least 30 away from any watercourse, water body or natural vegetation, and ideally on mud free, gravel covered, hard surface or well-maintained grassy area (e.g., parking lots or manicured lawns in Park). ■ Develop and implement the Invasive Plant Management Plan following the guidance and objectives of the *City of London Invasive Plant Management Strategy* (2017).	■ Weekly monitoring by environmental monitor for presence of new or establishing invasive species.	(-) LOW NET NEGATIVE EFFECT ■ While it is very difficult to avoid the introduction or spread of invasive species, especially if they are already present on site, the mitigation measures to be implemented will minimize this effect to the extent possible.
3.2	**Operational Phase – Indirect Impacts**			
3.2.1	**Disturbance to Native Wildlife** ■ Disturbance of breeding birds and other wildlife due to vehicle noise from the expanded roadway is not anticipated as noise and vibration levels are not anticipated to increase from baseline conditions to which urban wildlife is already tolerant of.	■ None	■ No monitoring required	NO NET EFFECT ■ With the existing roadway already operating at high capacity and most of the native vegetation being retained no additional impacts are expected to arise from the increased vehicular traffic.
3.2.2	**Water Quality** ■ The increased use of chemical de-icers, sand, and salt throughout the expanded roadway may degrade the water quality to the Thames River during the winter months.	■ Utilize chemical de-icers and salt only as needed ■ Install appropriately sized and designed stormwater management systems to properly control flows as designed ■ Develop and implement a Road Salt and Snow Management Plan.	■ No monitoring required	NO NET EFFECT ■ With the significant usage already occurring within the City of London and installation of stormwater system upgrades the additional roadway size is not enough to significantly decrease the water quality within the Natural Heritage Features.
3.2.3	**Impacts to Fish and Fish Habitat, including Aquatic SAR Habitat** ■ The alteration to the riparian area and bank of the Thames River may result in changes to food and nutrient inputs, overhanging shade and cover, and instream substrate, structure and cover.	■ Minimize riparian vegetation removal as much as feasible. ■ Site restoration and re-vegetation including riparian planting ■ Minimize or avoid the removal of in-stream organic debris, rocks, or vegetation	■ No monitoring required	(-) LOW NET NEGATIVE EFFECT ■ The location and footprint of the proposed relocated stormwater outfall will be on the bank of the Thames River, and the resulting footprint is not anticipated to result in any loss of habitat. ■ The changes to bank and riparian conditions cannot be avoided, though mitigation and restoration measures are likely to reduce the impacts of these changes.
3.2.4	**Road mortality** ■ Road mortality is not anticipated to increase from baseline conditions as existing roads already act as a barrier.	■ None	■ No monitoring required	NO NET EFFECT ■ Wellington Road is being widening but is still largely limited to within the road right-of-way. Increased road mortality is not anticipated.

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8. Permits and Approvals

Section 1.3 outlines the legislative and policy context for the Project. Based on the field investigations and assessment of potential impacts, the required permits and conformance with legislation for the Project have been identified. **Table 8-1** below provides a summary of the anticipated permits and approvals for the proposed works. Applicable permits and approvals will need to be completed and submitted to the appropriate regulatory agencies prior to construction.

Table 8-1: Anticipated Permits and Approvals

Level of Government	Legislation	Governing Authority	Applicability to the Project
Federal	*Species at Risk Act, 2002 (SARA)*	Fisheries and Oceans Canada (DFO)	■ Review and approval required - there are records of federally listed aquatic Species at Risk (SAR) and Critical Habitat in the Study Area. This includes Critical Habitat for Silver Shiner in vegetated riparian areas of the Thames River, and Critical Habitat for Silver Shiner and Black Redhorse in the river itself. SARA permit is anticipated to be required for the proposed work, as well as the handling of aquatic SAR during fish and mussel relocation operations required work in wetted areas of the Thames River.
Federal	*Migratory Birds Convention Act, 1994* (MBCA)	Environment and Climate Change Canada (ECCC)	■ Contravention of the MBCA is not anticipated provided that vegetation removal and the installation of any required exclusionary measures occurs outside of the breeding bird season (April 1 to August 31).
Federal	*Fisheries Act, 1985*	Fisheries and Oceans Canada (DFO)	■ Required – a DFO Request for Review to the DFO Fish and Fish Habitat Projection Program (FFHPP) should be submitted well in advance of commencement of the works near water, including vegetation removal. The DFO FFHPP review will determine the potential for the project to cause the death of fish or the harmful alteration, disruption, or destruction (HADD) of fish habitat in contravention of the *Fisheries Act* requiring a *Fisheries Act* Authorization (and SARA permit) or, if not, will issue a Letter of Advice (LOA) for the project.
Provincial	*Endangered Species Act, 2007* (ESA)	Ontario Ministry of the Environment, Conservation and Parks (MECP)	■ Authorization under the ESA is required if spiny softshell habitat and potential bat SAR habitat cannot be avoided. ■ Approval or Notice of Activity registration under the ESA required for disturbance of riparian and river habitat for Silver Shiner, Black Redhorse, and Wavy-rayed Lampmussel. ■ Approval or registration also required for the removal of SAR fish or mussels from wetted in-water work areas.
	Fish and Wildlife Conservation Act, 1997	Ontario Ministry of Natural Resources and Forestry (MNRF)	■ Licence to Collect Fish for Scientific Purposes required for the removal of fish from wetted in-water work areas. ■ Wildlife Scientific Collectors Permit required for handling of wildlife and removing them from the work areas.
Municipal	*Tree Protection By-law C.P.-1515(a)-270*	City of London	■ Not required, as the proposed work is being undertaken by a municipality (i.e., City of London).
Local	*O.Reg. 157/06: Upper Thames River Conservation Authority (UTRCA) Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*	UTRCA	■ Required as the Study Area falls within UTRCA's Regulated Areas.

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9. Additional Studies and Next Steps

The following additional field studies may be required during detail design:

- Update SAR habitat screening as protection statuses of species under the ESA may change over time.
- Potential SAR presence/absence surveys following MECP approved protocols and guidelines that may be required during Detail Design and should be confirmed with MECP and UTRCA during the early phases of detail design; the following surveys are subject to change based on the updated SAR habitat screening, agency consultation and design-related impacts to suitable SAR:
  - Bat Leaf-off cavity tree searches and acoustic surveys for bat Species at Risk following *the Survey Protocol for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis and Tri-coloured Bat* (Ministry of Natural Resources and Forestry, 2017c) may be required and should be confirmed with MECP based on the anticipated bat SAR habitat loss.
  - Visual encounter surveys following the *Survey Protocol for Queensnake (Regina septemvittata) in Ontario in Ontario* (MNRF, 2015c) and basking surveys adapted from *Survey Protocol for Blanding's Turtle (Emydoidea blandingii) in Ontario* (MNRF, 2015d) for queensnake and spiny softshell, respectively.
  - Anuran nocturnal calling surveys following the Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (BSC *et al*. 2009).
- An updated tree inventory to document required removals based on the construction footprint and for use in consideration of replacement plantings.
- A fluvial geomorphological assessment with review of the hydraulic properties (HEC RAS hydraulic model output) of the Thames River and the outlet channel to understand the sediment deposition processes contributing to turtle habitat at the existing outfall if it is to be plugged and non-functional.

Consultation with UTRCA, DFO and MECP will be undertaken during detail design to determine/develop appropriate avoidance, mitigation and compensation measures to avoid or minimize effects on all affected SAR.

An Environmental Management Plan is to be prepared during the detail design prior to issuance of contract drawings where the mitigation measures are tailored to the site based on the recommendations identified in this EIS report and shall include the following supporting documents/plans:

- The Clean Equipment Protocol for Industry (Halloran *et al.,* 2013)
- Spill Response Plan
- Invasive Species Management Plan
- Construction Monitoring and Inspection Plan
- Species at Risk and General Wildlife Handling Protocol

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10. Conclusions and Recommendations

The EIS for the Project documented in this report has been prepared in accordance with the relevant municipal, provincial and federal environmental legislation, policies and guidelines as documented in this report.

The existing natural heritage features identified within the Study Area for the Project through the comprehensive natural heritage background review and field program include the following:

- **Municipally/Provincially recognized natural heritage features:**
  - Significant Valleylands;
  - Significant Groundwater Recharge Areas; and
  - Highly Vulnerable Aquifers.
- **SWH**
  - *Confirmed*
    - Seasonal Concentration Areas: Turtle Nesting Area and Amphibian Breeding;
    - Specialized Habitat for Wildlife: Habitat for SOCC including Snapping Turtle, Northern Sunfish, and Northern Map Turtle; and,
    - Provincially rare FOD7-4 and FOD2-3 vegetation communities.
  - *Candidate*
    - Seasonal Concentration Areas: Bat Maternity Colonies and Turtle Wintering Areas;
    - Specialized Habitat for Wildlife: Habitat for SOCC including bald eagle, barn swallow, common nighthawk, eastern wood-pewee, golden-winged warbler, peregrine falcon, wood thrush and monarch.
    - Animal movement corridor was identified as Amphibian Movement Corridors.
- **SAR Habitat**
  - *Confirmed*
    - Black Redhorse (Critical Habitat).
    - Silver Shiner (Critical Habitat).
    - Wavy-rayed Lampmussel.
    - Spiny Softshell.
  - *Candidate (i.e., potential)*
    - Little brown myotis, northern myotis, tri-colored bat, and eastern small-footed myotis, queensnake, American chestnut and eastern false rue-anemone.

Potential impacts from the proposed works include damage and disturbance to adjacent natural features, disturbance to terrestrial wildlife, increased sedimentation and erosion potential, and disturbance to fish and mussel species and their habitat. Avoidance measures, such as the work limit restrictions designed for the Project and compliance with restriction of rehabilitation activities to outside of sensitive periods for local or significant wildlife species, in addition to incorporation of mitigation measures such as installation of tree protection fencing, wildlife exclusion measures, erosion and sediment control measures, machinery and equipment practices, and invasive species control strategies can aid in addressing these potential impacts. Compensation measures including planting of native trees and shrubs can further offset potential impacts to edge habitat and riparian habitat. Consultation with UTRCA, DFO and MECP will be undertaken during detail design to determine/develop appropriate avoidance, mitigation and compensation measures to avoid or minimize effects on all affected SAR.

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The anticipated permits and approvals required to complete the Project prior to the commencement of rehabilitation activities include a Request for Review submission to DFO for Project review under the *Fisheries Act* and SARA, SARA permit for the handling of fish and mussel SAR during relocation from in-water work areas, authorizations under the ESA for aquatic SAR habitat and handling of aquatic SAR during relocation, as well as turtle SAR habitat and potential bat SAR habitat if these cannot be avoided, and submission of an Application for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses to the UTRCA under Ontario Regulation 157/06 of the *Conservation Authorities Act*.

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Appendix A

Environmental Impact Study Checklist

Appendix A

Environmental Impact Study
ISSUES SUMMARY CHECKLIST REPORT

Application Title: Schedule C Class Environmental Assessment Western Road and Sarnia
Date Submitted: June 10 2021
Proponent: City of London

Qualifications

Primary Consultant: AECOM Canada Ltd.
Key contact person: John Pucchio (Project Manager)
Other consultant / field personnel: Katie Easterling (aquatics)
Hydrogeology / Hydrology:
Biological – Flora: Olga Hropach (terrestrial)
Biological – Fauna: Olga Hropach (terrestrial)
Other:

Context for Background Information

Subwatershed: The Forks
Tributary Fact Sheet Number:
Planning / Policy Area: Near Campus Neighbourhood

Technical Advisory Review Team

- ☑ Ecologist Planner: Emily Williamson
- ☐ Planner for File:
- ☑ EEPAC: Sany Levin
- ☑ Conservation Authority: Brent Verscheure
- ☐ Ministry of Natural Resources:
- ☐ Ministry of Municipal Affairs and Housing:
- ☐ Ministry of Agriculture and food:
- ☐ Other Review Groups (e.g., Community Associations , Field Naturalists):

1.0 DESCRIPTION OF THE ENVIRONMENT (FEATURES)

Purpose: To have a clear understanding of the current status of the land, and the proposed "development" or land use change.

1.1 Mapping (Location and Context)

Current Aerial Photography

- ☑ Land Use - Excerpts of the Official Plan for the City of London Ontario Schedules A, B, showing a 5-10 km radius of subject site
- ☑ Terrain setting @ 1:10,000 - 1:15,000 scale showing landscape features, subwatershed divides
- ☑ Existing Environmental Resources showing @1:2,000 - 1:5,000 showing Vegetation, Hydrology, contours, linages.
- ☑ Environmental Plan or Strategy from Subwatershed reports (tributary fact sheet), Community (Area) Plans, or other

1.2 Description of Site, Adjacent lands, Linage with Natural Heritage System

List all supporting studies and reports available to provide background summary (e.g. subwatershed, hydrological, geo-technical, natural heritage etc.).

Check the first box if the information is relevant and required as part of this study. Check the second box if sufficient data is available.

The study area for the Western Road and Sarnia Road / Philip Aziz Avenue Improvements includes predominately urban environments with pockets of natural cover, particularly associated with the forested ravine associated with the Thames River and fragmented forest patches south of Philip Aziz Avenue and east of Western Road. A mowed areas is present north of Sarnia Road. The remainder of the Study Area consists of commercial and/or residential developments.

Supporting studies in possession of AECOM:
Municipal Class EA – Western Road and Sarnia Road/Philip Aziz Avenue Improvements Existing Conditions (AECOM, 2015)

Environmental Project Report (EPR) for the London Rapid Transit Project's Transit Project Assessment Process (TPAP) (WSP, 2018)

1.2.1 Terrain Setting

☐	☑	Soils (surface and subsurface)
☐	☑	Glacial geomorphology - landform type
☐	☑	Subwatershed
☐	☑	Topographic features
☐	☐	Ground water discharge
☐	☐	Shallow ground water/baseflow
☐	☐	Ground water discharge/aquifer
☐	☐	Aggregate resources

1.2.2 Hydrology

- ☐ ☐ Hydrological catchment boundary and of wetlands + determine the catchment areas of all wetlands
- ☐ ☐ Surface drainage pattern
- ☑ ☑ Watercourses (Permanent, Intermittent)
- ☐ ☑ Stream order (Headwater, 1st, 2nd, 3rd or higher)
- ☐ ☑ Agricultural Drains
- ☑ ☑ Downstream receiving watercourse
- ☐ ☐ Hazard Line (Map 6)

1.2.3 Natural Hazards

- ☐ ☐ 100 year Erosion Line
- ☑ ☐ Floodline mapping
- ☑ ☐ Max line mapping – UTRCA mapping + text based regulated areas

1.2.4 Vegetation

- ☑ ☐ Vegetation patch Number
- ☑ ☐ System (Terrestrial, Wetland, Aquatic)
- ☑ ☐ Cover (Open, Shrub, Treed)
- ☑ ☐ Community Type(s)
- ☑ ☑ ELC Community Class (Bluff, Forest, Swamp, Tallgrass Prairie, Savannah & Woodland, Fen, Bog, Marsh, Open Water, Shallow Water)
  ELC Community Sites
- ☑ ☑ Rare Vegetation Communities

1.2.5 Flora

- ☑ ☐ Flora (Inventory dates, Source)

  Fall (late August 2021)
  Spring (May 2022)
  Summer (June-July 2022)

- ☑ ☐ Rare Flora (National, Provincial, Regional)

  Fall (late August 2021)
  Spring (May 2022)
  Summer (June-July 2022)

1.2.6 Fauna

☑ ☐ Fauna (Inventory dates; sources)

2 Rounds of Breeding Bird Surveys were completed between May 25 and July 10, 2021.
Amphibian and reptile surveys will be deferred to detailed design and will be conducted at the area of the outfall in accordance with Great Lakes Marsh Monitoring and MNRF Protocols

☑ ☐ Breeding Birds

☐ ☑ Migratory Birds

☐ ☑ Amphibians

☐ ☑ Reptiles

☐ ☑ Mammals

☐ ☑ Butterflies

☐ ☑ Odonata

☐ ☐ Other

☐ ☑ Partners In Flight (PIF)

☐ ☑ Rare Fauna

1.2.7 Wildlife Habitat + as per MNRF 2015 Criteria, as amended from time to time, and all applicable Official Plan policies and In-force London Plan policies

☑ ☐ Species-At-Risk Regulated Habitat critical habitat mapping

☑ ☐ Winter habitat for deer, wild turkey

☑ ☐ Waterfowl Habitat (wetlands, poorly drained landscape - bottomlands, beaver ponds, seasonally flooded areas, staging areas, feeding areas)

☑ ☐ Colonial Birds Habitat

☑ ☐ Hibernacula

☑ ☐ Habitat for Raptors

☑ ☐ Forests with springs or seeps

Ephemeral ponds

☑ ☐ Wildlife trees (snags, cavities, x-large trees > 65 cm DBH)

☑ ☐ Forest Interior Birds

Candidate Significant Wildlife Habitat as per the MNRF Ecoregion Criteria will be identified based on ELC surveys and breeding bird surveys; however, surveys to confirm significance are not included.

☑ ☐ Area-sensitive birds

Any area-sensitive birds recorded during the breeding bird surveys will be documented in the EIS report.

1.2.8 Aquatic Habitat

(SWS Aquatic Resource Management Reports)

☐ ☑ Fish Communities

☐ ☑ Fish spawning areas

☐ ☑ Fish migration routes

☐ ☑ Thermal refuge for fish

☐ ☑ Benthic inventory

☐ ☑ Substrate

☑ ☐ Riparian habitat (extent and type)

Aquatic habitat assessments will be completed for the new large stormwater outfall at the Thames River to document habitat features such as in-stream cover, aquatic vegetation and any specialized fish habitat features (e.g., spawning or rearing areas). Fish community sampling surveys are not included as there are sufficient fish records from secondary sources to document fish communities in the Thames River. Site visit anticipated to be completed in August 2021

1.2.9 Linkages and Corridors

(The diversity of natural features in an area, and the natural connections between them should be maintained, and improved where possible. PPS 2.3.3)

- ☐ ☑ Valleylands
- ☐ ☑ Significant Watercourses (Thames River, Stoney Creek, Medway Creek, Dingman Creek, Pottersburg Creek, Wabuno Creek, Mud Creek, Stanton Creek (Drain), Kelly Creek (Drain)
- ☐ ☑ Upland Corridors / species migration routes
- ☐ ☐ Big Picture Cores and Corridors
- ☐ ☑ Linkages between aquatic and terrestrial areas (riparian habitat, runoff)
- ☐ ☐ Groundwater connections
- ☐ ☐ Patch clusters (mosaic of patches in the landscape)

1.3 Social Values

1.3.1 Human Use Values

- ☐ ☐ Recreational linkages for hiking, walking
- ☐ ☐ Nature appreciation, aesthetics
- ☐ ☐ Education, research
- ☐ ☐ Cultural / traditional heritage
- ☐ ☐ Social (parks and open space)
- ☐ ☐ Resources Products (e.g. timber, fish, furbearers, peat)
- ☐ ☐ Aggregate Resources

1.3.2 Land Use - Cultural

- ☐ ☐ Archaeological (pre 1500)
- ☐ ☐ Historical (post 1500 - present)
- ☐ ☐ Adjacent historical and archeological
- ☐ ☐ Future

1.3.3 Land Use - Active

- ☐ ☐ Archaeological (pre 1500)

- ☐ ☐ Historical (post 1500 - present)
- ☐ ☐ Adjacent historical and archeological
- ☐ ☐ Future

1.3.4 Other

2.0 EVALUATION OF SIGNIFICANCE

Components of the Natural Heritage System
The policies in Section 15.4 apply to recognized and potential components of the natural heritage system as delineated on Schedule 'B' or features that may be considered for inclusion on Schedule 'S'. They also address the protection of environmental quality and ecological function with respect to water quality, fish habitat, groundwater recharge, headwaters and aquifers.

- ☐ **A component of a Subject Lands Status Report that is required to be included in the EIS is the evaluation of significance of all potential natural heritage features and areas recognized by In-force London Plan policies and/ or Official Plan policies.**

- ☑ **A component of a Subject Lands Status Report that is required to be included in the EIS is the confirmation and mapping of boundaries of all natural heritage features and areas.**

2.1 Environmentally Significant Areas

- ☑ Identified Environmentally Significant Areas (ESA)
- ☑ Potential ESAs - Expansion of an Existing ESA
- ☑ Potential ESA - Area not associated with an existing ESA

2.2 Wetlands

- ☑ Provincially Significant Wetlands
- ☑ Wetlands
- ☑ Unevaluated Wetlands

2.3 Areas of Natural and Scientific Interest

- ☑ Provincial Life Science ANSI
- ☑ Regional Life Science ANSI
- ☑ Earth Science ANSI

2.4 Habitat of Species-At-Risk (SAR)

- ☑ Endangered
- ☑ Threatened
- ☑ Vulnerable / Special Concern

2.5 Woodlands and Vegetation Patches

- ☑ Significant Woodlands
- ☑ Unevaluated Vegetation Patches and/ or other patches > 0.5ha

2.6 Corridors and Linkages

- ☑ River, Stream and Ravine Corridors
- ☑ Upland Corridors
- ☑ Naturalization and Anti-fragmentation Areas

3.0 IDENTIFICATION AND DESCRIPTION OF FUNCTIONS

Ecological Functions the natural processes, products or services that species and non-living environments provide or perform within or between ecosystems and landscapes. Check those functions that will be required to assess for the study (key and supporting functions).

3.1 Biological Functions

- ☑ Habitat (provision of food, shelter for species)
- ☑ Limiting habitat
- ☑ Species life histories (reproduction and dispersal)
- ☐ Habitat guilds
- ☑ Indicator species
- ☑ Keystone species
- ☑ Introduced species
- ☐ Predation / parasitism
- ☐ Population dynamics
- ☐ Vegetation structure, density and diversity
- ☐ Food chain support
- ☐ Productivity
- ☑ Diversity
- ☐ Carbon cycle
- ☐ Energy cycling
- ☑ Succession and disturbance processes
- ☑ Relationships between species and communities

3.2 Hydrological and Wetland Functions

- ☐ Groundwater recharge and discharge (hydrogeology)
- ☐ Water storage and release (fluvial geomorphology)
- ☐ Maintaining water cycles (water balance)
- ☐ Water quality improvement
- ☐ Flood damage reduction
- ☑ Shoreline stabilization / erosion control
- ☐ Sediment trapping
- ☐ Nutrient retention and removal / biochemical cycling
- ☑ Aquatic habitat (fish, macroinvertebrates)

3.3 Landscape Features and Functions

- ☑ Size
- ☑ Connections, corridors and linkages
- ☑ Proximity to other areas / natural heritage features (e.g. woodlands, wetlands, valleylands, water, etc.)
- ☑ Fragmentation

3.4 Functions, Benefits and Values of Importance to Humans

- ☐ Contributing to healthy and productive landscapes
- ☐ Improving air quality by supplying oxygen and absorbing carbon dioxide
- ☐ Converting and storing atmospheric carbon
- ☐ Providing natural resources for economic benefit
- ☐ Providing green space for human activities
- ☐ Aesthetic and quality-of-life benefit
- ☐ Environmental targets and/or environmental management strategies

4.0 ADDITIONAL COMPONENTS AND NOTES

- EIS to show and demonstrate conformity with the Provincial Policy Statement (2020), in-force London Plan (as of Nov. 2019) policies, and current Official Plan policies (1989), Environmental Management Guidelines (2006).
- "EEPAC noted that the London BRT EIS also has overlapping study area and may have additional information about Species at Risk (SAR). City of London noted that AECOM is already in possession of this report."

Minutes of Meeting

Meeting name
Environmental Impact Study Scope Consultation (Meeting #5)

Subject
Western Road – Sarnia Road / Philip Aziz Environmental Assessment

Meeting date
6-August -2021

Time
11:00 am

Location
Microsoft Teams

AECOM Project Number
60661402

Prepared By: AECOM

Attendees:
Emily Williamson, City of London
Brent Verscheure, UTRCA
Sandy Levin, EEPAC

Olga Hropach, AECOM
John Pucchio, AECOM
Karl Grueneis, AECOM
Katie Easterling, AECOM
Paul Adams, AECOM

Circulation:
Jane Fullick, City of London
Karl Grabowski, City of London

PLEASE NOTE: If this report does not agree with your records of the meeting, or if there are any omissions, please advise, otherwise we will assume the contents to be correct

Ref	Item	Action
01	**Introductions**	
	.1 General introduction of the project team was completed.	**INFO**
02	**Background/Overview**	**INFO**
	.1 AECOM initiated consultation and conceptual design work as part of an original Municipal Class Environmental Assessment (MCEA) between 2015 to 2016 for this same study area. The project was placed on hold in 2016 to consider alternatives for Rapid Transit routes through the study area.	
	.2 Project background was presented for work previously completed in support of the 2015 EA and proposed 2021 Natural Heritage Scope of Work as described in the attached slideshow presentation.	
03	**General Discussion**	**AECOM / City**
	.1 EEPAC: questioned if mussel studies in the Thames River are included. City of London indicated that a detailed EIS and permitting has been completed for the Huron Street Watermain which has an overlapping study area with this project. Detailed surveys have been completed to document presence of mussel species in the reach already. AECOM indicated that fish habitat assessments at the Thames River do not include in-water studies. Presence of mussels will be assumed or confirmed via background documentation and recommendations for a mussel relocation plan will be made if in-water works are proposed for the new or upgrade storm sewer outfall.	

Ref	Item	Action
	.2 EEPAC noted that the London BRT EIS also has overlapping study area and may have additional information about Species at Risk (SAR). City of London noted that AECOM is already in possession of this report.	
	.3 EEPAC noted that there was an EA completed a number of years ago for a repair/relocation of an exposed water line within the study area done for the city of London (Pat Lupton). City of London/EEPAC to provide referenced EA report.	
	.4 City of London indicated there are sensitive areas relating to reptile SAR along the east and west banks of the Thames River at the outlet and that extreme caution need to be taken during field investigations not to disturb habitat or potential SAR. AECOM noted that no in-field investigation work is proposed along the east bank. The City is to provide a high level map showing ecological concerns.	
	.5 City of London noted that they can share Scott Gillingwater's report of his findings along the Thames River at the proposed outfall location with AECOM in order to provide better understanding of site sensitivity. City of London has already provided UTRCA report, which contains sensitive SAR information and is meant for AECOM's internal ecology team to review.	
	.6 AECOM asked if someone from UTRCA needs to accompany AECOM field staff while completing work along the Thames River. UTRCA responded that its not required but Scott may want to attend, and AECOM should extend an invitation. AECOM to extend an invitation for field site visit which is currently planned for August 12, 2021.	
	.7 City of London requested recommendations on whether there is a wait period between when mussels can be relocated again (i.e., if there is a rest period required), as mussels may need to be relocated again for this project after they have been relocated for the Huron Street Watermain. AECOM referenced the DFO Mussel Relocation Plan, which will be provided to City of London, and indicated that relocation is limited based on timing of year and temperature of the water (has to be >16ºC). It is also recommended that mussels relocated for the Huron Street Watermain project should not be moved to the future construction footprint for the proposed outfall for this project. AECOM to provide DFO Mussel Relocation Plan. City of London to provide Mussel Relocation Plan for Huron Watermain for AECOM's reference	
	.8 AECOM noted that the northwest area of the intersection of Western Road / Sarnia Road / Phillip Aziz Avenue, will consider future road connections from the University but development will be done by the University. Field work has been completed in that area in 2015 and will be re-confirmed in 2021 from publicly accessible areas.	
	.9 EEPAC noted the presence of an environmentally significant area (ESA) in the area and mentioned that there has been restoration works with the University and a native nursery. Suggested contacting Michael Lunau for more information. City of London identified that there may be a new edge delineation for the ESA which they will provided once available. AECOM to confirm if work was previously done in the ESA. City of London provided contact for Michael Lunau. City of London to provide ESA delineation.	
	.10 City of London, AECOM and EEPAC reviewed the EIS checklist. City of London requested that the PDF checklist be used instead and re-sent. City of London to provide vegetation patch numbers. AECOM to provide PDF checklist.	
	.11 AECOM requested UTRCA to provide most recent regulated flood plain limits for the study area. UTRCA to provide regulation limits mapping.	

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Appendix B

Aquatic Photolog

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Photographic Log

Client Name:	Report Name	Project No.
City of London	Western Road and Sarnia Road / Philip Aziz Avenue Improvements	60339161

Thames River, August 2021

Photograph 1 ↑

General view of the river, substrate, and riparian vegetation in the Study Area. Facing upstream (North) from the left bank at the drain outlet.

Photograph 2 ↑

View of the left (facing upstream) bank and riparian vegetation in the Study Area, facing Northwest from the left bank at the drain outlet.

Photograph 3 ↑

View of the right (facing upstream) bank and riparian vegetation in the Study Area. Facing Northeast from the left bank..

Photograph 4 ↑

Substrate with mussel shell below the drain outlet to the river.

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Photographic Log

Client Name:	Report Name	Project No.
City of London	Western Road and Sarnia Road / Philip Aziz Avenue Improvements	60339161

Thames River, August 2021

Photograph 5 ↑

General view of the river, riparian vegetation, and substrate. Facing upstream (North) from upstream of the drain outlet.

Photograph 6 ↑

View of the river and left bank, facing upstream (Northwest) from upstream of the drain outlet.

Photograph 7 ↑

View of the river and right bank, facing upstream (Northeast) from upstream of the drain outlet.

Photograph 8 ↑

View of the river and left bank, facing downstream (South) from upstream of the drain outlet.

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Photographic Log

Client Name:	Report Name	Project No.
City of London	Western Road and Sarnia Road / Philip Aziz Avenue Improvements	60339161

Thames River, August 2021

Photograph 9 ↑

View of the left bank, facing downstream (Southeast) toward the location of the drain outlet.

Photograph 10 ↑

View of the left bank of the drainage channel at the drain outlet to the river. Facing East from the drain outlet.

Photograph 11 ↑

Deposited material on the left bank of the river at the drain outlet. Facing Southeast from the drain outlet.

Photograph 12 ↑

View of the river facing downstream (South), from downstream of the drain outlet

Thames River, August 2021

Photograph 13 ↑

View of the river and right bank, facing downstream (Southeast) from the left bank.

Photograph 14 ↑

View of the river and left bank, facing downstream (Southwest).

AECOM	Photographic Log	
Client Name: City of London	**Report Name** Western Road and Sarnia Road / Philip Aziz Avenue Improvements	**Project No.** 60339161

Unnamed Tributary to Thames River (Constructed Drain), August 2021

Photograph 1 ↑

View of the channel upstream of its outlet to the Thames River. Facing downstream (East) toward the Thames River.

Photograph 2 ↑

View of the channel with thick riparian vegetation and cattails, facing upstream (West) toward the Western University Sports Field.

Photograph 3 ↑

View of the channel and thick vegetation within the Study Area, facing downstream (East) toward the Western University Sports Field.

Photograph 4 ↑

View of the channel and substrate within the Study Area, upstream (West) of the Western University Sports Field.

Photograph 5 ↑

Outlet of the drain running under the Western University Sports Field. Facing upstream (west).

Photograph 6 ↑

View of the channel within the Study Area, facing downstream (East) from the culvert outlet at Western Road.

Photograph 7 ↑

View of the channel and thick vegetation within the Study Area, facing upstream (West) toward Western Road.

Photograph 8 ↑

Bed and substrate in the channel within the Study Area, facing upstream (West) toward the culvert at Western Road.

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Appendix C

Plant Inventory List

Appendix C: Vascular Plant List

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Botanical Name			Plant Species Information							Local Ranks:			Climate Change		ELC ID#:	1	2	3	4	5
Common Name	Scientific Name	Family	CC	CW	Native	Invasive	SRANK	COSEWIC	SARO	CZ	CZRESTR	MD	CCVI	CCVI	ELC	CUM1-1	CUW1	FOD2-3	FOD5-5	FOD7-4
Manitoba Maple	Acer negundo	Aceraceae	0	0	N	Y	S5			C	0	C					x			x
Norway Maple	Acer platanoides	Aceraceae	0	5	I	Y	SE5			IU	0	IU								x
Sugar Maple	Acer saccharum	Aceraceae	4	3	N	N	S5			C	0	C	LV	VH				x	x	x
(Acer rubrum X Acer saccharinum)	Acer x freemanii	Aceraceae	6	0	N	N	SNA			hyb	0	hyb								x
Staghorn Sumac	Rhus typhina	Anacardiaceae	1	3	N	N	S5			C	0	C					x			x
Wild Carrot	Daucus carota	Apiaceae	0	5	I	N	SE5			IC	0	IC				x	x			x
Jack-in-the-pulpit	Arisaema triphyllum	Araceae	5	-3	N	N	S5			C	0	C						x		
Great Burdock	Arctium lappa	Asteraceae	0	3	I	N	SE5			IU	0	IR				x				x
Common Burdock	Arctium minus	Asteraceae	0	3	I	N	SE5			IC	0	IC				x				
Brown Knapweed	Centaurea jacea	Asteraceae	0	5	I	N	SE5			IX	0	IX				x	x			x
Wild Chicory	Cichorium intybus	Asteraceae	0	3	I	N	SE5			IC	0	IC				x	x			x
Canada Thistle	Cirsium arvense	Asteraceae	0	3	I	Y	SE5			IC	0	IC				x				
Annual Fleabane	Erigeron annuus	Asteraceae	0	3	N	N	S5			C	0	C				x				x
Common Hawkweed	Hieracium vulgatum	Asteraceae	0	5	I	N	SE2?			IR	0	IR				x				
Black-eyed Susan	Rudbeckia hirta	Asteraceae	0	3	N	N	S5			C	0	C				x				
Tall Goldenrod	Solidago altissima	Asteraceae	1	3	N	N	S5			0	0	0				x	x			x
Canada Goldenrod	Solidago canadensis	Asteraceae	1	3	N	N	S5			0	0	0				x				
White Heath Aster	Symphyotrichum ericoides	Asteraceae	4	3	N	N	S5			0	0	0				x				
New England Aster	Symphyotrichum novae-angliae	Asteraceae	2	-3	N	N	S5			C	0	C				x	x			x
Red-seeded Dandelion	Taraxacum erythrospermum	Asteraceae	0	5	I	N	SE5			IX	0	IR				x				
Common Dandelion	Taraxacum officinale	Asteraceae	0	3	I	N	SE5			IC	0	IC				x				
Spotted Jewelweed	Impatiens capensis	Balsaminaceae	4	-3	N	N	S5			C	0	C								x
Purple Jewelweed	Impatiens glandulifera	Balsaminaceae	0	-3	I	Y	SE4			IR	0	IR								x
May-apple	Podophyllum peltatum	Berberidaceae	5	3	N	N	S5			C	0	X						x	x	
Eastern Hop-hornbeam	Ostrya virginiana	Betulaceae	4	3	N	N	S5			C	0	C						x	x	
Common Viper's Bugloss	Echium vulgare	Boraginaceae	0	5	I	N	SE5			IC	0	IC				x				
Garlic Mustard	Alliaria petiolata	Brassicaceae	0	0	I	Y	SE5			IC	0	IC						x	x	x
Tatarian Honeysuckle	Lonicera tatarica	Caprifoliaceae	0	3	I	Y	SE5			IC	0	IX						x	x	x
Cranberry Viburnum	Viburnum opulus ssp. opulus	Caprifoliaceae	0	-3	I	Y	SE3?			IX	0	IR						x	x	x
Alternate-leaved Dogwood	Cornus alternifolia	Cornaceae	6	3	N	N	S5			C	0	X								
Drooping Woodland Sedge	Carex arctata	Cyperaceae	5	5	N	N	S5			C	0	C						x	x	
Common Teasel	Dipsacus fullonum	Dipsacaceae	0	3	I	Y	SE5			IC	0	IC				x	x			x
Eastern Redbud	Cercis canadensis	Fabaceae	8	3	N	N	SX			H	CZ	IR								x
Black Medick	Medicago lupulina	Fabaceae	0	3	I	N	SE5			IC	0	IC				x	x			
Black Locust	Robinia pseudoacacia	Fabaceae	0	3	I	Y	SE5			IC	0	IC					x	x	x	
Purple Crown-vetch	Securigera varia	Fabaceae	0	5	I	Y	SE5			IX	0	IX				x	x			x
Red Clover	Trifolium pratense	Fabaceae	0	3	I	N	SE5			IC	0	IX				x	x			
White Clover	Trifolium repens	Fabaceae	0	3	I	N	SE5			IC	0	IX				x	x			
White Oak	Quercus alba	Fagaceae	6	3	N	N	S5			C	0	C					x			x
Northern Red Oak	Quercus rubra	Fagaceae	6	3	N	N	S5			C	0	C					x			x
Bitternut Hickory	Carya cordiformis	Juglandaceae	6	0	N	N	S5			C	0	X						x	x	
Black Walnut	Juglans nigra	Juglandaceae	5	3	N	N	S4?			C	0	X						x	x	x
Red Ash	Fraxinus pennsylvanica	Oleaceae	3	-3	N	N	S4			C	0	C								
Common Lilac	Syringa vulgaris	Oleaceae	0	5	I	Y	SE5			IX	0	IX								x
Broad-leaved Enchanter's Nightshade	Circaea canadensis	Onagraceae	2	3	N	N	S5			C	0	X								x
Common Evening-primrose	Oenothera biennis	Onagraceae	0	3	N	N	S5			C	0	X				x				
Blue Spruce	Picea pungens	Pinaceae	0	3	I	N	SE1			IR	0	IX					x			
Eastern White Pine	Pinus strobus	Pinaceae	4	3	N	N	S5			C	0	X	LV	VH						x
Scots Pine	Pinus sylvestris	Pinaceae	0	3	I	Y	SE5			IX	0	IR					x			
English Plantain	Plantago lanceolata	Plantaginaceae	0	3	I	N	SE5			IC	0	IC				x	x			x
Common Plantain	Plantago major	Plantaginaceae	0	3	I	N	SE5			IC	0	IC				x	x			x
Sycamore	Platanus occidentalis	Platanaceae	8	-3	N	N	S4			C	cz	C								x
European Reed	Phragmites australis ssp. australis	Poaceae	0	-3	I	Y	SE5			IC	0	IC				x				
Kentucky Bluegrass	Poa pratensis	Poaceae	0	3	N	N	S5			0	0	0				x	x			x
Glossy Buckthorn	Frangula alnus	Rhamnaceae	0	0	I	Y	SE5			IU	0	IU								x
European Buckthorn	Rhamnus cathartica	Rhamnaceae	0	0	I	Y	SE5			IC	0	IC					x	x	x	x
Yellow Avens	Geum aleppicum	Rosaceae	2	0	N	N	S5			C	0	X						x	x	x
Common Apple	Malus pumila	Rosaceae	0	5	I	N	SE4			IC	0	IX							x	
Chokecherry	Prunus virginiana	Rosaceae	2	3	N	N	S5			C	0	C								
Allegheny Blackberry	Rubus allegheniensis	Rosaceae	2	3	N	N	S5			C	0	C								x
Red Raspberry	Rubus idaeus	Rosaceae	2	3	N	N	S5			0	0	0					x	x	x	x
Rough Bedstraw	Galium asprellum	Rubiaceae	6	-5	N	N	S5			C	0	X					x			
Eastern Cottonwood	Populus deltoides	Salicaceae	4	0	N	N	S5			0	0	0							x	x
(Salix alba X Salix euxina)	Salix x fragilis	Salicaceae	0	0	I	N	SNA			hyb	0	hyb								
Butter-and-eggs	Linaria vulgaris	Scrophulariaceae	0	5	I	N	SE5			IC	0	IC				x				
Tree-of-heaven	Ailanthus altissima	Simaroubaceae	0	5	I	Y	SE5			IR	0	IR								x
Bristly Greenbriar	Smilax tamnoides	Smilacaceae	6	0	N	N	S5			C	0	X								x
Bittersweet Nightshade	Solanum dulcamara	Solanaceae	0	0	I	Y	SE5			IC	0	IC								x
Basswood	Tilia americana	Tiliaceae	4	3	N	N	S5			C	0	C						x	x	x
Narrow-leaved Cattail	Typha angustifolia	Typhaceae	0	-5	I	Y	SE5			IC	0	IX				x				x
Common Hackberry	Celtis occidentalis	Ulmaceae	8	0	N	N	S4			C	0	X					x	x	x	x
Siberian Elm	Ulmus pumila	Ulmaceae	0	3	I	Y	SE3			IX	0	IR					x			x
Stinging Nettle	Urtica dioica	Urticaceae	2	0	N	N	S5			0	0	0								x
Thicket Creeper	Parthenocissus vitacea	Vitaceae	4	3	N	N	S5			C	0	X								
Riverbank Grape	Vitis riparia	Vitaceae	0	0	N	N	S5			C	0	C								x

Appendix C: Vascular Plant List

AECOM

Floristic Summary and Analysis for Entire Study Area			
Summary			
Total Species:		75	N/A
Native Species:		39	52%
Introduced Species:		36	48%
Invasive Species:		19	25%
ESA Status			
END		0	0%
THR		0	0%
SC		0	0%
COSEWIC Status			
END		0	0%
THR		0	0%
SC		0	0%
Provincially Rare (S-rank of S1-S3)			
S1		0	0%
S1?		0	0%
S1S2		0	0%
S1S3		0	0%
S2		0	0%
S2?		0	0%
S2S3		0	0%
S2S4		0	0%
S3		0	0%
S3?		0	0%
S3S4		0	0%
Total S1-S3:		**0**	**0%**
Local Rank			
None			
Co-efficient of Conservatism and			
Co-efficient of Conservatism (CC)	**18.75**		
CC 0 to 3	lowest sensitivity	53	####
CC 4 to 6	moderate sensitivity	19	49%
CC 7 to 8	high sensitivity	3	8%
CC 9 to 10	highest sensitivity	0	0%
Floral Quality Index (FQI)			
FQI:	**117.09**		
Presence of Wetland Species			
Wetness Value (CW) (average):	**15**		
upland	5	12	16%
facultative upland	2 to 4	39	52%
facultative	1 to -1	14	19%
facultative wetland	-2 to -4	8	11%
obligate wetland	-5	2	3%

Floristic Summary and Analysis Per ELC					
Summary					
Total Spe	28	25	18	19	46
Native Sp	8	10	13	13	26
Introduce	20	15	5	6	20
Invasive S	5	7	5	5	15
ESA Status					
END	0	0	0	0	0
THR	0	0	0	0	0
SC	0	0	0	0	0
COSEWIC Status					
END	0	0	0	0	0
THR	0	0	0	0	0
SC	0	0	0	0	0
Provincially Rare (S-rank of S1-S3)					
S1	0	0	0	0	0
S1?	0	0	0	0	0
S1S2	0	0	0	0	0
S1S3	0	0	0	0	0
S2	0	0	1	1	1
S2?	0	0	0	0	0
S2S3	0	0	0	0	0
S2S4	0	0	0	0	0
S3	0	0	0	0	0
S3?	0	0	0	0	0
S3S4	0	0	0	0	0
Total S1-	**0**	**0**	**1**	**1**	**1**
Local Rank					
None					
Co-efficient of Conservatism and Floral Quality Inde					
Co-efficie	**0.28571**	**1.28**	**2.8889**	**2.6842**	**1.8913**
CC 0 to 3	27	21	9	10	33
CC 4 to 6	1	3	8	8	10
CC 7 to 8	0	1	1	1	3
CC 9 to 1	0	0	0	0	0
Floral Quality Index (FQI)					
FQI:	**0.81**	**4.05**	**10.42**	**9.68**	**9.64**
Presence of Wetland Species					
Wetness	**2.78571**	**2.32**	**1.6111**	**1.9474**	**1.6522**
upland	7	3	1	2	6
facultative	18	17	10	10	22
facultative	0	3	5	6	12
facultative	2	1	2	1	5
obligate w	1	1	0	0	1

Glossary

Rarity Ranks	
SARO Status	
RANK	**DEFINITION**
EXP	**Extirpated** -A species that no longer exists in the wild in Ontario but still occurs elsewhere.
END	**Endangered -** A species facing imminent extinction or extirpation in Ontario.
THR	**Threatened -** A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	**Special Concern** - A species with characteristics that make it sensitive to human activities or natural events.

Variant National and Subnational Conservation Status Ranks	
RANK	**DEFINITION**
N# **S#**	**Range Rank** - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
NU **SU**	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNR **SNR**	**Unranked** - National or subnational conservation status not yet assessed.
NNA **SNA**	**Not Applicable** - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., long distance aerial and aquatic migrants, hybrids without conservation value, and non-native species or ecosystems
Not Provide	Species or ecosystem is known to occur in this nation or state/province. Contact the appropriate NatureServe network program for assignment of conservation status.

Rank Qualifier	
RANK	**DEFINITION**
N#? **S#?**	**Inexact Numeric Rank** - Denotes inexact numeric rank; this should not be used with any of the Variant National or Subnational Conservation Status Ranks, or NX, SX, NH, or SH.

Coefficient of Wetness				
CW VALUE	**ABBRV.**	**INDICATOR STATUS**	**% OCCUR. IN WETLANDS**	**DEFINITION**
-5	**OBL**	Obligate Wetland	99	Almost always occur in wetlands. With few exceptions, these plants (herbaceous or woody are found in standing water or seasonally saturated soils (14 or more consecutive days) near the surface.
-4	**FACW+**			
-3	**FACW**	Facultative Wetland	67-99	Usually occur in wetlands, but may occur in non-wetlands. These plants predominately occur with hydric soils, often in geomorphic settings where water saturates the soils or floods the soil surface at lease seasonally.
-2	**FACW-**			
-1	**FAC+**			
0	**FAC**	Facultative	34-66	Occur in wetlands and nonwetlands. These plants can grow in hydric, mesic, or xeric habitats. The occurrence of these plants in differenct habitats represents responses to a variety of environmental variables other than just hydrology, such as shade tolerance, soil pH, and elevation, and they have a wide tolerance of soil moisture conditions.
1	**FAC-**			
2	**FACU+**			
3	**FACU**	Facultative Upland	1-33	Usually occur in non-wetlands, but may occur in wetlands. These plants predominately occur on drier or more mesic sites in geomorphic settings where water rarely saturates the soils or
4	**FACU-**			
5	**UPL**	Obligate Upland	1	Almost never occur in wetlands. These plants occupy mesic to xeric non-wetland habitats. They almost never occur in standing water or saturated soils. Typical growth forms include herbaceous,

"+" or "-" signs have been attached to the three Facultative categories to express exaggerated tendencies for those species. The "+" sign denotes that the species generally has a greater estimated probability of occurring in wetlands than species having the general indicator category, but a lesser estimated probability of occurring in wetlands than those having the next higher general indicator. The"-" sign denotes that the species generally has a lesser estimated probability of occurring in wetlands than those having the general indicator status, but a greater estimated probability of occurring in wetlands than those having the next lowest

Climate Change Vulnerability Index (CCVI)	
CCVI Score Abbreviations	
CODE	**DEFINITION**
EV	**Extremely Vulnerable** - Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
HV	**Highly Vulnerable** - Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.
MV	**Moderately Vulnerable** - Abundance and/or range extent within geographical area assessed likely to decrease by 2050.
LV	**Less Vulnerable** - Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will increase/decrease substantially by 2050. Actual range boundaries may change.
CCVI Confidence Levels	
LEVEL	**DEFINITION**
VH	**Very High** - >90% confidence.
High	**High** - 80–90% confidence.
Mod	**Moderate** - 60 - 80% confidence.
Low	**Low** - <60% confidence.

Carolinian Status	
REGION	**DEFINITION**
CZ	**CZ status** (see below)
RANK	**DEFINITION**
H	**Historic.** Native in all Carolinian Zone areas and no known records for at least 30 years in all areas where native and ranked (i.e. not X). Occasionally used for a native species known to be extirpated from its only known Carolinian Zone location(s).
R	**Rare.** Native to the Carolinian Zone and (a) rare (as defined in source lists; sometimes including "very uncommon") or historic (no records in ≥30 years) in more than half of the Carolinian Zone areas (≥6) in which it is native and ranked (i.e. not X); or (b) if rare or historic in <6 areas it must be uncommon or common in no more than one area.
U	**Uncommon.** Native in the Carolinian Zone and (a) listed as common in no more than one Carolinian Zone area; and (b) not rare or historic in more than half of the Carolinian Zone areas (≥6) in which it is native and ranked (i.e. not X).
C	**Common.** Native in the Carolinian Zone and (a) common in at least two Carolinian Zone areas; and (b) not rare or historic in more than half of the Carolinian Zone areas (≥6) in which it is native and ranked (i.e. not X).
X	**No status.** Present and native in the Carolinian Zone but no status assigned because of lack of information, often due to confusion with similar species.
note	In a few cases, based on professional opinion, Carolinian Zone status ranks departed from the above criteria, particularly if the species is not ranked (i.e. X) in at least four Carolinian Zone areas.
CZ RESTR	restricted in Ontario as a native species to CZ (=CZ) or nearly restricted (approximately 90%+ records) in Ontario as a native species to CZ (=cz)
MD	Middlesex County (including City of London)
RANK	**DEFINITION**
I	introduced; thought to have been present in the Carolinian Zone or individual CZ area prior to European settlement; believed to be deliberately or inadvertently introduced to the CZ by humans (followed by a status, below)
C	common
U	uncommon
R	rare
H	historic records only (generally >30 years)
X	present; status unknown or not specified in source lists
?	unconfirmed report
hyb	hybrid

AECOM

Appendix D

Breeding Bird Survey Results

Appendix D. Breeding Bird List

AECOM

Common Name	Scientific Name	S-Rank[2]	SARA Status[3]	COSEWIC Status[4]	ESA Status[5]	OBBA 17TMH76	Round 1 Breeding Bird Surveys	Round 2 Breeding Bird Surveys	Incidentals
Partridges, Grouse & Turkeys (PHASIANIDAE)									
Wild Turkey	*Meleagris gallopavo*	S5				DD		X	X
Plovers and Lapwings (CHARADRIIDAE)									
Killdeer	*Charadrius vociferus*	S5B,S5N				NE	S		
Pigeons & Doves (COLUMBIDAE)									
Mourning Dove	*Zenaida macroura*	S5				NY	S	X	
Swifts (APODIDAE)									
Chimney Swift	*Chaetura pelagica*	S4B,S4N	THR Sch 1	THR	THR	AE	X		X
Woodpeckers & Allies (PICIDAE)									
Downy Woodpecker	*Picoides pubescens*	S5				NY	H		
Swallows (HIRUNDINIDAE)									
Barn Swallow	*Hirundo rustica*	S4B		THR	THR	NY	X		x
Jays & Crows (CORVIDAE)									
Blue Jay	*Cyanocitta cristata*	S5				NE		X	X
Chickadees & Titmice (PARIDAE)									
Black-capped Chickadee	*Poecile atricapillus*	S5				NY	S	S	
Thrushes (TURDIDAE)									
American Robin	*Turdus migratorius*	S5B				NY		CF	
Mockingbirds, Thrashers & Allies (MIMIDAE)									
Gray Catbird	*Dumetella carolinensis*	S4B				NY		S	
Starlings (STURNIDAE)									
European Starling	*Sturnus vulgaris*	SNA				NY		X	X
Vireos (VIREONIDAE)									
Warbling Vireo	*Vireo gilvus*	S5B				CF	S		
Wood-Warblers (PARULIDAE)									
Yellow Warbler	*Dendroica petechia*	S5B				FY	S	S	
Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B					S		
Cardinals, Grosbeaks & Allies (CARDINALIDAE)									
Northern Cardinal	*Cardinalis cardinalis*	S5				NY	P	S	
New World Sparrows & Allies (EMBERIZIDAE)									
Chipping Sparrow	*Spizella passerina*	S5B				CF		X	
Vesper Sparrow	*Pooecetes gramineus*	S4B				S	S		
Savannah Sparrow	*Passerculus sandwichensis*	S4B				A		H	
Song Sparrow	*Melospiza melodia*	S5B				NY	S	P	
Blackbirds & Allies (ICTERIDAE)									

Appendix D. Breeding Bird List

Common Name	Scientific Name	S-Rank[2]	SARA Status[3]	COSEWIC Status[4]	ESA Status[5]	OBBA 17TMH76	Round 1 Breeding Bird Surveys	Round 2 Breeding Bird Surveys	Incidentals
Red-winged Blackbird	*Agelaius phoeniceus*	S4				NY	S	S	
Common Grackle	*Quiscalus quiscula*	S5B				CF	S	FY	
Baltimore Oriole	*Icterus galbula*	S4B				CF		X	X
Finches & Allies (FRINGILLIDAE)									
House Finch	*Carpodacus mexicanus*	SNA				NY		X	X
American Goldfinch	*Cardeulis tristis*	S5B				T	P	S	
Old World Sparrows (PASSERIDAE)									
House Sparrow	*Passer domesticus*	SNA				FY	S	S	

Glossary

1 Global Rank (GRank)

G1 - Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 - Imperiled—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
G3 - Vulnerable—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.
G4 - Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 - Secure—Common; widespread and abundant.

2 Sub-national Rank (Provincial) (SRank)

S1 - Critically Imperiled, often < 5 occurrences
S2 - Imperiled, often <20 occurences
S3 - Vulnerable, often 80 or fewer
S3S4 - Uncertain between S3 and S4
S4 - Aparently Secure, uncommon
S5 - Secure, common
SNA - Not Applicable —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

3 SARA - Species at Risk Act (Federal)

EXP - Extripated - a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
END - Endangered - wildlife species that is facing imminent extirpation or extinction..
THR - Threatened - wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC - Special Concern a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Schedule 1 - The official list of species that are classified as extirpated, endangered, threatened, and of special concern.
Schedule 2 - Species listed in Schedule 2 are species that had been designated as endangered or threatened, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.
Schedule 3 - Species listed in Schedule 3 are species that had been designated as special concern, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

4 COSEWIC - Committee on the Stauts of Endangerd Wildlife in Canada (same as above)

5 ESA - Endangered Species Act (Provincial)

EXP - Extripated - a species that no longer exists in the wild in Ontario but still occurs elsewhere.
END - Endangered - a species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act.
THR - Threatened - a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC - Special Concern (formerly Vulnerable) - a species with characteristics that make it sensitive to human activities or natural events.
DD - Data Deficient

6 CASSARO - Committee on the Status of Species at Risk in Ontario (same as above)

9 TRCA L-Rank (species of conservation concern local ranking)

L1 - Of regional concern in TRCA jurisdiction due to rarity,stringent habitat needs, and/or threat to habitat.
L2 - Of regional concern; typically occurs in high-quality naturalareas and under highly specific site conditions; probably at riskin the Toronto area.
L3 - Of regional concern; restricted in occurrence and/or requiresspecific site conditions; generally occurs in natural rather thancultural areas.
L4 - Generally secure in rural matrix; of conservation concern in theurban matrix.
L5 - Generally secure; may be a conservation concern in a fewspecific situations. Contributes to natural cover.
L+ - Community defined by alien species (e.g. Scots pineplantation, buckthorn thicket). Contributes to natural cover atleast to some extent.

References

1 & 2 - Ontario Ministry of Natural Resources. 2009. Natural Heritage Information Centre.
3 - Government of Canada. 2015. Species at Risk Public Registry.
4 - Government of Canada. 2015. Committee on the Stauts of Endangerd Wildlife in Canada.
5 - Government of Ontario. 2015. Species at Risk in Ontario.
6 - Government of Ontario. 2015. Species at Risk in Ontario.
7 - Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St.Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of NaturalResources, Bird Studies Canada, Environment Canada.
8 - Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix C). Pg 161-165
9 - Toronto Region Conservation Authority (TRCA). 2008. TRCA Fauna Ranks and Scores.
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11 - Environment Canada. 2014. Bird Conservation Strategy for Bird Conservation Region 13in Ontario Region: Lower Great Lakes/St. Lawrence Plain. Pg 16-20
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AECOM

Appendix E

Species at Risk and Species of Conservation Concern Screening

Appendix E. Species at Risk and Species of Conservation Concern Habitat Screening

AECOM

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Associated ELC Communities	Known Species Range[1, 2]	Source Identifying Species Record	Suitable Habitat Identified Within the Study Area
Red-headed Woodpecker *Melanerpes erythrocephalus*	END	THR Schedule 1	END	The Red-headed Woodpecker lives in open woodland and woodland edges, and is often found in parks, golf courses, and cemeteries. These areas typically have many dead trees, which the bird uses for nesting and perching. A few of these birds will stay the winter in woodlands in southern Ontario if there are adequate supplies of nuts. The Red-headed Woodpecker is found in a variety of habitats, including oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, beaver ponds, and burns.	**TPS, TPW, CUW, FOD1, FOD2, FOD4-1, FOD6, FOD7**, and **FOD9** that are open and have an abundance of dead trees.	The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare. In Canada, its range includes southern Saskatchewan, Manitoba, Ontario, and Quebec.	eBird	Medium Suitable woodland communities with cavity trees were present.
Bald Eagle *Haliaeetus leucocephalus*	SC	No Status	Not at Risk	Bald Eagles nest in a variety of habitats and forest types, almost always near a major lake or river where they do most of their hunting. While fish are their main source of food, Bald Eagles can easily catch prey up to the size of ducks, and frequently feed on dead animals, including White-tailed Deer. They usually nest in large trees such as pine and poplar. During the winter, Bald Eagles sometimes congregate near open water such as the St. Lawrence River, or in places with a high deer population where carcasses might be found.	**FOC, FOM, FOD, SWC, SWM** and **SWD**. Nests typically located near major bodies of water.	In Ontario, they nest throughout the north, with the highest density in the northwest near Lake of the Woods. Historically they were also relatively common in southern Ontario, especially along the shore of Lake Erie, but this population was all but wiped out 50 years ago. After an intensive re-introduction program and environmental clean-up efforts, the species has rebounded and can once again be seen in much of its former southern Ontario range.	eBird, iNaturalist	Medium Suitable forested communities adjacent to Thames River are present.
Canada Warbler *Cardellina canadensis*	SC	THR Schedule 1	THR	The Canada Warbler breeds in a range of deciduous and coniferous, usually wet forest types, all with a well-developed, dense shrub layer. Dense shrub and understory vegetation help conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks. It is also found in riparian shrub forests on slopes and in ravines and in old-growth forests with canopy openings and a high density of shrubs, as well as in stands regenerating after natural disturbances, such as forest fires, or anthropogenic disturbances, such as logging. Canada Warbler habitat is believed to be in decline, especially in South America, where the Canada Warbler overwinters. Habitat loss has also been observed in the eastern part of its breeding range, where wet forests have been drained for urban development or farming.	**FOC3, FOC4, FOM6, FOM7, FOM8, FOD6, FOD7, FOD8, FOD9, SWC, SWM** and **SWD** with a well-developed shrub layer.	The Canada Warbler only breeds in North America and 80% of its known breeding range is in Canada. Its primary breeding range is in the Boreal Shield, extending north into the Hudson Plains and south into the Mixedwood Plains. Although the Canada Warbler breeds at low densities across its range, in Ontario it is most abundant along the Southern Shield. The Canada Warbler breeds primarily across much of southeastern Canada, the northeastern United States, the Great Lakes region. In Canada, it breeds in all provinces and territories except Nunavut and Newfoundland and Labrador.	eBird, iNaturalist	Low No suitable habitat.
Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	SC	Traditional Common Nighthawk habitat consists of open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshores, and mine tailings. Although the species also nests in cultivated fields, orchards, urban parks, mine tailings, and along gravel roads and railways, they tend to occupy natural sites. The Common Nighthawk nests in a wide range of open, vegetation-free habitats, including dunes, beaches, recently harvested forests, rocky outcrops, grasslands, pastures, marshes, and river banks. This species also inhabits mixed and coniferous forests. The Common Nighthawk probably benefited from the newly-opened habitats created by the massive deforestation associated with the arrival of European settlers in eastern Canada and United States. The appearance of gravel roofs contributed to the expansion of the Common Nighthawk's habitat in North America.	**SD, BB, RB, CUM, BO, FOM, FOC** and **FOD** with openings with little vegetation.	The range of the Common Nighthawk spans most of North and Central America. In Canada, the species is found in all provinces and territories except Nunavut. In Ontario, the Common Nighthawk occurs throughout the province except for the coastal regions of James Bay and Hudson Bay.	eBird, iNaturalist, AECOM (2015)	Medium Buildings in Study Area may have gravel roof tops.
Eastern Wood-pewee *Contopus virens*	SC	SC Schedule 1	SC	The Eastern Wood-pewee lives in the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in intermediate-age mature forest stands with little understory vegetation. During migration, a variety of habitats are used, including forest edges and early successional clearings.	**FOC, FOM, FOD, SWD, SWM** and **CUW**.	The Eastern Wood-pewee is found across most of southern and central Ontario, and in northern Ontario as far north as Red Lake, Lake Nipigon, and Timmins. The breeding range of the Eastern Wood-pewee covers much of south-central and eastern North America.	eBird, iNaturalist, OBBA	Medium Forest and woodland communities may provide suitable habitat.
Golden-winged Warbler *Vermivora chrysoptera*	SC	THR Schedule 1	THR	Golden-winged Warblers prefer to nest in areas with young shrubs surrounded by mature forest – locations that have recently been disturbed, such as field edges, hydro or utility right-of-ways, or logged areas. In their breeding areas, Golden-winged Warblers seem to be fond of regeneration zones where young shrubs grow, surrounded by mature forest, and characterized by plant succession of 10 to 30 years. The warblers frequent clusters of herbaceous plants and low bushes (where they place their nests, which are built on the ground). They favour environments where the trees are spread out, as well as the forest edge, and use this setting for perching, singing, and looking for food. Golden-winged Warblers are found in dry uplands, swamp forests, and marshes. This warbler shows a preference for beaver ponds and burned-out or intermittently cultivated areas.		The Golden-winged Warbler is found in southern Saskatchewan, Manitoba, Ontario, and Quebec, as well as the north-eastern United States. In Ontario, these birds breed in central-eastern Ontario, as far south as Lake Ontario and the St. Lawrence River, and as far north as the northern edge of Georgian Bay. Golden-winged Warblers have also been found in the Lake of the Woods area near the Manitoba border, and around Long Point on Lake Erie. Golden-winged Warblers nest primarily in the northeastern United States, southeastern Saskatchewan, southwestern Manitoba, southwestern Ontario and far southwestern Quebec. In Ontario, they breed from the far southwest of the province north as far as the centre of the Nipissing region, the southern part of the Sudbury and Algoma districts, and the southwest part of the Rainy River district, near Lake of the Woods.	eBird, iNaturalist	Medium Thicket communities, riparian vegetation in proximity to larger mature forests are present.

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Associated ELC Communities	Known Species Range[1, 2]	Source Identifying Species Record	Suitable Habitat Identified Within the Study Area
Peregrine Falcon *Falco peregrinus* Peregrine Falcon (anatum/tundrius) *Falco peregrinus anatum/tundrius*	SC	SC Schedule 1	Not At Risk	Peregrine Falcons usually nest on tall, steep cliff ledges close to large bodies of water. Although most people associate Peregrine Falcons with rugged wilderness, some of these birds have adapted well to city life. Urban peregrines raise their young on ledges of tall buildings, even in busy downtown areas. Cities offer peregrines a good year-round supply of pigeons and starlings to feed on. The Peregrine Falcon is found in various types of habitats, from Arctic tundra to coastal areas and from prairies to urban centres. It usually nests alone on cliff ledges or crevices, preferably 50 to 200 m in height, but sometimes on the ledges of tall buildings or bridges, always near good foraging areas. Suitable nesting sites are usually dispersed, but can be common locally in some areas. The natural nesting habitat has not changed significantly since the population crash and is still largely available. In addition, structures built by humans in both rural and urban areas provide the Peregrine Falcon with other potential nesting sites. And though urbanization and other land uses have had a significant impact on some areas where they feed, Peregrine Falcons can usually modify their diet based on the prey species present in a given area.	**CLO**	The historic North American distribution of the eastern subspecies is east of the Rocky Mountains and south of the tree line. Although Peregrine Falcons now nest in and around Toronto and several other southern Ontario cities, the majority of Ontario's breeding population is found around Lake Superior in northwestern Ontario. The anatum Peregrine Falcon breeds in the interior of Alaska and throughout northern Canada up to southern Greenland, and across continental North America up to northern Mexico. In Canada it is found in all territories and provinces except Prince Edward Island, Nunavut, and the Island of Newfoundland. The tundrius Peregrine Falcon breeds in Alaska and throughout northern Canada up to Greenland. In Canada, it breeds from northern Yukon, the low Arctic islands, northern Northwest Territories, and northern Nunavut up to Baffin Island, Hudson Bay, Ungava, and northern Labrador.	eBird	Medium Buildings within Study Area may provide suitable habitat.
Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	THR	The Wood Thrush lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing perches. These birds prefer large forests, but will also use smaller stands of trees. They build their nests in living saplings, trees, or shrubs, usually in Sugar Maple or American Beech. In Canada, the Wood Thrush nests mainly in second-growth and mature deciduous and mixed forests, with saplings and well-developed understory layers. This species prefers large forest mosaics, but may also nest in small forest fragments.	**FOD** and **FOM** that are greater than 1 ha in size.	The Wood Thrush is found all across southern Ontario. It is also found, but less common, along the north shore of Lake Huron, as far west as the southeastern tip of Lake Superior. There is a very small population near Lake of the Woods in northwestern Ontario, and there have been scattered sightings in the mixed forest of northern Ontario. The Wood Thrush breeds in southeastern Canada from southern Ontario east to Nova Scotia.	eBird, iNaturalist, NHIC, OBBA	Medium Forested community on the west side of the Study Area connects with the larger forests within the Medway environmentally significant area.
Bank Swallow *Riparia riparia*	THR	THR Schedule 1	THR	Bank Swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. The birds breed in colonies ranging from several to a few thousand pairs. The Bank Swallow breeds in a wide variety of natural and artificial sites with vertical banks, including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stock piles of soil. Sand-silt substrates are preferred for excavating nest burrows. Breeding sites tend to be somewhat ephemeral due to the dynamic nature of bank erosion. Breeding sites are often situated near open terrestrial habitat used for aerial foraging (e.g., grasslands, meadows, pastures, and agricultural cropland). Large wetlands are used as communal nocturnal roost sites during post-breeding, migration, and wintering periods.		The Bank Swallow is found all across southern Ontario, with sparser populations scattered across northern Ontario. The largest populations are found along the Lake Erie and Lake Ontario shorelines, and the Saugeen River (which flows into Lake Huron). In North America, it breeds widely across the northern two-thirds of the U.S., north to the treeline. It breeds in all Canadian provinces and territories, except perhaps Nunavut.	eBird, OBBA	Low No suitable habitat.
Barn Swallow *Hirundo rustica*	SC	THR Schedule 1	SC	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges, and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces. Before European colonization, Barn Swallows nested mostly in caves, holes, crevices, and ledges in cliff faces. Following European settlement, they shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared rights-of-way, cottage areas and farmyards, islands, wetlands, and subarctic tundra.	**TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1**; containing or adjacent structures that are suitable for nesting.	The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist. The Barn Swallow has become closely associated with human rural settlements. It breeds across much of North America south of the treeline, south to central Mexico. In Canada, it is known to breed in all provinces and territories.	eBird, iNaturalist, NHIC, OBBA, AECOM (2015)	Medium Barn Swallows were identified foraging within the Study Area. No nests found however, suitable structures were present.
Cerulean Warbler *Setophaga cerulea*	THR	END Schedule 1	END	Cerulean Warblers spend their summers (breeding seasons) in mature, deciduous forests with large, tall trees and an open understorey. They are found in both wet bottomland forests and upland areas. At a finer spatial scale, canopy configuration (e.g., foliage stratification, gap distribution, tree species distribution) are predictors of habitat suitability.	**FOD** and **SWD** that are mature and contain an open understory.	The Cerulean Warbler's breeding range extends from extreme southwestern Quebec and southern Ontario west to Minnesota and Nebraska and south to Texas and other Gulf states across to North Carolina. In southern Ontario, populations appear to be separated into two distinct bands: one from southern Lake Huron to western Lake Ontario, and further north, the other from the Bruce Peninsula and Georgian Bay area to the Ottawa River. This species breeds in the deciduous forests of eastern North America but has a patchy distribution. The Canadian breeding range consists of two main geographic clusters in southwestern and southeastern Ontario, plus a small number of breeding individuals in southwestern Quebec.	eBird	Low No suitable habitat. Observation made during migration.

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Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	THR	Eastern Meadowlarks breed primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs, or fence posts are used as elevated song perches. Eastern Meadowlarks prefer grassland habitats, including native prairies and savannahs, as well as non-native pastures, hayfields, weedy meadows, herbaceous fencerows, and airfields.	**TPO, TPS, CUM1, CUS**, and **MAM2** with elevated song perches.	In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield but it also inhabits the Lake Nipissing, Timiskaming, and Lake of the Woods areas. Including all subspecies, the Eastern Meadowlark's global breeding range extends from central and eastern North America, south through parts of South America. However, there is only one subspecies in Canada and the neighbouring northeastern U.S. In Canada, the bulk of the population breeds in southern Ontario.	eBird	Low None found during field investigations.
Louisiana Waterthrush *Parkesia motacilla*	THR	THR Schedule 1	THR	The Louisiana Waterthrush is usually found in steep, forested ravines with fast-flowing streams. The Louisiana Waterthrush occupies specialized habitat, showing a strong preference for nesting along relatively pristine headwater streams and wetlands situated in large tracts of mature forest. Although it prefers running water (especially clear, coldwater streams), it also inhabits heavily wooded swamps with vernal or semi-permanent pools, where its territories can overlap with its sister species the Northern Waterthrush. It is often classified as both an area-sensitive forest species, and a riparian-obligate species. Louisiana Waterthrush nests are constructed within niches in steep stream banks, in the roots of uprooted trees, or in mossy logs and stumps, usually within a few metres of water.	**FOD, FOM,** and **SWD** with fast flowing coldwater streams or large pools of open water.	The Louisiana Waterthrush summer range extends from the lower Great Lakes south to Georgia and west to Kansas. In Canada, the Louisiana Waterthrush breeds only in southern Ontario, along the Niagara Escarpment, in woodlands along Lake Erie, and scattered locations elsewhere. In Canada, the Louisiana Waterthrush breeds in southern Ontario, where it is considered a rare, but regular local summer resident. The bulk of the Canadian population is concentrated in two areas of Ontario: the Norfolk Sand Plain region bordering the north shore of Lake Erie, and the central Niagara Escarpment between Hamilton and Owen Sound.	AECOM (2015)	Low No suitable habitat., No fast flowing streams or large pools of open water were present within forested communities.
Northern Sunfish (Great Lakes - Upper St.Lawrence populations) *Lepomis peltastes*	SC	SC Schedule 1	SC	In Ontario, the Northern Sunfish lives in shallow vegetated areas of quiet, slow flowing rivers and streams, as well as warm lakes and ponds, with sandy banks or rocky bottoms. Northern Sunfish prefer to be near aquatic vegetation where they can avoid strong currents. During the breeding season, males guard their nests which are made by digging saucer-like depressions in gravel or cobble substrates. It eats mostly aquatic insect larvae and algae, but is known for feeding at the water's surface more frequently than other sunfish. Northern Sunfish usually occur in clear waters and is considered intolerant of siltation. Substrate usually consists of sand and gravel, as in the Thames River.	NA	In Canada, the Northern Sunfish only lives in Ontario and Quebec. The Great Lakes - Upper St. Lawrence populations are found throughout southern Ontario including waters flowing into Lake Huron, Georgian Bay, Lake St. Clair, Lake Erie, and Lake Ontario, as well as rivers and small lakes in eastern Ontario. In Canada, Northern Sunfish range includes northwestern Ontario, south and central Ontario, and southern Québec. Because Northern Sunfish is found in Canada in two National Freshwater Biogeographic Zones it is assessed as two designatable units.	DFO	Medium Species presence identified as occurring or potentially occurring in the Study Area. Suitable habitat conditions observed during field investigations.
Black Redhorse *Moxostoma duquesnei*	THR	THR Schedule 1	THR	In Ontario, the Black Redhorse lives in pools and riffle areas of medium-sized rivers and streams that are usually less than two metres deep. These rivers usually have few aquatic plants, a moderate to fast current, and a sandy or gravel bottom. In the spring, it migrates to breeding habitat where eggs are laid on gravel in fast water. The winter is spent in deeper pools. Adults feed on crustaceans and aquatic insects, while the young fish feed on plankton. The Black Redhorse is found in medium-size rivers, where the river bed is composed of sand or gravel and bedrock substrates, where siltation is minimal and where the current is fairly strong. The Black Redhorse has typically been caught in waters that are oxygen rich and fertile which have a mean temperature of 20 °C in July.		In Canada, the Black Redhorse is found only in southwestern Ontario at a few locations in the Bayfield River, Maitland River, Ausable River, Grand River, Thames River, and Spencer Creek watersheds. In Canada, this fish in found in the Great Lakes basin; it has been seen in Catfish Creek and in the Grand, Thames, and Maitland Rivers. Its distribution extends into the United States, in the Mississippi River system.	DFO	High Critical Habitat identified along the Thames River.
Silver Shiner *Notropis photogenis*	THR	THR Schedule 1	THR	Silver Shiners prefer moderate to large size streams with swift currents that are free of weeds and have clean gravel or boulder bottoms. They live in schools and feed on crustaceans and adult flies that fall in the water or fly just above the surface. In June or July, they spawn by scattering their eggs over gravel riffles. This fish is found in moderate to large, deep, relatively clear streams with swift currents, and moderate to high gradients. Stream widths at capture sites in an Ontario study mostly ranged from 30 to 100 m. Most capture sites were in deep swift riffles and faster currents of pools below the riffles. Stream substrate at capture sites was of gravel, pebble, cobble, boulder, sand, mud, and clay; probably the type of substrate is not very important. The species may avoid areas with submersed vegetation. Stream sections where the water temperature is warmer may be preferred by the fish in the spring. Vegetated riparian habitat provides important function for Silver Shiner thorugh overhanging cover and shade, and food and nutrient inputs, and is therefore associated with Critical Habitat for this species.	NA	In Ontario, it is found in the Thames and Grand Rivers, and in Bronte Creek and Sixteen Mile Creek, which flow into Lake Ontario. In Canada, it occurs only in southern Ontario, in the watersheds of the Grand and Thames rivers and Bronte Creek, and in the drainages of the Great Lakes Erie, St. Clair, and Ontario. The species was first reported from Canada in 1973, though older collections have since been found. It appears that the fish populations in Canada have been reproductively isolated from the U.S. populations for a long time, and it is not likely that the two groups will come in contact. The Silver Shiner was found to be locally abundant in the Grand and Thames river watersheds in 1979. The species occurs almost continually throughout each river section within its range, but is rare in, or absent from, smaller tributary streams and slow-flowing sections of the main rivers.	DFO, iNaturalist	High Critical Habitat identified along the Thames River.

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Monarch *Danaus plexippus*	SC	SC Schedule 1	END	Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers. Milkweeds (numerous species) are the sole food plant for Monarch caterpillars. These plants grow predominantly in open and periodically disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests. Milkweeds are often planted outside their native range, and sometimes wayward Monarchs are observed at these patches. Monarchs require staging areas which are used to rest, feed, and avoid inclement weather during migration. In Canada, they are found along the north shores of the Great Lakes where Monarchs roost in trees before crossing large areas of open water.	**AI, TP,** and **CUM** where milkweed plants are present.	The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie. The overall native range of the Monarch occurs from Central America northward through the continental United States to southern Canada, and from the Atlantic Coast westward to the Pacific Coast. The Canadian range of occurrence includes portions of all ten provinces and the Northwest Territories. Monarchs are loosely divided into eastern and western subgroups based on their migratory routes and overwintering sites. Eastern Monarchs breed from Alberta east to Nova Scotia and migrate south to overwinter in the mountains of Central Mexico. The breeding range in Canada is south of the 50° latitude in Ontario, Quebec, and the Maritimes. Each fall hundreds of thousands of Monarchs migrate through Long Point in southern Ontario but it's unknown what proportion of the Canadian population these individuals represent.	OBA, iNaturlist	Medium Suitable meadws with milkweed is present within the Study Area.
Eastern Small-footed Myotis (Eastern Small-footed Bat) *Myotis leibii*	END	N/A	N/A	In the spring and summer, Eastern Small-footed Bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. These bats often change their roosting locations every day. At night, they hunt for insects to eat, including beetles, mosquitos, moths, and flies. In the winter, these bats hibernate, most often in caves and abandoned mines. They seem to choose colder and drier sites than similar bats and will return to the same spot each year.		The Eastern Small-footed Bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park. Most documented sightings are of bats in their winter hibernation sites.	BCI	Medium Forested may provide suitable roost habiat.
Little Brown Myotis (Little Brown Bat) *Myotis lucifugus*	END	END Schedule 1	END	Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings, and barns for summer colonies where they can raise their young. Bats can squeeze through very tiny spaces (as small as six millimetres across) and this is how they access many roosting areas. Little Brown Bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. Their specific physiological requirements limit the number of suitable sites for overwintering. In the east, large numbers (i.e., >3000 bats) of several species typically overwinter in relatively few hibernacula. In the west, there are fewer known hibernacula, and numbers appear lower per site. Females establish summer maternity colonies, often in buildings or large-diameter trees. Foraging occurs over water, along waterways, and forest edges. Large open fields or clearcuts generally are avoided. In autumn, bats return to hibernacula, which may be hundreds of kilometres from their summering areas, swarm near the entrance, mate, and then enter that hibernaculum, or travel to different hibernacula to overwinter.		The Little Brown Bat is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. In Canada, *Myotis lucifugus* occurs from Newfoundland to British Columbia, and northward to near the treeline in Labrador, Northwest Territories and Yukon.	BCI	Medium Forested may provide suitable roost habiat.
Northern Myotis (Northern Long-eared Bat) *Myotis septentrionalis*	END	END Schedule 1	END	Northern Long-eared Bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April. The Northern Long-eared Bat overwinters in cold and humid hibernacula (caves/mines). Their specific physiological requirements limit the number of suitable sites for overwintering. In the east, large numbers (i.e., >3000 bats) of several species typically overwinter in relatively few hibernacula. In the west, there are fewer known hibernacula, and numbers appear lower per site. Females establish summer maternity colonies in buildings or large-diameter trees. Foraging occurs along waterways, forest edges, and in gaps in the forest. Large open fields or clearcuts generally are avoided. In autumn, bats return to hibernacula, which may be hundreds of kilometres from their summering areas, swarm near the entrance, mate, and then enter that hibernaculum, or travel to different hibernacula to overwinter.	**FOC, FOM, FOD, SWC, SWM,** and **SWD** where suitable roosting (i.e. cavity trees and trees with loose bark) habitat is available.	The Northern Long-eared Bat is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon. In Canada, *Myotis septentrionalis* occurs from Newfoundland to British Columbia, and northward to near the treeline in Labrador, Northwest Territories, and Yukon.	BCI	Medium Forested may provide suitable roost habiat.
Tri-colored Bat *Perimyotis subflavus*	END	END Schedule 1	END	During the summer, the Tri-colored Bat is found in a variety of forested habitats. It forms day roosts and maternity colonies in older forest and occasionally in barns or other structures. They forage over water and along streams in the forest. Tri-colored Bats eat flying insects and spiders gleaned from webs. At the end of the summer they travel to a location where they swarm; it is generally near the cave or underground location where they will overwinter. They overwinter in caves where they typically roost by themselves rather than part of a group. The Tri-colored Bat overwinters in cold and humid hibernacula (caves/mines). Their specific physiological requirements limit the number of suitable sites for overwintering. In the east, large numbers (i.e., >3000 bats) of several species typically overwinter in relatively few hibernacula. In the west, there are fewer known hibernacula, and numbers appear lower per site. Females establish summer maternity colonies in buildings or large-diameter trees. Foraging occurs over water, along waterways, and forest edges. Large open fields or clearcuts generally are avoided. In autumn, bats return to hibernacula, which may be hundreds of kilometres from their summering areas, swarm near the entrance, mate, and then enter that hibernaculum, or travel to different hibernacula to overwinter.		This bat is found in southern Ontario and as far north as Espanola near Sudbury. Because it is very rare, it has a scattered distribution. It is also found from eastern North America down to Central America. In Canada, *Perimyotis subflavus* occurs in Nova Scotia, New Brunswick, Quebec, and Ontario.	BCI	Medium Forested may provide suitable roost habiat.

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Associated ELC Communities	Known Species Range[1, 2]	Source Identifying Species Record	Suitable Habitat Identified Within the Study Area
Wavy-rayed Lampmussel *Lampsilis fasciola*	THR	SC Schedule 1	SC	The Wavy-rayed Lampmussel is usually found in small to medium rivers with clear water. It lives in shallow riffle areas with clean gravel or sand bottoms. Like all mussels, this species filters water to find food, such as bacteria and algae. Mussel larvae are parasitic and must attach to a fish host, where they consume nutrients from the fish body until they transform into juvenile mussels and drop off. The Wavy-rayed Lampmussel's fish hosts are the Largemouth Bass (*Micropterus salmoides*) and Smallmouth Bass (*Micropterus dolomieu*). The presence of fish hosts is one of the key features for an area to support a healthy mussel population. The mussel inhabits clear rivers and streams of a variety of sizes, where the water flow is steady and the substrate is stable. It is typically found in gravel or sand substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. It is most abundant in small to medium-sized streams. Even in optimal habitats, it accounts for only 2-4% of the abundance of the mussel community. Its presence at sites that invariably support a great diversity of other mussel species suggests that it cannot tolerate sub-optimal conditions.		In Canada, the Wavy-rayed Lampmussel is found only in Ontario in the Grand, upper Thames, Maitland, Ausable, and St. Clair rivers, and the Lake St. Clair delta. It has disappeared from Lake Erie, the Detroit River, and most of Lake St. Clair, and may also be gone from the Sydenham River. The Wavy-rayed Lampmussel was formerly found throughout the Ohio and Mississippi river systems, the upper Allegheny River drainage in New York, lakes Erie and St. Clair and their drainages, and in tributaries of Lake Michigan, lower Lake Huron, and Lake Ontario, including the Niagara River. All Canadian populations are restricted to the upper Grand River and limited sections of the Thames, Sydenham, and possibly the Ausable rivers, all in Ontario. It appears to have been extirpated from western Lake Erie, Lake St. Clair, and the Detroit River due to competition from Zebra Mussels. Its distribution in the Grand River has become restricted to a ~40 km stretch of the upper river, whereas once it occurred in the upper and middle reaches. It has probably always been rare in the Thames and Sydenham rivers, where it currently survives in 8 km and 5 km reaches, respectively.	DFO	Medium Species presence identified as occurring or potentially occurring in the Study Area. Suitable habitat conditions observed during field investigations.
Black Ash *Fraxinus nigra*	END	N/A	THR	Black Ash is a medium-sized, shade-intolerant hardwood tree species that occurs on moist to wet sites such as swamps, bogs, and riparian areas. Like other Ash (Fraxinus) species, black ash has wind-dispersed pollen and seeds and regenerates readily from seed and via stump sprouting	SWD, SWM, SWC	Black Ash occurs from western Newfoundland to southeastern Manitoba and North Dakota, ranging southward to Iowa, Illinois, Virginia and Delaware. Black Ash's range extends farther north than any other ash and approximately 51% of the species' global range is within Canada. Black Ash occurs throughout most of Ontario, except the Far North, ranging from southern Ontario east to the Quebec border, west to the Manitoba border and north to approximately 51° latitude.	iNaturalist	Low None found during field investigations.
Butternut *Juglans cinerea*	END	END Schedule 1	END	In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry, rocky soil. This species does not do well in the shade, and often grows in sunny openings and near forest edges. Butternut occurs primarily in neutral to calcareous soils of pH 5.5 to 8, often in regions with underlying limestone, and is generally absent from acidic regions. It tends to reach greatest abundance in rich well-drained mesic loams in floodplains, streambanks, terraces, and ravine slopes, but can occur in a wide range of other situations. In closed-canopy stands, it must be in the overstory to thrive. Seedling establishment, growth, and survival to maturity are most frequent in stand openings, riparian zones, and forest edges.	**FOD** and mature hedgerows; Soil: dry rocky or moist (4, 5, 6) to fresh (2, 3).	Butternut can be found throughout central and eastern North America. In Ontario, this species is found throughout the southwest, north to the Bruce Peninsula, and south of the Canadian Shield. Butternut's native Canadian range is restricted to southern Ontario and Quebec (primarily south of the area bounded by Georgian Bay, the Ottawa Valley, and the Quebec City region), and western and southern portions of New Brunswick.	iNaturlist	Low None found during field investigations.
Green Dragon *Arisaema dracontium*	SC	SC Schedule 3	SC	The Green Dragon grows in somewhat wet to wet deciduous forests along streams, particularly maple forest and forest dominated by Red Ash and White Elm trees.	**FOD6, FOD7, FOD8, FOD9,** and **SWD** with moist soils.	Primarily a plant of the southern United States, the Green Dragon is found from the Great Lakes region and southern Quebec east to the Atlantic coast, south to Florida and the Gulf coast, and west to Texas and Nebraska. In Ontario, it is believed to still occur at about 30 to 35 sites in the southwestern part of the province. In Canada, the Green Dragon is found in southern Ontario and southwestern Quebec.	NHIC	Low None found during field investigations.
American Chestnut *Castanea dentata*	END	END Schedule 1	END	The American Chestnut prefers drier upland deciduous forests with sandy, acidic to neutral soils. In Ontario, it is only found in the Carolinian Zone between Lake Erie and Lake Huron. The species grows alongside Red Oak, Black Cherry, Sugar Maple, American Beech, and other deciduous tree species.	**FOD** with dry sandy soil.	The American Chestnut has almost disappeared from eastern North America due to an epidemic caused by a fungal disease called the chestnut blight (*Cryphonectria parasitica*). In Canada, the American Chestnut is restricted primarily to southwestern Ontario. This species occurs throughout eastern North America from southern Maine to southern Ontario and Michigan, south to Georgia to Mississippi. Remnants of once large populations of this tree still survive across most of its historical range in southern Ontario as well as most of the states within its range to the south.	MECP	Medium Potentially suitable habitat with FOD2-3/FOD5-5, though none found during field investigations

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Associated ELC Communities	Known Species Range[1, 2]	Source Identifying Species Record	Suitable Habitat Identified Within the Study Area
Eastern False Rue-anemone *Enemion biternatum*	THR	THR Schedule 1	THR	False Rue-anemone grows in deciduous forests and thickets with rich, moist soil, often in valleys, floodplains, and ravine bottoms. This species is frequently found close to watercourses within mature forests with lots of maple and beech trees. It prefers partial sun or somewhat shady conditions. This species inhabits open wooded slopes, river floodplains, rich woods, and thickets.	**FOD2, FOD4, FOD5, FOD6, FOD7,** and **FOD9**.	In Canada, based on information available in 2003, False Rue-anemone is believed to occupy only six places in southwestern Ontario, all in the Carolinian region. False Rue-anemone occurs in Canada and the United States.	MECP	Medium Potthtially suitable habitat FOD7-4, though none found during field investigations
Kentucky Coffee-tree (Middlesex County) *Gymnocladus dioicus*	THR	THR Schedule 1	THR	Kentucky Coffee-tree is found in a variety of habitats, but grows best on moist, rich soil. Consequently, it is often found in floodplains, though it will tolerate shallow rocky or sandy soils. It is shade-intolerant, and therefore grows along the edges of woodlots or relies on canopy openings in forests and woodlots. Kentucky Coffee-trees occur in an area of Canada that has one of the warmest climates and longest growing seasons in the country and where climate is moderated year round by the proximity of lakes Erie and Huron. Within this area, the Kentucky Coffee-tree inhabits open areas of floodplains and the edges of wetlands. In these habitats, the trees do not usually suffer from shading because occasional flooding inhibits canopy closure by competing species.	**FOD** typically on moist rich soils along forest edges or in forest openings.	The Kentucky Coffee-tree is rare throughout its range, which extends from the southern Great Lakes region east to New York in scattered localities, south to Oklahoma and Arkansas, and west to Kansas and Nebraska. In Canada, it is only found in southwest Ontario where it was documented at 20 locations in 2000. There are currently 25 known native populations of the Kentucky coffee-tree in Canada. Because the species is quite conspicuous, it is unlikely that it has been missed in recent attempts to locate it, and no additional occurrences are likely to be found in Canada.	MECP	Low None found during field investigations.
Queensnake *Regina septemvittata*	END	END Schedule 1	END	The Queensnake is an aquatic species that is seldom found more than a few metres from the water. It prefers rivers, streams, and lakes with clear water, rocky or gravel bottoms, lots of places to hide, and an abundance of crayfish. Queensnakes will often hibernate in groups with other snakes, amphibians, and even crayfish. Suitable hibernation sites (called hibernacula) include abutments of old bridges and crevices in bedrock. Queensnakes are most commonly associated with rocky streams and rivers, but are also occasionally found in marsh, pond, and lake shore habitats. This highly aquatic species is usually found within 3 m of the shoreline and only at sites where there is an abundance of crayfish, its primary food source.	**OAO** with clear water and rocky or gravel bottoms with lots of places to hide and abundance of crayfish.	In Ontario, the Queensnake is found only in the southwest in Middlesex, Brant, Huron, and Essex counties, and on the Bruce Peninsula. There are fewer than 25 sites where it is known to occur in these areas. The extremely specialized habitat requirements of the Queensnake restrict this species to particular areas, with large gaps of unfavourable habitat in between populations. The snake's home range is quite small, making Queensnakes less likely to move into new areas or areas where it was historically found. The Queensnake is relatively widespread in eastern North America, ranging from southeastern Pennsylvania, western New York and southwestern Ontario, west to southeastern Wisconsin, and south to the Gulf Coast from the Florida panhandle to eastern Mississippi. The Queensnake occurs west of the Niagara Escarpment, from the northern portion of the Bruce Peninsula, south to Lake Erie, and west to Essex County.	UTRCA Correspondence, ORAA	Medium Suitable habitat may be present along vegetation communities adjacent to the Thames river. Preferred overhangng vegetation was noted during field investigations.
Spiny Softshell *Apalone spinifera*	END	END Schedule 1	END	Spiny Softshells are highly aquatic turtles that rarely travel far from water. They are found primarily in rivers and lakes but also in creeks and even ditches and ponds near rivers. Key habitat requirements are open sand or gravel nesting areas, shallow muddy or sandy areas to bury in, deep pools for hibernation, areas for basking, and suitable habitat for crayfish and other food species. These habitat features may be distributed over an extensive area, as long as the intervening habitat doesn't prevent the turtles from traveling between them. Spiny Softshell inhabits a wide variety of aquatic habitats, including rivers, marshy creeks, oxbows, lakes, and impoundments. Common habitat features include a soft bottom with sparse aquatic vegetation, as well as sandbars or mudflats. Overwintering sites are generally in well oxygenated lakes and rivers.	**OAO** characterized as rivers with nearby open sand or gravel nesting areas, shallow muddy or sandy substrates, deep pools, basking areas and suitable habitat for food species.	In Canada, the Spiny Softshell is found only in Quebec and southwestern Ontario in the Lake St. Clair, Lake Erie, and western Lake Ontario watersheds. The majority of Spiny Softshells in Ontario are found in the Thames and Sydenham rivers and at two sites in Lake Erie. The size of the home range of this turtle depends on availability of habitat features such as nesting and hibernation sites. Some turtles travel up to 30 kilometres in a year from one part of their home range to another. Globally, the Spiny Softshell occurs in eastern North America from the New England states through extreme southern Quebec and Ontario, west to Nebraska, south to Texas, and across the Gulf states to the Atlantic. The Canadian population is divided into two geographically distinct subpopulations: a Great Lakes/St. Lawrence subpopulation in southern Quebec and a Carolinian subpopulation in southern Ontario.	UTRCA Correspondence, ORAA	High The location of Spriny Softshells in Ontario is considered to be sensitive and condifential information. AECOM has consulted with UTRCA regarding this matter.
Northern Map Turtle *Graptemys geographica*	SC	SC Schedule 1	SC	The Northern Map Turtle inhabits rivers and lakeshores where it basks on emergent rocks and fallen trees throughout the spring and summer. In winter, the turtles hibernate on the bottom of deep, slow-moving sections of river. They require high-quality water that supports the female's mollusc prey. Their habitat must contain suitable basking sites, such as rocks and deadheads, with an unobstructed view from which a turtle can drop immediately into the water if startled. The Northern Map Turtle inhabits both lakes and rivers, showing a preference for slow moving currents, muddy bottoms, and abundant aquatic vegetation. These turtles need suitable basking sites (such as rocks and logs) and exposure to the sun for at least part of the day.	**OAO, SA** with emergent rocks and fallen trees suitable habitat for prey.	The Northern Map Turtle's range extends from the Great Lakes region west to Oklahoma and Kansas, south to Louisiana, and east to the Adirondack and Appalachian mountain barrier. In Canada, it is found in southwestern Quebec and southern Ontario. In southern Ontario, it lives primarily on the shores of Georgian Bay, Lake St. Clair, Lake Erie, and Lake Ontario, and along larger rivers including the Thames, Grand, and Ottawa. It reaches its northern limit in southern Ontario and southwestern Quebec, where it is associated with the Great Lakes Basin and the St. Lawrence River.	ORAA	High UTRCA confirmed species presence and suitable nesting habitat along shoreline in Study Area.

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Associated ELC Communities	Known Species Range[1, 2]	Source Identifying Species Record	Suitable Habitat Identified Within the Study Area
Snapping Turtle *Chelydra serpentina*	SC	SC Schedule 1	SC	Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid summer, females travel overland in search of a suitable nesting site, usually gravelly or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams, and aggregate pits. Although Snapping Turtles have been observed in shallow water in almost every kind of freshwater habitat, the preferred habitat of the species is characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation. Established populations are most often located in ponds, sloughs, shallow bays or river edges, and slow streams, or areas combining several of these wetland habitats. Individual turtles will persist in urbanized water bodies, such as golf course ponds and irrigation canals, but it is unlikely that a population could become established in such habitats. The Snapping Turtle can occur in highly polluted waterways, but environmental contamination is known to reduce the already low reproductive output of this species. Basking on offshore logs and protruding rocks can be common in Snapping Turtles, depending on environmental temperature. Females generally nest on sand or gravel banks along waterways. Upon emergence from the nest in early fall, hatchling Snapping Turtles usually move to water, after which they bury themselves under leaf litter or debris. Snapping Turtles overwinter underwater, buried beneath logs, sticks or overhanging banks in small streams that flow continuously throughout the winter. They can also hibernate buried in deep mud in marshy areas or beneath floating mats of vegetation. Snapping Turtle habitat is diminishing in both quantity and quality in Canada, with losses primarily due to conversion of wetlands to agriculture and urban development.	**OAO, SA** near gravelly or sandy areas.	The Snapping Turtle's range extends from Ecuador to Canada. The Snapping Turtle's range is contracting. In Canada, the species is widespread from Nova Scotia to southeastern Saskatchewan, though it is absent from northwestern Ontario, where summers are likely too cool for Snapping Turtle embryos to complete development successfully. The Snapping Turtle is therefore present in mainland Nova Scotia, southern New Brunswick, southern and central Quebec, southern and central Ontario, southern Manitoba, and southeastern Saskatchewan, primarily in the Qu'Appelle watershed.	UTRCA Correspondence, ORAA	High UTRCA confirmed species presence and suitable nesting habitat along shoreline in Study Area.
Eastern Foxsnake (Carolinian population) *Pantherophis gloydi*	END	END Schedule 1	END	Eastern Foxsnakes in the Carolinian population are usually found in old fields, marshes, along hedgerows, drainage canals, and shorelines. Females lay their eggs in rotting logs, manure, or compost piles, which naturally incubate the eggs until they hatch. During the winter, Eastern Foxsnakes hibernate in groups in deep cracks in the bedrock and in some man-made structures. Eastern Foxsnakes in the Essex-Kent and Haldimand-Norfolk regions use mainly unforested, early successional vegetation communities (e.g., old field, prairie, marsh, dune-shoreline) as habitat during the active season. Hedgerows bordering farm fields and riparian zones along drainage canals are regularly used. In some areas of intensive farming, these linear habitat strips likely make up the bulk of habitat available for foxsnakes.		The Eastern Foxsnake is only found in Ontario, Michigan, and Ohio. Ontario contains 70% of their range in two distinct populations: the Carolinian population in southwestern Ontario and the eastern Georgian Bay population. Within Ontario, the species' distribution is highly disjunct, occupying three discrete regions along the Lake Erie-Lake Huron waterway shoreline. The three regional populations from south to north are (1) Essex-Kent, (2) Haldimand-Norfolk, and (3) Georgian Bay Coast.	MECP	Low Occurrence record square does not overlap the Study Area.

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Appendix F

Environmental Management Plan

Appendix F

Western Road and Sarnia Road / Philip Aziz Avenue Improvements Environmental Management Plan

In order to address the potential impacts identified for any proposed work associated with the Project, there are three general categories of measures:

1. **Avoidance** – Avoidance involves the design of a plan that protects natural heritage features and functions by keeping the works outside of natural heritage features wherever possible.
2. **Standard Mitigation** – Mitigation involves the implementation of measures designed to eliminate or reduce impacts by designing facilities or including natural elements that filter or prevent impacts.
3. **Compensation** – Compensation involves the replacement of a feature and/or function that may be lost as a result of the construction and long-term presence of the works.

The following sections detail the recommendations for avoidance, mitigation and compensation.

1.1 Avoidance

The avoidance of potential impacts for the proposed work is inherent in the identification and protection of natural heritage features within the Study Area.

Work Limit Restriction – The limits for the Proposed Works include relocating the outfall to 50 m south away from turtle habitat to avoid work in and around the existing outfall. Restricting the footprint of construction activities will aid in avoiding impacts to SAR habitat and the adjacent natural heritage features. No in-water works shall occur at the existing outfall to avoid impacts on sensitive turtle habitat.

Timing Restrictions – Restricting construction related activities to outside of sensitive periods (e.g., breeding, rearing, migration) for wildlife species can limit disturbance during various life cycle processes. Timing restrictions to avoid impacts to wildlife include:

- Limit construction activities to the daylight hours (i.e., 7am to 7pm) in order to reduce the amount of noise disturbance.
- Where vegetation removal is required, it should be completed outside of the active bird nesting season (April 1 to August 31) to avoid incidental take and therefore contravention of the MBCA. Should vegetation removal be required during the active bird nesting season, a nest survey should be conducted by a qualified ecologist or equivalent and should only be considered for simple habitats as defined by Environment and Climate Change Canada (2019).
- Where tree removal is required, it should be completed outside of the bat roosting season (April 1 to September 30) to avoid contravention of Section 9 of the ESA.
- Work below the high water mark, including activities done within isolation measures (e.g., coffer dams) should not occur between March 15 and July 15 of any given year. This is a standard measure in order to minimize disturbance to aquatic communities during critical periods and was obtained from MNRF timing window guidelines (MNRF, 2013). Any proposed works in or near water should also follow the mitigation measures detailed in **Section 1.2** as well as adhere to measures provided by DFO in response to the submission of a Request for Review to the Fish and Fish Habitat Protection Program (FFHPP), or other permits should they apply.

1.2 Mitigation

Standard mitigation measures are typically associated with construction related impacts. These mitigation measures are commonly implemented with infrastructure projects and include measures intended to minimize the risk of potential impacts to the natural environment. The following measures are proposed to further mitigate the potential impacts:

Installation of Fencing – The installation of tree protection fencing and equipment exclusion fencing can minimize construction related impacts such as damage to trees or sediment loading in adjacent natural heritage features. Consideration should be given to install protective fencing adjacent to wooded areas and the Thames River. Proper installation and maintenance are necessary to reduce the risk of potential impacts.

Wildlife Exclusionary Measures – To avoid contravention of the MBCA, vegetation removal and work on potential nesting structures (i.e., culverts) should occur outside of the bird nesting period (**April 1 to August 31** in southern Ontario). Bird exclusionary measures such as tarps should be installed on relevant structures (i.e., culverts) in advance of the active season in accordance with the *Best Management Practices for Excluding Barn Swallows and Chimney Swifts from Buildings and Structures* (MNRF, 2017a). If activities are proposed to occur during the general nesting period, a breeding bird and nest survey may be undertaken prior to required activities in simple habitat as identified by a qualified Biologist. Nest searches in simple habitats by an experienced searcher are required and will be completed by a qualified Biologist no more than 48 hours prior to vegetation removal.

Additional wildlife exclusionary measures including fencing should also be implemented to prevent wildlife encounters during construction activities. Exclusion fencing type and installation should follow the *Best Management Practices for Mitigation the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario* (MNRF, 2016). Exclusion fencing for Queensnake should install fencing based on recommended fencing depths and heights based on MECP's *Best Practices for Reptile and Amphibian Exclusion Fencing* (MECP, 2021). Fencing depth and height of exclusion measures should consider the variety of wildlife using the area and be installed such that any species potentially impacted are screened for and relocated.

Sediment, Erosion and Dust Control – A sediment and erosion control plan should be developed that includes the installation of sediment and erosion control measures such as silt fencing and straw-bale check dams prior to construction activities. To mitigate dust deposition, a dust suppressant can be applied to areas of exposed soils and areas of concrete drilling/cutting to reduce or eliminate dust generation. To protect sensitive environmental receivers adjacent to the project works, the dust suppressant should be limited to the application of water. Exposed soils and disturbed areas should be re-stabilized following construction, with non-biodegradable erosion and sediment control measures removed from site once these areas have been stabilized.

Machinery/Equipment Practices – The risk of impacts from construction machinery can be minimized or avoided with proper machinery inspections and maintenance, and by establishing areas away from natural heritage features that are dedicated to re-fueling and storing machinery. Refueling, maintenance, or repair of equipment should not occur within 30 m of a watercourse or drainage feature. Emergency spill-kits and drop trays should be kept on site and deployed as necessary for equipment working near or over water. No machinery/equipment should enter or ford the Thames River at any time.

Invasive Species Control – Prior to and during construction develop and implement an Invasive Species Control Plan. Development of the plan should consider the *London Invasive Plant Management Strategy* (City of London 2017), including the *Clean Equipment Protocol for Industry* (Halloran *et al.*, 2013) and the *City of London Environmental Management Guidelines (*2021).and .

EMP with Wildlife Observation and Handling Protocols, including SAR Awareness Training – Construction staff will be made aware of the possible wildlife, including SAR and SOCC, that may occur within the work area.

The Wildlife Observation and Handling Protocol will include SAR identification and the proper protocols to implement if wildlife or SAR/SOCC are encountered in the work area to reduce harm/injury to the animal. Staff will be trained on the Wildlife Observation and Handling Protocol to an appropriate level for their job duties from a qualified Biologist/Ecologist. The handling protocol should follow the MNRF's *Ontario Species at Risk Handling Manual: For Endangered Species Act Authorization Holders* (MNRF, no date). The EMP will be developed for the detail design stage of the project once it becomes available.

Wildlife and Mussel Relocation Plan – prior to the start of construction wildlife and mussel relocation plans will be developed to address relocating SAR mussels and SAR turtles from the work area for isolation. The mussel relocation plan will be based on the Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario – Great Lakes Area (OGLA) (Mackie, Morris & Ming, 2008) which includes mandatory monitoring of any relocated SAR one month, one year and two years following the relocation. The wildlife relocation plan will be developed following the guidance of MECP and UTRCA and include requirements for any monitoring identified therein.

In-water Work: Work below the high water mark will be done with isolation measures in place, such as a cofferdam or similar measure in order to protect the waterbody from release of sediment or other deleterious substances, and prevent fish from entering the work area. Prior to establishing an isolated area, a wildlife and mussel relocation must be completed following the methodology of the applicable plans. Following isolation fish must be relocated from the wetted areas of this isolated in-water work area, with an additional screening for any remaining mussels or other wildlife. If dewatering is required where fish may be present in wetted areas, pump intakes should be screened to prevent fish and turtle mortality. Equipment operation from below the high water mark should be avoided. Minimize or avoid as much as feasible the removal of riparian vegetation, in-water or shoreline organic debris, rocks, or vegetation.

1.3 Compensation, Restoration and Enhancement

While being the least desirable measure, compensation for loss of vegetation or habitat, or the restoration of degraded areas can offer a means of providing a benefit to the natural features and functions that contribute to an overall natural heritage system. The proposed activities include vegetation removal on the edges of vegetation communities, including riparian habitat. Where vegetation removals area requires and machinery use has resulted in degradation of edge habitat, compensation plantings should be considered and include native trees, shrubs and herbaceous species where appropriate. Plantings should utilize the UTRCA's planting recommendations based on site conditions such as soil moisture, sunlight level and ability to spread (UTRCA, 2021). The amount of compensation planting and at what ratio should be confirmed with the City of London once the CDA is further refined during the detail design phase.

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Appendix B

B.3 Cultural Heritage Reports

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Cultural Heritage Resource Assessment: Existing Conditions and Preliminary Impact Assessment

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

City of London

60661402

October 2021

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Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

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- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
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Revision History

Rev #	Revision Date	Revised By:	Revision Description
0		Liam Ryan	Draft Report

Distribution List

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1. Introduction

1.1 Project Context

AECOM Canada Ltd. (AECOM) was retained by the City of London to conduct a Cultural Heritage Resource Assessment (hereafter CHRA) based on the updated Phase 2 plans for the proposed Western Road and Sarnia and Sarnia Road/Philip Aziz Avenue Improvements (the 'Project'). The City of London is undertaking a Municipal Class Environmental Assessment (MCEA) study to identify necessary improvements at the Western Road and Sarnia Road/Philip Aziz Avenue intersection (the 'Study Area'). The MCEA study will identify and balance the needs of the users within the community, including pedestrians, cyclists and motorists. The MCEA study will be carried out in accordance with Class EA consultation requirements having full consultation with the community, stakeholders, agencies and Indigenous communities.

The City of London Transportation Master Plan (2030 TMP) identified the need to improve the Western Road and Sarnia Road/Philip Aziz Avenue intersection in the next 5 years. Currently, the existing road/intersection experiences at capacity or over capacity conditions with respect to vehicular movements in addition to pedestrian and cyclist activity. As a result, traffic congestion, safety concerns, increased delays and decreasing levels of service are being experienced and will continue if left untreated. Further, the existing storm drainage in the area does not meet current design standards and requires upgrades.

The MCEA provides the City the opportunity to develop a range of planning and design alternatives that can improve intersection turning movements, provide additional capacity by removing constraints, improve pedestrian and cyclist facilities and safety. Improvements will also provide continuity with Western Road north and south of the study area, address stormwater drainage and enhance streetscape conditions. The consultation process will help solicit public and agency feedback to select the best plan for the future.

Following the City of London's 'Complete Streets' guidelines, 'Urban Design' guidelines, and Western University's Master Plan Vision, there is an opportunity to create a gateway to the campus. The MCEA will strive to create a street/intersection that is as functional and comfortable as possible for all users (students, children, seniors, cyclists, motorists, transit users and pedestrians), while ensuring that there is a place for trees and the natural environment is protected.

In 2015, AECOM's Cultural Heritage Specialist completed a Cultural Heritage Resources Review (AECOM, 2015) as part of the *Final Technical Memorandum* (AECOM, 2015) for the proposed Western Road and Sarnia Road/Philip Aziz Avenue improvements. At that time, the study area was larger and extended along Western Road from Huron University College entry southerly to Platts Lane and the Sarnia Road/Philip Aziz Avenue corridor extends from Coombs Avenue easterly to the Thames River. The heritage review was completed in order to screen the study area for known cultural heritage resources. The review completed for the 2015 Cultural Heritage Resources Review report used the 2006 *City of London's Register of Cultural Heritage Resources* and documented a total of four (4) heritage properties[1] and one unregistered cemetery:

- 150 Philip Aziz/1180 Western Road, Designated Part IV
- 1285 Western Road, Listed,
- 1349 Western Road, Listed
- 1379 Western Road, Listed
- Stirrup Court Burial Site, Unregistered cemetery

[1] The 2015 AECOM report incorrectly documented five (5) heritage properties. The 2015 AECOM report documented Cronyn Hall and Huron University College as two separate heritage properties. This is incorrect as they both share the municipal address of 1349 Western Road. The correct number of heritage properties documented in 2015 should be four (4) and one unregistered cemetery.

In 2016, the project was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). As it is related to this project, the northern routes for RT have been deferred and the City has decided to restart this project.

1.2 Purpose of the CHRA

The purpose of this CHRA is to determine existing conditions within the Study Area (the project limits), present an inventory of municipally, provincially, and/or federally recognized built heritage resources (BHRs) and cultural heritage landscapes (CHLs), as well as to identify potential BHRs and CHLs within the Study Area. The CHRA will evaluate the potential impacts that the Project will have on those CHLs and BHRs and propose appropriate mitigation measures. See **Section Error! Reference source not found.** for project methodology.

1.3 Location and Physical Description of the Study Area

1.3.1 Location of Study Area

The Study Area is located in London, within Middlesex County, Ontario. More specifically, the Study Area is located between a largely residential neighbourhood known as University Heights and the Western University.

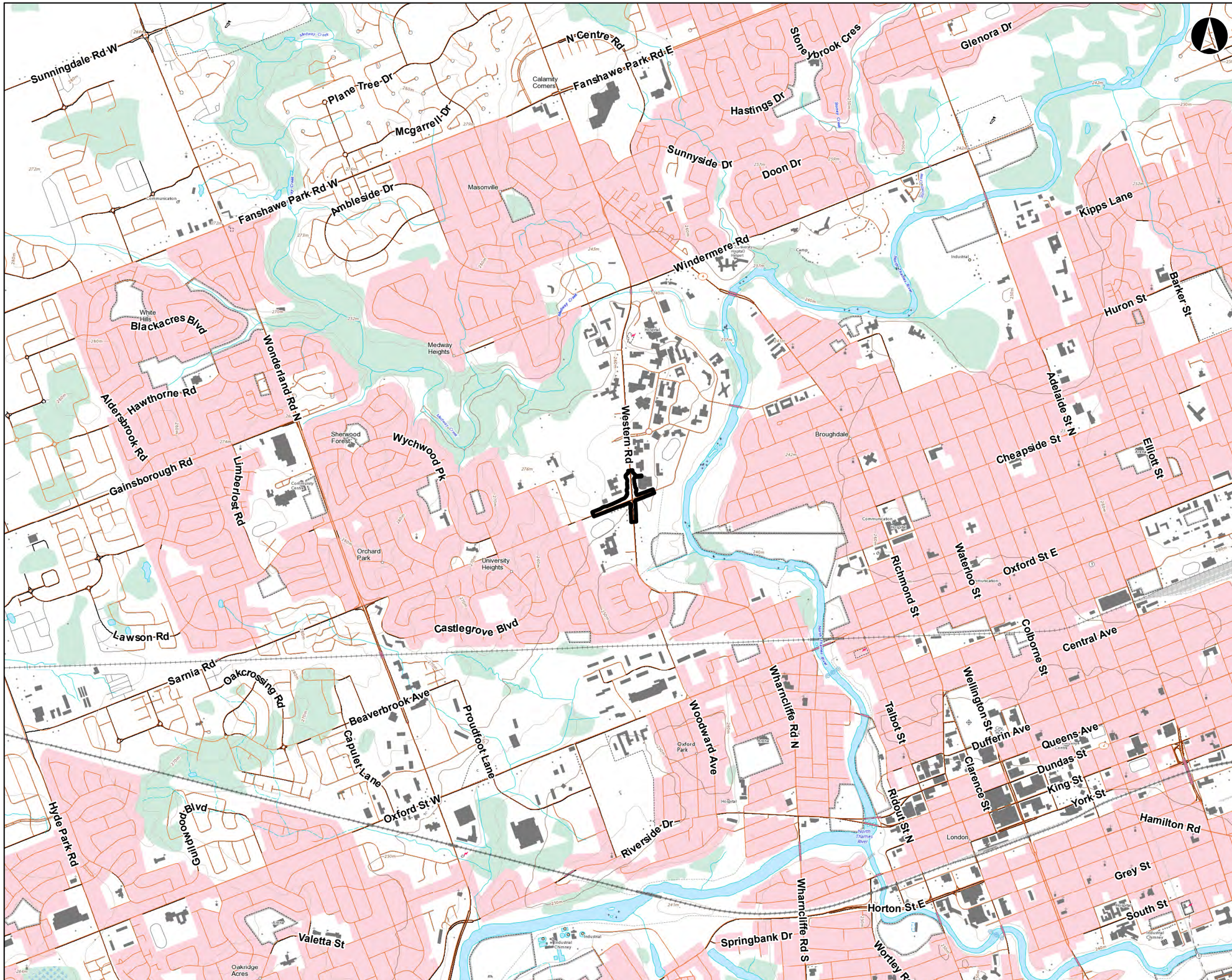
The Study Area focusses on the intersection improvements to Western Road and Sarnia Road/Philip Aziz roadways. The Study Area extends 153.6 metres south and 193.7 metres north along Western Road from the centre of the Western Road and Sarnia Road/Philip Aziz Avenue intersection. The Sarnia Road/Philip Aziz Avenue corridor extends 153 metres east from the intersection along Philip Aziz Avenue and 282.7 metres west from the intersection along Sarnia Road. In some cases, the Study Area extends beyond the two rights-of-way and includes small portions of adjacent lands.

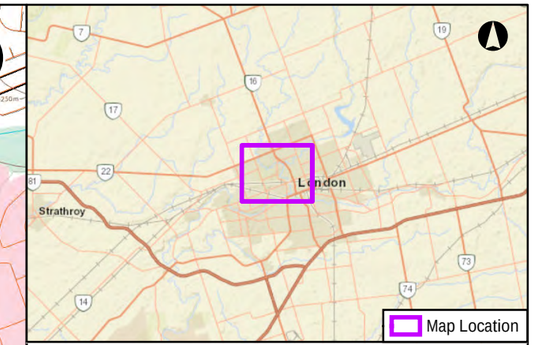
1.3.2 Description of the Study Area

Western Road is a corridor which consists of double northbound and southbound lanes with median turning lanes and access ways to the Western University and affiliated college building and commercial facilities. There is currently a single westbound left turn lane at the Sarnia Road/Western Road intersection and a single eastbound left turn lane at the Philip Aziz Avenue/Western Road. Western Road has an urban cross section with curb and gutter generally throughout with the exception of some sections south of Lambton Drive where the asphalt extends to the sidewalk.

Sarnia Road travelling easterly to Western Road generally consists of double eastbound and westbound lanes with a median approaching the Western Road intersection, access ways to institutions and a northbound left turn lane and a southbound right turn lane at the intersection. This section of road has an urban cross section with curb and gutter throughout the length of the Study Area. A modular concrete retaining wall abuts the north edge of the westbound sidewalk east of Brescia Lane.

Philip Aziz Avenue consists of single eastbound and westbound lanes and a southbound left turn lane at the Western Road intersection. The road has a combination of gabion retaining walls and relatively steep slopes along the north side. The road surface slopes to the east and is narrow with no shoulders or sidewalks.





Legend

Study Area

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Study Area Location Overlaid
on a Current Topographic Map

0 125 250 500 750 1,000 1,250 1,500 1,750
Meters
DATUM: NAD 1983 UTM Zone 17N

September 2021	1:25,000 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2019, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
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Figure 1

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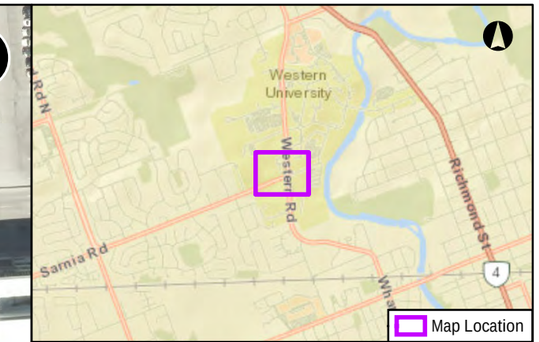
Date Saved: 8/8/2021 4:36:52 PM User Name: clarkb



Legend

Study Area

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Study Area Overlaid on
Current Aerial Photography

0 25 50 100
Meters
DATUM: NAD 1983 UTM Zone 17N

September 2021	1:1,500 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2019, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
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Figure 2

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Date Saved: 9/8/2021 1:45:20 PM User Name: clarks

2. Methodology

2.1 Key Tasks

AECOM prepared this CHRA according to the requirements identified in the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) *Ontario Heritage Tool Kit (*2006*).* Therefore, the following steps were taken:

- Background research using primary and secondary sources to establish a historical context for the Study Area and its surrounding environs;
- A review of the *City of London's Register of Cultural Heritage Resources* to identify properties that have been designated under Parts IV or V of the *Ontario Heritage Act* or listed on the registers.
- The Study Area was screened for BHRs and CHLs through the review of following online searchable databases:
    - Ontario Heritage Trust Conservation Easements;
    - Ontario Heritage Trust's Places of Worship Inventory;
    - Ontario Heritage Trust's Provincial Plaque Program*;*
    - Ontario Heritage Trust's Ontario Heritage Act Register*;*
    - Ontario Historical Society's Ontario Heritage Directory and Map;
    - Ontario Genealogical Society's Ontario Cemetery Index;
    - Parks Canada's National Historic Sites;
    - Parks Canada's The Canadian Register of Historic Places on *Canada's Historic Places* website;
    - Parks Canada's Directory of Federal Heritage Designations*;*
    - Canadian Heritage River System website; and,
    - United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites.
- A field review was conducted on September 14, 2021, by Tara Jenkins, Cultural Heritage Specialist, Lead (AECOM), to document the existing conditions of the Study Area from the publicly accessible right-of-way to confirm or identify existing and potential BHRs and CHLs.
- Property descriptions were prepared in **Table 3** of all BHRs and CHLs, including their heritage interest or value, physical description, historical description, and contextual description.

  Following the preliminary impact assessment, recommendations are made on next steps in order to ensure all BHRs and CHLs identified are properly mitigated.

This report was completed by a team of AECOM's Cultural Resource Management staff including Liam Ryan, BA (Cultural Heritage Specialist, Junior), Tara Jenkins, MA, CAHP (Cultural Heritage Specialist, Lead), and Adria Grant, MA, CAHP (Associate Vice President, Impact Assessment and Permitting).

2.2 Determination of Potential Cultural Heritage Value or Interest

For this CHRA, the field review and identification of the BHRs and CHLs within the Study Area were supported by a background review of historical maps and aerial photographs, and community consultation (see **Section 2.3**). The following municipality-specific resources were consulted in addition to contacting municipal staff:

- *The City of London's Register of Cultural Heritage Resources* (2019)

The BHRs and CHLs can be categorized as either:

- **Known BHRs and CHLs** – consisting of municipally, provincially, or federally designated or listed properties that have an existing level of heritage protection, designation, or recognition; or
- **Potential BHRs and CHLS** – consisting of properties that contain buildings or structures that appear to be older than 40 years of age and have potential to meet the criteria of Ontario Regulation 9/06: *Criteria for Determining Cultural Heritage Value or Interest.*

This CHRA screens for potential BHRs and CHLs by employing the 40-year threshold. Use of a 40-year old threshold is an indicator that a property may be of cultural heritage value or interest. While identification of a BHRs and CHLs that is 40 years old or older does not confer outright heritage significance, this threshold provides a means to collect information about resources that may retain cultural heritage value or interest. Similarly, if a BHR and CHL is less than 40 years old, this does not preclude the resource from retaining cultural heritage value or interest. In addition to the 40-year threshold, professional knowledge, expertise, and a high-level application of the *Ontario Heritage Act* criteria outlined in Ontario Regulation 9/06 for determining cultural heritage value or interest, was also applied in this CHRA to screen for potential BHRs and CHLs within the Study Area. It should be noted that this report does not provide a comprehensive evaluation of a property according to Ontario Regulation 9/06 and does not satisfy the requirement of a Cultural Heritage Evaluation Report.

2.3 Community Consultation

The following stakeholders were contacted to gather information on known BHRs and CHLs, active and inactive cemeteries, etc. within and adjacent to the Study Area:

Table 1: Record of Community Consultation

Contact	Contact Information	Date	Notes
Kyle Gonyou / City of London / Heritage Planner	Kgonyou@london.ca	September 15, 2021	Kyle Gonyou was contacted to confirm the scope of work and to provide background information on the Study Area and adjacent lands. Kyle Gonyou confirmed the scope of work and provided AECOM historical information on the Study Area and adjacent lands.
Mark Richardson / London Public Library / Public Services Librarian	Mark.Richardson@lpl.ca	September 16, 2021	A request for photographs and newspaper articles were made to gain background information on 150 Philip Aziz Avenue. Mark Richardson provided AECOM with materials from the following sources: ▪ Conversations with the Artist Philip Aziz, by Kym Wolfe (2016) ▪ London City Life Magazine (October/November 2005, pp. 28-3) ▪ London Free Press, Feb. 4, 2016

Contact	Contact Information	Date	Notes
			▪ City of London Heritage Designation no. 256
Jean Hung / Western University / Archives Assistant	Archives@uwo.libanswers.ca	September 20, 2021	A request for photographs was made to see there were newspaper pictures that captured the brick entrance of 150 Philip Aziz Avenue. Jean Hung searched the London Free Press negatives and there were no pictures that captured the entrance of the property. Photographs may be requested by AECOM in the future, if an HIA is required.

3. Policy Context

3.1 Environmental Assessment

This report was prepared to satisfy cultural heritage reporting requirements undertaken as part of the Ontario MCEA process. Pursuant to the Environmental Assessment Act (R.S.O. 1990, Chapter E. 18), applicable infrastructure improvements and development projects are subject to appropriate studies to evaluate and assess the potential related impacts of a project on the social, economic, or cultural environment, (i.e. the cultural heritage of an area). Infrastructure improvement projects have the potential to impact cultural heritage resources in various ways including, but not limited to:

- Direct Impact: Loss or displacement of cultural resources through removal or demolition; and
- Indirect Impact: Disruption of cultural resources due to the introduction of physical; visual, audible, or atmospheric elements that are not keeping with the significance of the resources and its contextual surroundings

3.2 Planning Act and Provincial Policy Statement

The *Planning Act* (1990) and the associated Provincial Policy Statement (2020) provide a legislative framework for land use planning in Ontario. Both documents identify matters of provincial interest, which include the conservation of significant features of architectural, cultural, historical, archaeological, or scientific interest. The *Planning Act* requires that all decisions affecting land use planning matters "shall be consistent with" the Provincial Policy Statement. In general, the Provincial Policy Statement recognizes that Ontario's long-term prosperity, environmental health, and social well-being depend on protecting natural heritage, water, agricultural, mineral, cultural heritage, and archaeological resources for their economic, environmental, and social benefits.

Section 2 of the *Planning Act* makes a series of provisions regarding cultural heritage. Section 2 of the *Planning Act* identifies various provincial interests that must be considered by the relevant authorities during the planning process. Specific to cultural heritage, subsection 2(d) of the *Planning Act* states that, "The Minister, the council of a municipality, a local board, a planning board and the Municipal Board, in carrying out their responsibilities under this Act, shall have regard to, among other matters, matter of provincial interest such as... the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest."

As one of 18 interests to be considered, cultural heritage resources are to be considered within the framework of varying provincial interests throughout the land use planning process.

Pursuant to Section 3 of the *Planning Act* the Provincial Policy Statement 2020, Policy 2.6.1 states "Significant built heritage resources and significant cultural heritage landscapes shall be conserved."

Further policy in Section 3, Policy 2.6.3 states "Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property except where the proposed development and site alteration has been evaluated and it had been demonstrated that the heritage attributes of the protected heritage property will be conserved."

3.3 Ontario Heritage Act

The *Ontario Heritage Act* enables municipalities and the province to designate individual properties and/or districts as being of cultural heritage value or interest. The province or municipality may also "list" a property or include a property on a municipal register that has not been designated but is believed to be of cultural heritage value or

interest. *Ontario Regulation 9/06, Criteria for Determining Cultural Heritage Value or Interest* (O. Reg. 9/06) under the *Ontario Heritage Act* provides criteria for determining cultural heritage value or interest. If a property meets one or more of the following criteria it may be designated under Section 29 of the *Ontario Heritage Act*.

3.3.1 Ontario Regulation 9/06

Ontario Regulation 9/06 provides the Criteria for Determining Cultural Heritage Value or Interest under the *Ontario Heritage Act*. This regulation was created to ensure a consistent approach to the designation of heritage properties under *Ontario Heritage Act*. All designations under the *Ontario Heritage Act* after 2006 must meet at least one of the criteria outlined in the regulation.

A property may be designated under Section 29 of the *Ontario Heritage Act* if it meets one or more of the following criteria for determining whether the property is of cultural heritage value or interest:

1. The property has design value or physical value because it,
   i. is a rare, unique, representative or early example of a style, type, expression, material or construction method;
   ii. displays a high degree of craftsmanship or artistic merit;
   iii. demonstrates a high degree of technical or scientific achievement.
2. The property has historical value or associative value because it,
   i. has direct associations with a theme, event, belief, person, activity, organization, or institution that is significant to a community,
   ii. yields, or has the potential to yield, information that contributes to an understanding of a community or culture;
   iii. demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.
3. The property has contextual value because it,
   i. is important in defining, maintaining or supporting the character of an area;
   ii. is physically, functionally, visually, or historically linked to its surroundings, or
   iii. is a landmark O. Reg. 9/06, s 1 (2)

3.4 City of London Municipal Heritage Policies

3.4.1 City of London's London Plan (2016)

The London Plan is the City's Official Plan. *The London Plan* sets out an approach for planning in London which emphasizes growing inward and upward, so that the City can reduce the costs of growth, create walkable communities, revitalize urban neighbourhoods and business areas, protect farmlands, and reduce greenhouse gases and energy consumption. The plan sets out to conserve the City's cultural heritage and protect environmental areas, hazard lands, and natural resources. The plan has been approved by the Ontario Ministry of Municipal Affairs.

Specifically related to heritage conservation, *The London Plan* outlines a number of policies related to the conservation of cultural heritage resources within the City. Select policies in the Cultural Heritage section have been appealed to the Ontario Municipal Board (OMB) and are under review, however, despite under appeal, the General Cultural Heritage Policy related to Design should be given consideration:

> *565_ New development, redevelopment, and all civic works and projects on and adjacent to heritage designated properties and properties listed on the Register will be design to protect the heritage attributes and character of those resources, to minimize visual and physical impact on these resources. A heritage impact assessment will be required for new development on and adjacent to heritage designated properties and properties listed on the Register to assess potential impacts, and explore alternative development approaches and mitigation measures to address any impact to the cultural heritage resource and its heritage attributes. (Subject to LPAT Appeal)*

Within the context of considering potential impact on cultural heritage resources, the Glossary of Terms (Policy 1795) in *The London Plan* defines adjacency as "sites that are contiguous; sites that are directly opposite a cultural heritage resource separated by a laneway, easement, right-of-way, or street; or sites which a proposed development or site alteration has the potential to impact identified visual character, streetscapes or public views as defined within a statement explaining the cultural heritage value or interest of a cultural heritage resource"[2].

The London Plan also provides the following relevant definitions relating to its cultural heritage resources:

> **Cultural heritage landscape** means a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal Community. The area may involve features such as structures, spaces, archaeological sites, or natural elements that are valued together for their interrelationship, meaning or association. Such a cultural heritage landscape is valued by Londoners and is of significance to an understanding of the histories of a people or place.
>
> **Cultural heritage resource** means a human work or a place that gives evidence of human activity or has spiritual or cultural meaning or value, and which has been determined to have historic value. Cultural heritage resources include both the physical and intangible resources, properties protected under the Ontario Heritage Act, built heritage resources, cultural heritage landscapes, archaeological resources, paleontological resources and both documentary and material heritage.
>
> **Conservation of cultural heritage resources** means actions or processes that are aimed at safeguarding the heritage attributes of a cultural heritage resource so that it retains its cultural heritage value or interest and extends its physical life. This may involve preservation, rehabilitation, restoration or a combination of these actions or processes.

3.4.2 City of London Register of Cultural Heritage Resources

In accordance with the *Ontario Heritage Act*, in consultation with the London Advisory Committee on Heritage (LACH), City Council approves and maintains a Register listing properties of cultural heritage value or interest (*The London Plan* 2016 557). The Register is a living document subject to change. The City of London's Register of Cultural Heritage Resources (2019), also known as the City of London Inventory of Heritage Resources, and CityMap (www.maps.london.ca) are reviewed in this Cultural Heritage Report to locate known cultural heritage resources within the Study Area and collect any relevant information. The Register includes heritage listed properties (Section 27 of the Ontario Heritage Act), individually designated heritage properties (under Part IV of the Ontario Heritage Act), and properties designated as part of a Heritage Conservation District (under Part V of the Ontario Heritage Act). All properties included on the Register are believed to have potential cultural heritage value or interest.

[2] *Policy 1795 is currently subject to Local Planning Area Tribunal (LPAT) appeal PL170100.*

The City of London Register of Cultural Heritage Resources (2019) identified four (4) known cultural heritage resources within and/or adjacent to the Study Area (see **Section 5** for the identification of the cultural heritage resources).

4. Historical Context Overview

4.1 Historical Background

This section provides a summary of the historic research and a description of the Study Area that may be affected by the proposed Western Road and Sarnia Road/Philip Aziz Avenue Improvements. Historically, the Study Area is located within Lot 17 and Lot 18, Concession 2, and Lot 17 and 18, Concession 3, in the Township of London, Middlesex County.

To understand the history of the Study Area, a review of both historical mapping and aerial photography were consulted to identify settlements, structures, and landscape features.

4.2 Natural Environment and Physical Settling

The modern physiography of southern Ontario is largely a product of events of the last major glacial stage and the landscape is a complex mosaic of features and deposits produced during the last series of glacial retreats and advances prior to the withdrawal of the continental glaciers from the area. Southwestern Ontario was finally ice free approximately 12,500 years ago. The landscape of southern Ontario can be subdivided into physiographic regions based on the physiographic characteristics of the geographic areas. These characteristics have played important roles in the evolution of the landscape and settlement within the respective regions (Chapman and Putnam 1984:190).

The Study Area is located within the Stratford Till Plain physiographic region (Chapman & Putnam 1984:133). The region is described as a broad clay plain of 2,2205 square kilometres, extending from London in the south to Blyth and Listowel in the north with a projection toward Arthur and Grand Valley. It is an area of ground moraine interrupted by several terminal moraines. The moraines are more closely spaced in the southwestern portion of the region. Throughout the area the till is fairly uniform, being a brown calcareous silty clay whether on the ridges or the more level ground moraine. The region is a product of the Huron ice lobe. Some of the silt and clay is calcareous rock flour, probably a good deal of it coming from previously deposited varved clays of the Lake Huron Basin.

4.1 Historical Context Overview

4.1.1 Indigenous Land Use and Settlement

Southern Ontario has a cultural history that begins approximately 11,000 years ago. The land now encompassed by the City of London has a cultural history which begins approximately 10,000 years ago and continues to the present. Table 2 provides a general summary of the history of Indigenous land use and settlement of the area[3].

Table 2: Cultural Chronology for Indigenous Settlement in Western Ontario

Archaeological Period	Time Period	Characteristics
Early Paleo	9000-8400 BC	▪ Fluted Points ▪ Arctic tundra and spruce parkland, caribou hunters
Late Paleo	8400-8000 BC	▪ Holcombe, Hi-Lo and Lanceolate Points

[3] While many types of information can inform the precontact settlement of the City of London, this summary table provides information drawn from archaeological research conducted in southern Ontario over the last century. As such, the terminology used in this review relates to standard archaeological terminology for the province rather than relating to specific historical events within the region..

Archaeological Period	Time Period	Characteristics
		▪ Slight reduction in territory size
Early Archaic	8000-6000 BC	▪ Notched and Bifurcate base Points ▪ Growing populations
Middle Archaic	6000-2500 BC	▪ Stemmed and Brewerton Points, Laurentian Development ▪ Increasing regionalization
Late Archaic	2000-1800 BC	▪ Narrow Point ▪ Environment similar to present
	1800-1500 BC	▪ Broad Point ▪ Large lithic tools
	1500-1100 BC	▪ Small Point ▪ Introduction of bow
Terminal Archaic	1100-950 BC	▪ Hind Points, Glacial Kame Complex ▪ Earliest true cemeteries
Early Woodland	950-400 BC	▪ Meadowood Points ▪ Introduction of pottery
Middle Woodland	400 BC – AD 500	▪ Dentate/Pseudo-scallop Ceramics ▪ Increased sedentism
	AD 550-900	▪ Princess Point ▪ Introduction of corn horticulture
Late Woodland	AD 900-1300	▪ Agricultural villages
	AD 1300-1400	▪ Increased longhouse sizes
	AD 1400-1650	▪ Warring nations and displacement
Contact Period	AD 1600-1875	▪ Early written records and treaties
Historic	AD 1749-present	▪ European settlement (French and English)

4.1.2 Historical Land Use and Settlement

4.1.2.1 Township of London

Working alongside Colonel Thomas Talbot, Colonel Mahlon Burwell initiated the first formal survey of the Township of London in 1810, one of the first townships in Middlesex County to be extensively settled. This survey initially focused on the first six concessions north to Sunningdale Road but was suspended when war erupted in 1812. The northern section of the township was surveyed following the war, with the first settlers arriving between 1817 and 1818. The first land patent, however, dates to 1812 and relates to lands that formed part of Burwell's initial survey. Among those individuals who received the earliest patents were Burwell and the honorable John Hale. These grants were given in lieu of payment for services and loyalty, as both gentlemen did not plan to homestead on these lots, but instead intended to sell them to arriving immigrants (LTHBC 2001:11-14; H.R. Page & Co. 1878:9).

In 1818, a group of Irish settlers arrived in the Township of London and established homesteads on lots in the 4th, 5th, and 6th concessions. Their emigration was organized by Richard Talbot of Tipperary, Ireland, who had spent a great deal of time working on behalf of the government to find families who were interested in relocating to Upper Canada. Richard Talbot took the advice of his kinsman Colonel Thomas Talbot and brought these families to London Township which was said to be one of the most productive agricultural areas in the Thames River Valley (LTHBC 2001:13-14). By 1851, much of London Township had been settled.

4.1.2.2 City of London

The Thames River had a profound impact on the growth of London. The city developed at the junction of the north and south branches of the river, and as a result bridge construction has been important in connecting London to the river. London underwent a number of population booms throughout its history beginning when the 32nd Regiment was stationed in London in 1838. Development of saw, cording, and grist industries powered by the Thames River and Medway Creek assisted the city's growth in the mid 1800's, bolstered by the arrival of the railways in the

1850s, including the Great Western Railway in 1853, the London Port Stanley Railway in 1856, and the Grand Trunk Railway in 1858. The railway brought an influx of immigrants and promoted community commerce and travel. Records suggested London grew by 239 percent between 1840 and 1850 as the population increased from 2,078 to 7,035 due to the entry of British immigrants to Upper Canada (Whebell 1992). Steady growth in London continued as the city was established as a financial centre for the surrounding regions with large manufacturing industries taking root, including the Carling and Labatt's Brewery and the London Cigar Industry. London was incorporated as a village in 1840 and by 1855 the population had leapt to 10,000 at which time it officially became a city (Armstrong 1986).

In 1961, a major annexation of portions of the townships surrounding the City of London, including London Township, resulted in the addition of land and close to 60,000 people to the City. A portion of the Study Area was included in this annexation, including the Masonville area. As a result, the City grew from approximately 28 to 160 square kilometres. In the 1970s, Richmond Street (Highway 4)[4] and Fanshawe Park Road (Highway 22) began to serve as major arterial roads for urban London. In addition, another annexation in 1993 occurred which forms the current northern City Limit, just north of Sunningdale Road.

4.1.3 Review of Historical Mapping and Aerial Photography

The *1878 Illustrated Historic Atlas of the County of Middlesex* was reviewed to determine the potential for the presence of historical features within the Study Area (**Figure 3**). It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases, given that they were financed by subscription, and subscribers were given preference with regard to the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases.

The *1878 Illustrated Historic Atlas of the County of Middlesex* (**Figure 3**) shows that the Study Area and adjacent lands were rural in nature and that several roads were in place by the late nineteenth century. A number of historical rural residences with orchards are illustrated adjacent to the Study Area.

The 1929/1930 National Topographic System (NTS) map shows development within the Study Area (**Figure 4**). The Study Area is located west of the Thames River and within close proximity to the community of Broughdale. There are three large institutional buildings illustrated to the northeast of the Study Area within the area labelled as 'Western University'. In addition, a sports track is located within Western University. Brescia Hall and its associated buildings are located to the northwest of the Study Area. The lands surrounding the surrounding the intersection of Western Road and Sarnia Road/Philip Aziz continue to be rural / residential in nature and include five adjacent structures including a garage (marked by a "G" on the mapping). One of the structures located south of the Study Area includes the structure that would later be owned by a prominent Canadian Artist, Philip Aziz.

A 1946 aerial photograph (**Figure 5**) illustrates that the land surrounding the Study Area continues to be rural in nature with London's urban development on the east side of the Thames River. The land south of the Study Area includes agricultural fields and residences. The lands to the north of the Study Area includes agricultural fields and institutional buildings associated with the Western University and Brescia Hall. A structure is illustrated within the property at 150 Philip Aziz Avenue[5] that will later be owned by Philip Aziz. The structure is buffered from the intersection of Western Road and Philip Aziz Avenue by a treeline. The garage located at the southwest corner of the intersection is still present.

Since the mid-twentieth century the lands surrounding the Study Area have significantly developed. Today, as shown in the current aerial photograph (**Figure 2**), the Study Area and adjacent lands are dominated by the institutional

[4] In 2017, Highway 4 was rerouted through London which shifted the route along Richmond Street, Sunningdale Road, and Wonderland Road. This new route maintains a connection with the north and south of the city.

[5] Philip Aziz Avenue was formerly known as Huron Street before being renamed in 2005.

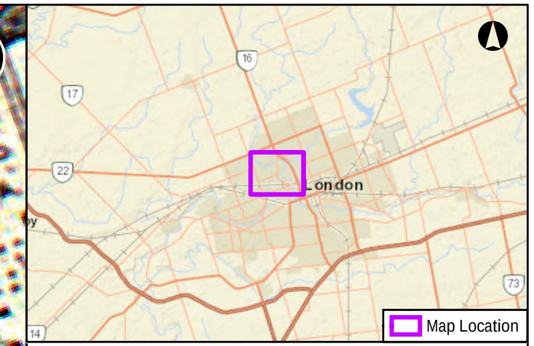
landscape of Western University which includes a network of institutional buildings and circulation routes. The Philip Aziz property at 150 Philip Aziz Avenue, is the only remaining structure adjacent to the Study Area that dates to the nineteenth century (originally constructed in circa 1875).

4.1.3.1 The Stirrup Court Cemetery

While not illustrated on the *1878 Illustrated Historic Atlas of the County of Middlesex,* the 1929/1930 NTS map or the 1946 aerial photograph, the 2015 AECOM report identified that within the Ontario Genealogical Society (OGS) list of unregistered cemeteries for Middlesex County an unmarked cemetery known as the Stirrup Court Cemetery was located "within in the modern subdivision of Stirrup Court, off of Sarnia Road" (Nelson, 2020). This was near the western limits of the Study Area, however not within the Study Area. The cemetery was originally the Stiles family cemetery and by the 1870s it was being used as a community cemetery (Woodley, n.d.).The cemetery was excavated in 1982 by William Fox of the Ministry of Culture and Communication and Dr. Michael Spence of the Western University after human remains were uncovered in the course of a house construction. There were approximately 27 individuals exhumed who were of British descent and are believed to been buried between 1840 and 1890 (Woodley, n.d). It is believed that most of the burials in the cemetery were removed, and that most of the human bones from the disturbed area and fill locations were recovered (Woodley, n.d.).The road improvements are not anticipated to impact the former Stirrup Court Cemetery located within the modern subdivision of Stirrup Court.

4.1.4 Summary of Land Use and Settlement

In summary, a review of the historical mapping reveals that the context of the Study Area and surrounding lands were primarily within a rural context throughout the 19th and into the mid-20th century as the landscape included farmhouses and active agricultural fields. Beginning in 1924, the context surrounding the Study Area began to change as a number of large institutional buildings associated with the Western University were constructed north of the Study Area. Today, the Study Area and surrounding lands are dominated by the institutional campus of Western University.



Legend

Study Area

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Study Area Overlaid on the
1878 Illustrated Historical Atlas

0 75 150 300 450 600 750 900 1,050
Meters
DATUM: NAD 1983 UTM Zone 17N

September 2021	1:15,000 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2019, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
P#: 60661402	V#:	

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Figure 3

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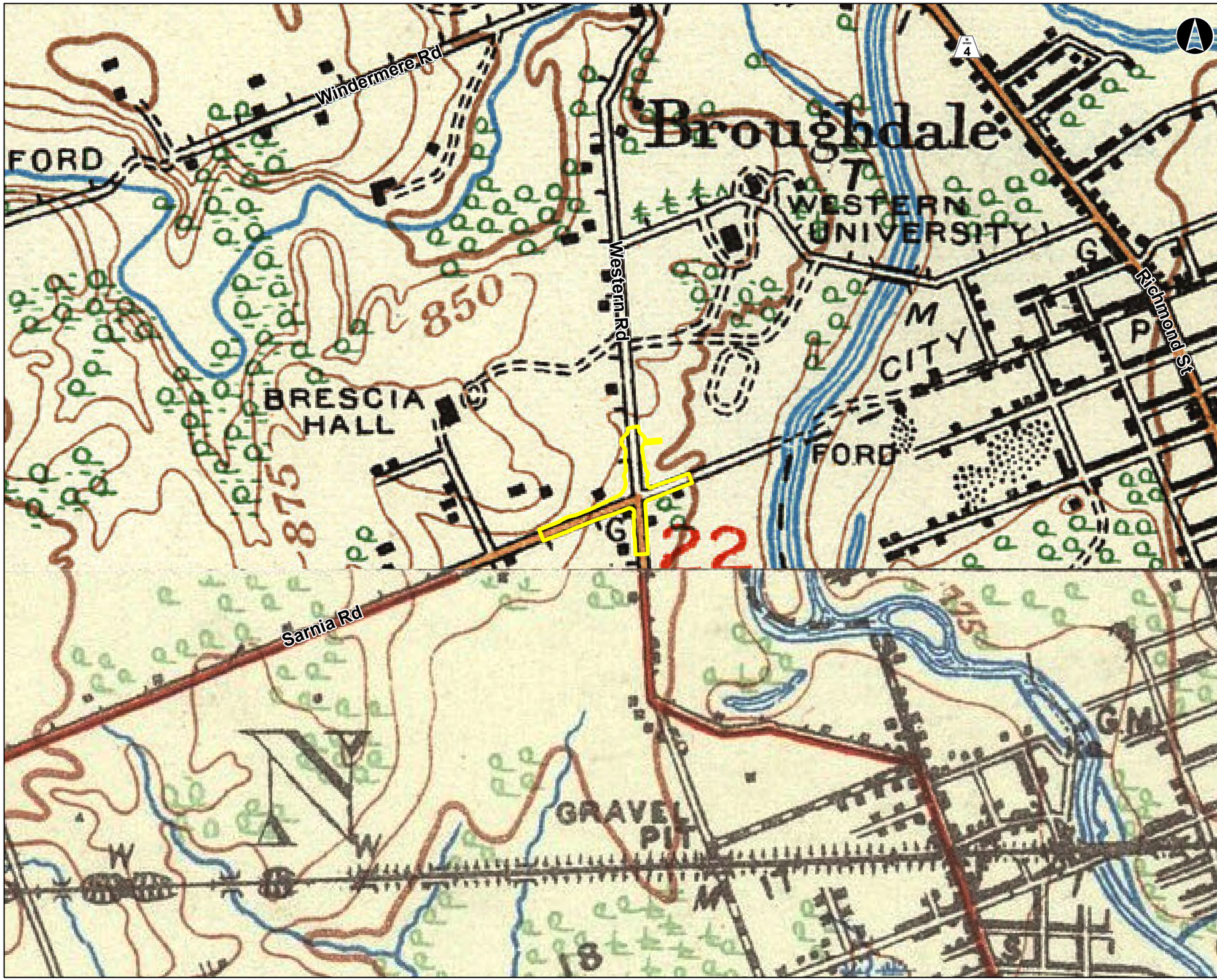
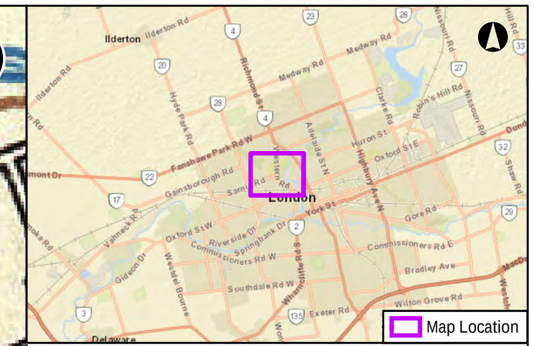
Map location: \\na.aecomnet.com\LFS\AMER\London-CALON1\DCS\Projects_TRN\60661402_Col_WesternRdEA\900_CAD_GIS\920_929_GIS_Graphics\Design\01_Reports\CHARRFig3-StudyArea1878.mxd
Date Saved: 8/8/2021 4:52:02 PM User Name: clarks





Legend

Study Area

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Study Area Overlaid on the
1929 and 1930 Topographic Maps

0 50 100 200 300 400 500 600 700
Meters
DATUM: NAD 1983 UTM Zone 17N

September 2021	1:10,000 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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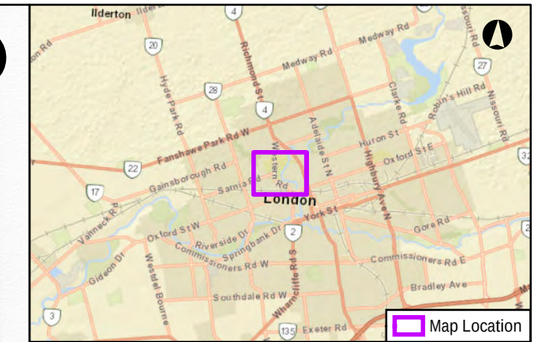
Map location: \\na.aecomnet.com\LFS\AMER\London-CALON1\DCS\Projects_TRN\60661402_CoL_WesternRd\EA\900_CAD_GIS\920_929_GIS_Graphics\Design\01_Reports\CHARF\fig4-StudyArea\1929-30.mxd
Date Saved: 9/8/2021 5:27:53 PM User Name: clark0



Legend

Study Area

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Study Area Overlaid on the
1946 Aerial Photography

0 50 100 200 300 400 500 600 700
Meters
DATUM: NAD 1983 UTM Zone 17N

September 2021	1:9,000 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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Figure 5

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Map location: \\na.aecomnet.com\LFS\AMER\London-CALON1\DCS\Projects_TRN\60661402_Col_WesternRdEA\900_CAD_GIS\920_929_GIS_Graphics\Design\01_Reports\CHARRfig5-StudyArea1946.mxd
Date Saved: 8/8/2021 5:41:34 PM User Name: clarks

5. Identification of Cultural Heritage Resources

5.1 Study Area Context – Existing Conditions

The Study Area focusses on the intersection improvements to Western Road and Sarnia Road/Philip Aziz roadways. The Study Area extends 153.6 metres south and 193.7 metres north along Western Road from the centre of the Western Road and Sarnia Road/Philip Aziz Avenue intersection. The Sarnia Road/Philip Aziz Avenue corridor extends 153 metres east from the intersection along Philip Aziz Avenue and 282.7 metres west from the intersection along Sarnia Road. In some cases, the Study Area extends beyond the two rights-of-way and includes small portions of adjacent lands.

The field review was conducted from the rights-of-way on September 14, 2021, by Tara Jenkins, Cultural Heritage Specialist, to record the existing conditions of the Study Area. The field review was conducted to document the current character of the area and to identify potential BHRs and CHLs that may be still extant as pinpointed during the review of the historical map set. The existing conditions with select photographs are summarized below and represent the properties as viewed from the Study Area.

The adjacent lands are dominated by Western University and associated buildings. The Study Area extends beyond the two rights-of-way in several locations and is anticipated to require acquirement of a portion of 1285 Western Road, 271 Ramsay Road, 1151 Richmond Street, and 150 Philip Aziz Avenue. Two Western University gateway features are found within the Study Area, are outside the BHRs and CHLs, and are within the public right-of-way (**Photograph 1** and **Photograph 2**). An iron fence (**Photograph 3**) is located within Study Area along Philip Aziz Avenue. In addition, a portion of the driveway and a brick entrance feature of 150 Philip Aziz Avenue is located within the Study Area (**Photograph 4**).

5.1.1 Western Road

The Study Area on Western Road consists of double northbound and southbound lanes with median turning lanes and access lanes to Western University. There is currently a single westbound left turn lane at the Sarnia Road/Western Road intersection and a single eastbound left turn lane at the Philip Aziz Avenue/Western Road. Western Road has an urban cross-section with curbs and gutters generally throughout.

Photographs 5 to 11 are presented from south to north along Western Road.

5.1.2 Sarnia Road/Philip Aziz Avenue

Sarnia Road travelling easterly to Western Road generally consists of double eastbound and westbound lanes with occasional median turning lanes approaching the Western Road intersection, access ways to institutions and a northbound left turn lane and a southbound right turn lane at the intersection. This section of road has an urban cross-section with curbs and gutters throughout the length. A modular concrete retaining wall abuts the north edge of the westbound sidewalk east of Brescia Lane.

Philip Aziz Avenue consists of single eastbound and westbound lanes and a southbound left turn lane at the Western Road intersection. The road has a combination of gabion retaining walls and relatively steep slopes along the north side. The road surface slopes downwards to the east and is narrow with no shoulders or sidewalks. The driveway entrance to 150 Philip Aziz Avenue is located on the south side of Philip Aziz Avenue.

Photographs 12 to 17 are presented from west to east along Sarnia Road/Philip Aziz Avenue.

Photograph 1:
Western University gateway feature located at the northeast corner of Western Road and Philip Aziz Avenue (AECOM 2021)

Photograph 2:
Western University entrance feature located at the southeast corner of Western Road and Philip Aziz Avenue (AECOM 2021)

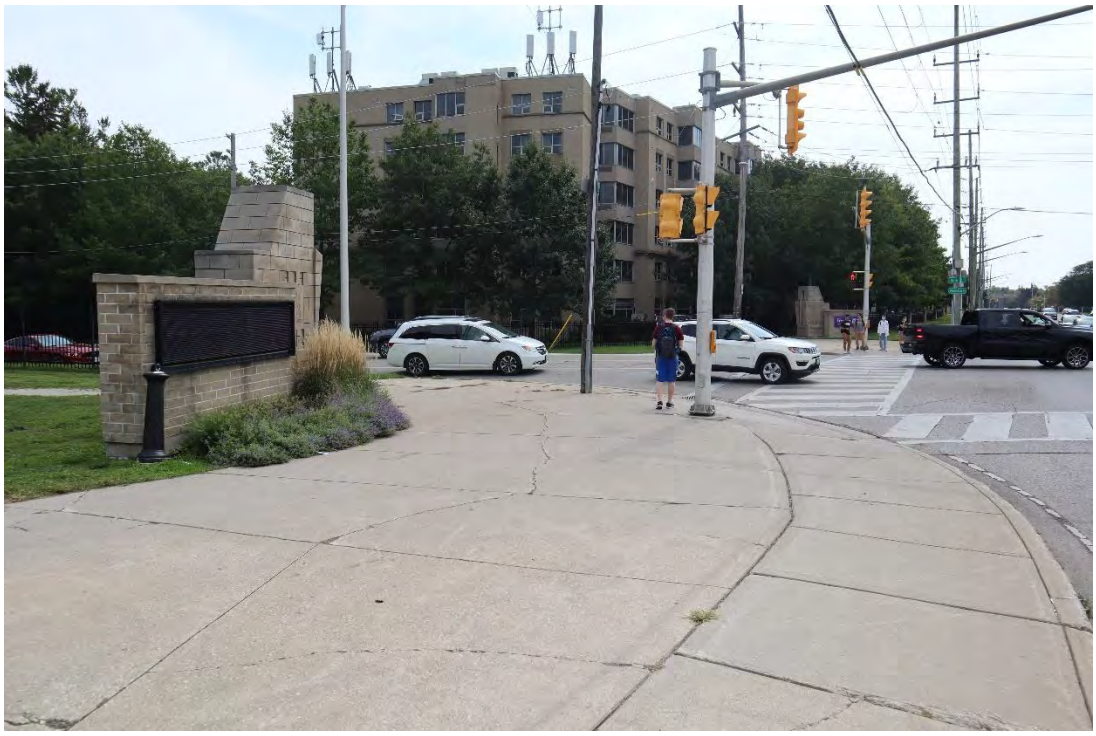
Photograph 3:
Iron fence located on the north side of Philip Aziz Avenue, looking east (AECOM 2021)

Photograph 4:
View of 150 Philip Aziz Avenue's driveway and brick entrance feature, looking south (AECOM 2021)

Photograph 5:
View of Western Road illustrating the double northbound and southbound lanes, a single westbound left turn lane at the Sarnia Road/Western Road intersection, a concrete sidewalk, and manicured lawns, looking north (AECOM 2021)

Photograph 6:
View of Western Road illustrating the double northbound lanes, a single westbound left turn lane at the Sarnia Road/Western Road intersection, a concrete sidewalk, and a manicured lawns, looking north (AECOM 2021)

Photograph 7:
View of Western Road illustrating the Western Road and Sarnia Road/Philip Aziz Avenue intersection, looking north (AECOM 2021)



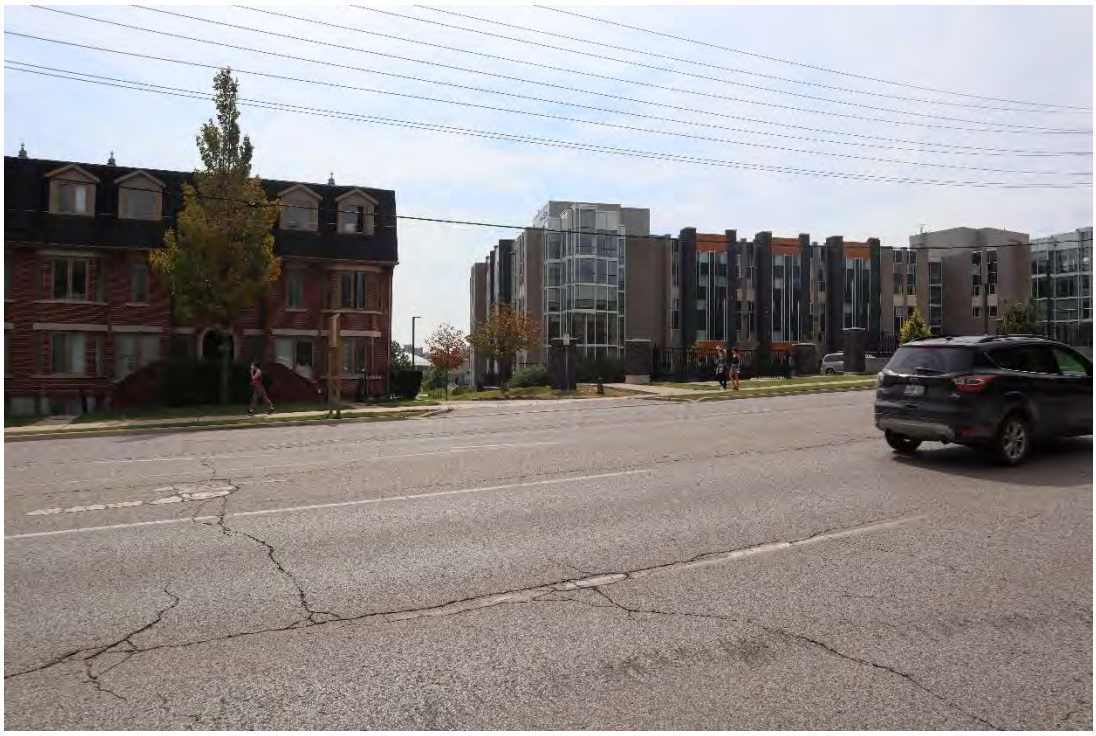
Photograph 8:
View of Western Road illustrating the two welcome signs and the northeastern corner of the Western Road and Sarnia Philip Aziz Avenue intersection, looking south (AECOM 2021)

Photograph 9:
View of Western Road illustrating the entrance to Elborn College, looking west (AECOM 2021)

Photograph 10:
View of Western Road illustrating double northbound and southbound lanes, fencing and manicured lawns, looking north (AECOM 2021)

Photograph 11:
View of Western Road illustrating double northbound and southbound lanes, fencing and manicured lawns, looking south (AECOM 2021)

Photograph 12:
View of Sarnia Road illustrating the double eastbound and westbound lanes and the adjacent Western University associated properties, looking east (AECOM 2021)



Photograph 13:
View of Sarnia Road illustrating 1125-1131 Western Road, 230 Sarnia Road, looking south (AECOM 2021)

Photograph 14:
View of Sarnia Road illustrating the Western Road and Sarnia Road/Philip Aziz Avenue intersection, looking east (AECOM 2021)

Photograph 15:
View of Philip Aziz Avenue illustrating the single eastbound and westbound lanes, iron fencing, and the relatively steep slopes along the north side of the road, looking east (AECOM 2021)

Photograph 16:
View of Philip Aziz Avenue illustrating the single eastbound and westbound lanes and the driveway of 150 Philip Aziz Avenue, looking southeast (AECOM 2021)

Photograph 17:
View of Philip Aziz Avenue illustrating the gabion retaining walls (AECOM 2021)

5.2 Identified Built Heritage Resources and Cultural Heritage Landscapes

The Cultural Heritage Resources Review (AECOM, 2015) completed by AECOM identified a total of four (4) heritage properties and one (1) unregistered cemetery:

- 150 Philip Aziz/1180 Western Road, Designated Part IV
- 1285 Western Road, Listed,
- 1349 Western Road, Listed
- 1379 Western Road, Listed
- Stirrup Court Burial Site, Unregistered cemetery

Based on the background research and field review completed for this CHRA a total of three (3) known CHLs and one (1) BHR were identified within and/or adjacent to the Study Area. 1151 Richmond Street (CHL 2) and 1125-1131 Western Road/230 Sarnia Road (CHL 3) were added within this CHRA as they are within and adjacent to the Study Area. These two properties were not included in the Cultural Heritage Resources Review (AECOM, 2015).

Stirrup Court Burial Site, 1349 Western Road (Cronyn Hall), and 1379 Western Road (Cronyn House) as documented in the Cultural Heritage Resources Review (AECOM, 2015) are no longer within or adjacent to the Study Area and are not included as BHRs and CHLs in this CHRA.

Key Findings

- A total of three (3) CHLs and one (1) BHR were identified using the City of London's Register of Cultural Heritage Resources (2019). All four (4) properties have formal heritage recognition within the City of London's Register of Cultural Heritage Resources.
  - BHR 1 is designated under Part IV of the *Ontario Heritage Act*
  - The three (3) CHLs (CHL 1, CHL 2, and CHL 3) are Listed on The City of London's Register of Cultural Heritage Resources (2019)

5.3 Summary of Built Heritage Resources and Cultural Heritage Landscapes

Based on the results of the background research and field review, a total of three (3) known CHLs and one (1) known BHR were identified. All the CHLs and BHRs identified are properties associated and owned by the Western University. The three (3) CHLs (CHL 1, CHL 2 and CHL 3) are comprised of large institutional buildings and parkland associated with the Western University and BHR 1 is comprised of a one-and-a-half storey house that is associated with Canadian artist, Philip Aziz (owned by the Western University).

A summary of the known CHLs and BHRs has been included in **Table 3** of this report, which provide the location, heritage interest or value, a physical description, a historical description, and a contextual description.

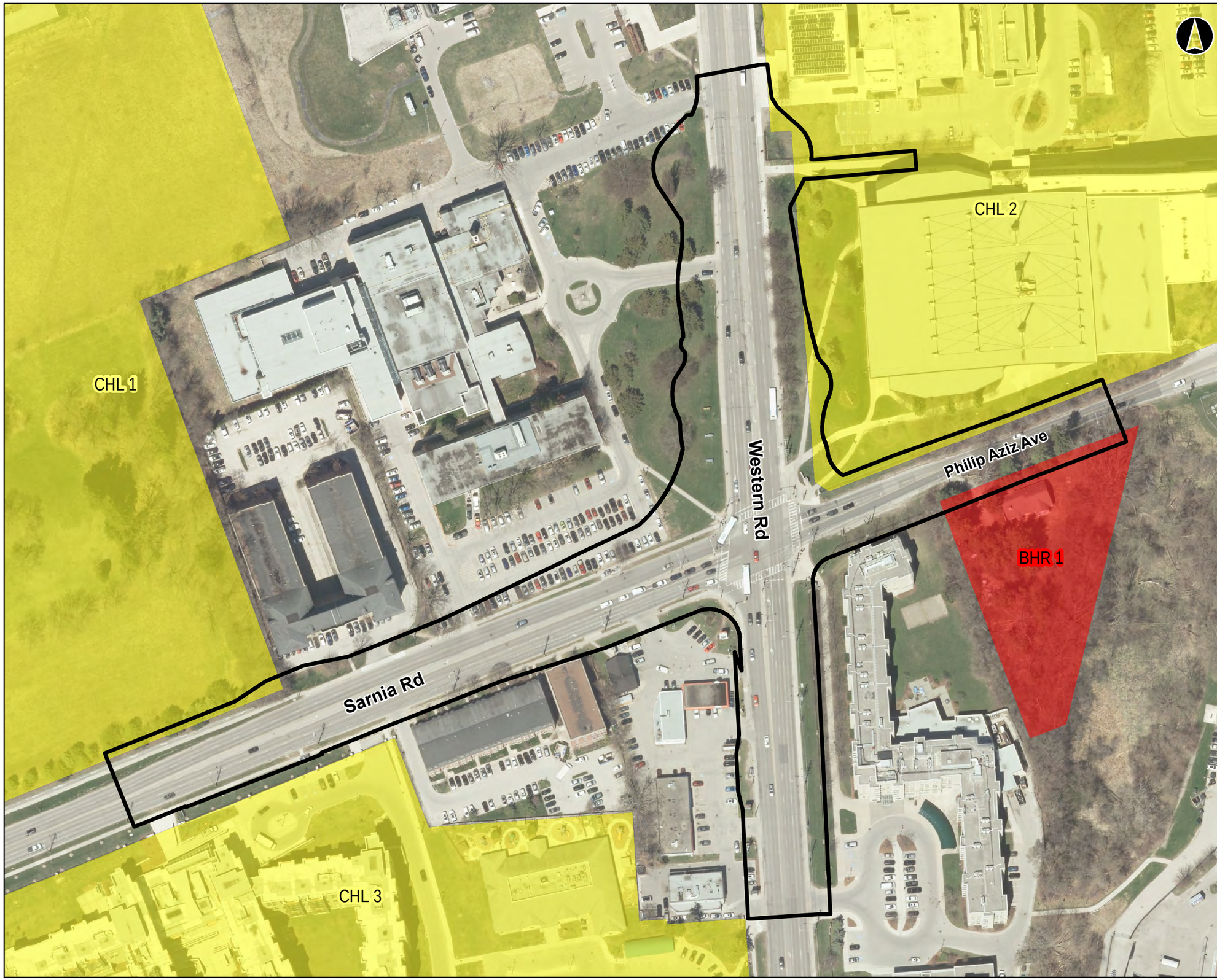
Table 3: Summary of Built Heritage Resources within the Study Area

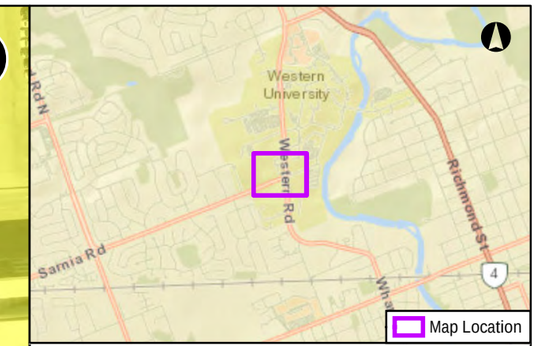
Feature IDs	Location/Address	Resource Type/Name	Heritage Recognition	Description	Photograph
CHL 1	1285 Western Road, 271 Ramsay Road	Institutional	Listed Heritage Property	**Historical Description:** Between 1919 and 1925, the Brescia University College was located in a converted house at 556 Wellington Street, in London, Ontario. As the student population grew, Brescia Hall (later renamed Ursuline Hall) was erected at 1285 Western Road, 271 Ramsay Road in 1924-25 to accommodate for the increase in student population (Brescia: Our History, n.d.). **Design and Physical Description:** Ursuline Hall was constructed by Joseph Michael Piggott. Ursuline Hall was designed in the Tudor Gothic style and consists of a stone exterior, grand rotunda, stained glass windows and a marble staircase that leads to the main entrance. In addition, the property contains other landmark buildings and lesser-known structures with potential for architectural significance. **Contextual Description:** CHL 1 is located at the northwest corner of Western Road and Sarnia Road. Ursuline Hall itself is set far back from the roads. Ursuline Hall and its contributing landscape features are considered a local landmark.	 View of CHL 1 from Sarnia Road, looking northwest (AECOM, 2021)

Feature IDs	Location/Address	Resource Type/Name	Heritage Recognition	Description	Photograph
CHL 2	1151 Richmond Street	Institutional	Listed Heritage Property	**Historical Description:** Several rural residences were illustrated within CHL 2 prior to 1930 (**Figure 3**). Construction on the present campus of Western University of Ontario began in 1922, and the new arts building (now known as University College) and the Science Building (now known as the Physics and Astronomy Building) opened in 1924. These buildings are first illustrated on the 1929 -1930 NTS map (**Figure 4**). **Design and Physical Description:** CHL 2 contains a number of early to mid-twentieth century buildings with potential design and physical value. Two of these buildings include: University College and the Physics and Astronomy Building. University College was designed by architect John M. Moore to be constructed in the Collegiate Gothic style (William, 1938). The building is clad in sandstone and uses limestone for trim features and sills. It contains stained glass windows, a central tower and large auditorium. The Physics and Astronomy Building was designed by architect John M. Moore to be constructed in the Collegiate Gothic style (William, 1938). The building is clad in sandstone and uses limestone for trim features and sills. The building contains intricate details in the masonry, which include carved faces, characters and natural items like leaves and berries. In addition, the property contains other landmark buildings and lesser-known structures with potential for architectural significance. **Contextual Description:** CHL 2 is located at the northeast corner of Western Road and Philip Aziz Avenue. Many of the early twentieth century buildings that contribute to the landscape features of the property are recognized as local landmarks. Many of the early twentieth century buildings on the property are noted for their beautiful architecture.	 View of CHL 2 from the southwest corner of Western Road and Sarnia Road (AECOM, 2021)

Feature IDs	Location/Address	Resource Type/Name	Heritage Recognition	Description	Photograph
CHL 3	1125-1131 Western Road, 230 Sarnia Road	Institutional	Listed Heritage Property	**Historical Description:** Within CHL 3, the Ontario College of Education (now known as the John G. Althouse building) was built in 1966. The Western University of Ontario's campus was well known for its Collegiate Gothic buildings, but in the late 1960s, the university abandoned this design style in favour of brutalist and modernist architectural designs (Background – President Paul Davenport, 2018). The John G. Althouse building would have been one of the early buildings constructed during this shift in architectural style. **Design and Physical Description:** The John G. Althouse was built in the Mid-Century Modern Style. **Contextual Description:** The John G. Althouse building and its contributing landscape features are a local landmark and the property is noted for its beautiful architecture.	 Distant view of John G. Althouse House from Sarnia Road, looking south (AECOM, 2021)

Feature IDs	Location/Address	Resource Type/Name	Heritage Recognition	Description	Photograph
BHR 1	150 Philip Aziz Avenue	Residential	Designated Part IV of the Ontario Heritage Act (By-law L.S.P. – 3367-235) Listed on the Canadian Register: 2010/02/03	**Historical Description:** The Philip Aziz Property is associated with its namesake, Philip Aziz, a lifelong Londoner and internationally known artist. The residence within BHR 1 was originally constructed in circa 1875 and a studio was later built by Philip Aziz in 1957. Philip Aziz purchased the property in 1950. Contained in both the house and studio, many of the features have been salvaged from significant buildings in the London area this includes: ▪ The windows have been salvaged from older homes within the city ▪ The large hammered copper sink was salvaged from the Smallman Residence at 468 Colborne Street ▪ Marble was salvaged from the Chapel of St. Peter's Seminary ▪ Stone brackets from the former Prevost Building that adorn the brick wall which flank the driveway **Design and Physical Description:** The property includes a one-and-a-half storey brick residence built in the nineteenth century and an art studio built by Philip Aziz. The property contains architectural materials salvaged from significant buildings in the London area. **Contextual Description:** The property is located at the southeast corner of Western Road and Philip Aziz Avenue.	 View of the property from Philip Aziz Avenue, looking east (AECOM, 2021)





Legend

- Study Area
- Designated Heritage Property, Part IV
- Listed Heritage Property

Cultural Heritage Resource Assessment Report
Western Road and Sarnia Road/Phillip Aziz EA
London, Ont.

Map of Cultural Heritage Resources

0 25 50 100
Meters
DATUM: NAD 1983 UTM Zone 17N

October 2021	1:1,500 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2019, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
P#: 60661402	V#:	

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Figure 6

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6. Proposed Undertaking and Impacts

6.1 Description of the Proposed Project

AECOM was retained by the City of London to conduct a CHRA based on Phase 2 plans for the proposed Western Road and Sarnia and Sarnia Road/Philip Aziz Avenue improvements Study Area. The City of London is undertaking a MCEA study to identify necessary improvements at the Western Road and Sarnia Road/Philip Aziz Avenue intersection and the Western Road corridor from Platts Lane to Huron University College entry. The MCEA study will identify and balance the needs of the users within the community, including pedestrians, cyclists and motorists. The MCEA study will be carried out in accordance with MCEA consultation requirements having full consultation with the community, stakeholders, agencies and Aboriginal communities.

In general, the improvements focus on the intersection of Western Road and Sarnia and Sarnia Road/Philip Aziz Avenue. The Study Area project limits are:

- Improvement of Western Road north of the intersection of Huron University;
- Improvement of Sarnia Road just west of the intersection; and,
- Widening of Philip Aziz Avenue.

6.2 Assessment of Impacts

6.2.1 Screening for Potential Impacts

To assess the potential impacts of the undertaking, identified cultural heritage resources are considered against a range of possible impacts based on the *Ontario Heritage Tool Kit, Heritage Resources in the Land Use Planning Process*, *InfoSheet #5 Heritage Impact Assessments and Conservation Plans* (MHSTCI 2006:3) which include, but are not limited to:

- Destruction, removal or relocation of any, or part of any, significant heritage attributes or features
- Alteration that is not sympathetic, or is incompatible, with the historic fabric or appearance
- Shadows created that alter the appearance of a heritage attribute or change the exposure or visibility of a natural feature or plantings, such as a garden
- Isolation of a heritage attribute from its surrounding environment, context, or a significant relationship
- Direct or indirect obstruction of significant views or vistas from, within, or to a built or natural heritage feature
- A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource
- Is a landmark.

Several additional factors are also considered when evaluating potential impacts on identified cultural heritage resources. These are outlined in a document set out by the Ministry of Culture and Communications (now Ministry of Heritage, Sport, Tourism, and Culture Industries) and the Ministry of the Environment entitled *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (October 1992) and include:

- Magnitude: the amount of physical alteration or destruction which can be expected
- Severity: the irreversibility or reversibility of an impact

- Duration: the length of time an adverse impact persists
- Frequency: the number of times an impact can be expected
- Range: the spatial distribution, widespread or site specific, of an adverse impact
- Diversity: the number of different kinds of activities to affect a heritage resource

For the purposes of evaluating potential impacts of construction, *The London Plan*'s definition on adjacency was used. It defines adjacency as "sites that are contiguous; sites that are directly opposite a cultural heritage resource separated by a laneway, easement, right-of-way, or street; or sites which a proposed development or site alteration has the potential to impact identified visual character, streetscapes or public views as defined within a statement explaining the cultural heritage value or interest of a cultural heritage resource"[6].

6.3 Potential Impacts of Proposed Work on Cultural Heritage Resources

This section provides an assessment of the potential adverse effects to the known BHRs and CHLs as a result of the proposed Western Road and Sarnia Road/Phillip Aziz Avenue improvements in the City of London (**Table 4**). The proposed mitigation measures are to inform the next steps of the project planning and design. It should be noted that avoidance of all known CHLs and BHRs is the preferred mitigation option.

[6] *Policy 1795 is currently subject to Local Planning Area Tribunal (LPAT) appeal PL170100.*

Table 4: Impacts to Cultural Heritage Resources and Recommended Mitigation Strategies

Feature ID	Location/Address	Heritage Recognition	Type and Description of Potential/Anticipated Impact	Mitigation Measures
CHL 1	1285 Western Road, 271 Ramsay Road	Listed Heritage Property	**No direct adverse impact:** A portion of CHL 1 is within the proposed right-of-way of the project (**Figure 6**). A portion of the retaining wall and treeline along the south boundary of CHL 1 are within the project limits. However, AECOMs design team has confirmed that there will be no impact to the retaining wall or the treeline (Email communication with John Pucchio, Structural Engineer, Project Manager, October 19, 2021). Therefore, there are no direct adverse impacts anticipated to CHL 1.	No mitigation measures required.
			No Indirect Impact: The culturally significant structures within CHL 1 are not within 40 metres of the right-of-way (**Figure 6**). Therefore, there is no potential for indirect impacts due to vibration.	No mitigation measures required.
CHL 2	1151 Richmond Street	Listed Heritage Property	**No direct adverse impact:** A portion of CHL 2 is within the proposed right-of-way of the project (**Figure 6**). A section of the iron fence within CHL 2 along the north side of Philip Aziz Avenue will be temporarily removed during construction. AECOMs design team has confirmed that the fence will be reinstated post-construction, if removal during construction is necessary (On-site meeting with John Pucchio and Rick Bogaert, Landscape Architect, on August 24, 2021). In addition, a portion of a circulation route within CHL 2, another iron fence located off of Western Road within CHL 2, and deciduous trees within the right-of-way of Western Road, are anticipated to be impacted by the project. AECOMs design team has confirmed that the Landscape Plan will include the reinstallation of the iron fence. The Landscape Plan will include new circulation route(s) and potentially a new arrival entrance that will create a positive impact on CHL 2.[7] These impacts will be temporary and will be mitigated through AECOM's Landscape Plan. Therefore, there are no adverse impacts anticipated for CHL 2 that require further heritage mitigation.	No mitigation measures required.
			Potential Indirect Impact:	**Vibration mitigation:** See **Section 7.2.1** of this CHRA for mitigation measures related to vibration.

[7] The stone entrance features that flank Philip Aziz Avenue within the right-of-way (Photographs 1 and 2) will not be impacted by the project and will be protected during construction. The Landscape Plan will reflect no impact.

Feature ID	Location/Address	Heritage Recognition	Type and Description of Potential/Anticipated Impact	Mitigation Measures
			The structures within CHL 2 are within 40 metres of the proposed right-of-way (**Figure 6**). Therefore, there may be potential for indirect impacts due to vibration. [8]	
CHL 3	1125-1131 Western Road, 230 Sarnia Road	Listed Heritage Property	**No direct impacts:** CHL 3 is not within the Study Area and is adjacent (**Figure 6**). Therefore, it is anticipated that there will not be any direct impacts to the property.	No mitigation measures required.
			No Indirect Impact The culturally significant structure within CHL 3 is not within 40 metres of the right-of-way (**Figure 6**). Therefore, there is no potential for indirect impacts due to vibration.	No mitigation measures required.
BHR 1	150 Philip Aziz Avenue	Designated Heritage Property, IV	**Potential direct adverse impact:** A portion of BHR 1 is within the proposed right-of-way of the project (**Figure 6**). A portion of the driveway and entrance feature of the property are anticipated to be acquired due to proposed road improvements.	Further work required: A Heritage Impact Assessment (HIA) is required to determine the impacts of the proposed road improvements.to BHR 1. In addition, the HIA will include an evaluation of the property using Ontario Regulation 9/06 and Ontario Regulation 10/06. The HIA will outline any impacts or site alterations to BHR 1 and make recommendations toward conservation methods and/or mitigative measures that will minimize impacts to BHR 1.
			Potential indirect impact: The heritage attributes of the property are within 40 metres of the right-of-way (**Figure 6**). Therefore, there is potential for indirect impacts due to vibration.	**Vibration mitigation:** See **Section 7.2.1** of this CHRA for mitigation measures related to vibration

[8] Although the effect of traffic and construction vibration is not fully understood, vibrations may be detectible in buildings with setbacks of less than 40 m from a curbside (Crispino and D'Apuzzo 2001; Ellis 1987; Rainer 1982; Wiss 1981).

7. Conclusion and Recommendations

7.1 Conclusions

This CHRA has documented the baseline cultural heritage conditions within the Study Area and includes a historical summary of the development of the Study Area, and an inventory of known BHRs and CHLs. A total of three (3) CHLs and one (1) BHR were identified as properties with known cultural heritage value or interest on *The City of London Register of Cultural Heritage* Resources (2019). CHL 1, CHL 2 and CHL 3 represent large institutional properties that contain a number of historical buildings that were built for Western University or associated colleges. BHR 1 represents a nineteenth century residential property that was owned by Canadian Artist Philip Aziz, now owned by Western University.

Following the preliminary impact assessment, BHR 1, 150 Philip Aziz Avenue, is anticipated to be directly adversely impacted by the Project. In addition, there is potential for indirect impacts to CHL 2, 1151 Richmond Street, and BHR 1 given the proximity of buildings to the proposed Study Area. CHL 1, 1285 Western Road/271 Ramsay Road and CHL 3, 1125-1131 Western Road/230 Sarnia Road, will not be adversely directly or indirectly impacted by the Project.

7.2 Recommendations

Based on the results of this CHRA, the following recommendations should be considered:

1. Construction activities, including temporary land use areas, should be suitably planned and undertaken to avoid negative impacts to adjacent cultural heritage resources (i.e. remain within the existing right-of-way).

2. Complete a Heritage Impact Assessment (HIA) for BHR 1, 150 Philip Aziz Avenue, as proposed in **Table 4**.

3. If the proposed design extends beyond the Study Area, AECOMs qualified heritage consultant will confirm if there are any changes to impacts to the cultural heritage resources and will identify if additional studies and requirements are required.

4. Ensure that AECOM's Landscape Plan for the project identifies protective measures for landscape features in CHL 2, 1151 Richmond Street, and landscape features associated with the Western University campus that will not be impacted by the project (i.e. the entrance features that flank Philip Aziz Avenue [Photograph 1 and 2]). Ensure the Landscape Plan includes the removal process and reinstatement of any landscape features that require temporary removal during construction (i.e. iron fencing, circulation routes, trees etc.). The Landscape Plan should provide a design plan the reinstates the circulation network to connect CHL 2 to Western Road and Philip Aziz Avenue, thus with a goal to create an overall positive impact on the Western University campus setting.

5. In order to avoid indirect impacts due to vibration on structures within BHR 1 and CHL 2 as identified in Table 4, a qualified vibration professional should monitor for vibration as recommended in **Section 7.2.1** below.

7.2.1 Vibration Recommendations

Evaluation of impacts related to vibration activities requires assessment based on identification of specific construction methods proposed, distance between the sensitive receptor (i.e. a built heritage resource) and the proposed road improvements, and anticipated vibration levels (mm/s). It is unknown at this time based on available

information if vibration impacts are anticipated, but vibration impacts will be reviewed as the project progresses. The vibration analysis will provide restrictions and vibration limits to be maintained during construction and will assess vibration impacts on the known BHRs and CHLs identified in this CHRA.

Given that cultural heritage resources are within and adjacent to the Study Area, as noted in the preliminary impact tables in **Table 4**, it is anticipated that in some locations vibration limits will be exceeded and therefore, the following mitigation measures for vibration impacts should be implemented:

- Prior to construction, determine which buildings require vibration mitigation and monitoring.
- Document (review and establish) the structural condition of a building to determine if it is vulnerable to vibration impacts from the project.
- Establish vibration limits based on structural conditions, founding soil conditions and type of construction vibration (refer to the Noise and Vibration Report).
- Implement vibration mitigating measures on the construction site and/or at the building (i.e. modify construction procedures, if required).

Construction and post-construction monitoring may be required for historic buildings that were determined subject to vibration damage. The following monitoring activities are recommended for vibration impacts:

- Monitor vibration during construction using seismographs, with notification by audible and/or visual alarms when limits are approached or exceeded; and
- Conduct regular condition surveys and reviews during construction to evaluate efficacy of protective measures. Implement additional mitigation as required.

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Heritage Impact Assessment: 150 Philip Aziz Avenue

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

City of London

60661402

March 2023

Delivering a better world

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Appendices

Appendix A. Select Preliminary Design

1. Introduction

1.1 Project Context

AECOM Canada Ltd. (AECOM) was retained by the City of London to prepare a Heritage Impact Assessment (HIA) for the property located at 150 Philip Aziz Avenue (Subject Property), in London, Ontario based on the updated Phase 2 plans for the proposed Western Road and Sarnia Road/Philip Aziz Avenue Infrastructure Improvements. The City of London is undertaking a Municipal Class Environmental Assessment (MCEA) study to identify necessary improvements at the Western Road and Sarnia Road/Philip Aziz Avenue intersection. The MCEA study will identify and balance the needs of the users within the community, including pedestrians, cyclists, and motorists. The MCEA study will be carried out in accordance with Class EA consultation requirements having full consultation with the community, stakeholders, agencies, and Indigenous communities.

The City of London Transportation Master Plan (2030 TMP) identified the need to improve the Western Road and Sarnia Road/Philip Aziz Avenue intersection in the next 5 years. Currently, the existing road/intersection experiences at-capacity or over-capacity conditions with respect to vehicular movements in addition to pedestrian and cyclist activity. As a result, traffic congestion, safety concerns, increased delays and decreasing levels of service are being experienced and will continue if left untreated. Further, the existing storm drainage in the area does not meet current design standards and requires upgrades.

The MCEA provides the City the opportunity to develop a range of planning and design alternatives that can improve intersection turning movements, provide additional capacity by removing constraints, improve pedestrian and cyclist facilities and safety. Improvements will address stormwater drainage and enhance streetscape conditions. The consultation process will help solicit public and agency feedback to select the best plan for the future.

Following the City of London's 'Complete Streets' guidelines, 'Urban Design' guidelines, and Western University's Master Plan Vision, there is an opportunity to create a gateway to the campus in this area. The MCEA will strive to create a street/intersection that is as functional and comfortable as possible for all users (students, children, seniors, cyclists, motorists, transit users and pedestrians) while ensuring that there is a place for trees, and the natural environment is protected.

In 2016, the project was put on hold when alternatives for transit routes through the study area were being considered as they related to Rapid Transit (RT). As it is related to this project, the northern routes for RT have been deferred and the City has decided to restart this project.

In 2021, AECOM's Cultural Heritage Specialists completed a *Cultural Heritage Resource Assessment: Existing Conditions and Preliminary Assessment* (2021) for the Western Road and Sarnia Road/Philip Aziz Avenue Improvements. The report recommended that an HIA be completed to determine the impacts of the proposed road improvements to the Subject Property.

1.2 Location and Physical Description of the Subject Property

1.2.1 Location

The Subject Property, formally 1180 Western Road, now 150 Philip Aziz Avenue, is located on the southeast corner of Western Road and Philip Aziz Avenue, and is within land owned by Western University, in the City of London, Ontario **(Figure 1** and **Figure 2**). Historically the Subject Property was located within a portion of Lot 17, Concession II, in the Township of London, Middlesex County, Ontario.

The Subject Property is bound by 1200 Western Road to the east, west and south, and Philip Aziz Avenue to the north. The Subject Property is located west of the North Thames River. The Subject Property is adjacent to the listed cultural heritage landscape of the institutional lands associated with Western University.

1.2.2 Physical Description

The Subject Property is an irregularly shaped lot, approximately 0.13 hectares in size, and is located on high ground that generally slopes towards Philip Aziz Avenue. The property comprises of a circa 1875 one-and-a-half storey house, an art studio and gallery constructed in 1957, a brick-built landscape feature that surrounds a large courtyard, a gravel driveway, and mature trees and dense brush that screen the property from the surrounding urban landscape. The mature trees and dense brush surround the circa 1875 one-and-a-half storey house and other landscape features located within the Subject Property. The landscape of the property in December 2022 can be interpreted as a rural "bucolic" property, despite the property being surrounded by institutional buildings associated with Western University.

1.3 Summary of Property Impacts on 150 Philip Aziz Avenue

The proposed infrastructure improvements include the construction of a bike lane, curb, and sidewalk, and retaining wall along Philip Aziz Avenue on the south side of the road directly adjacent to the current Subject Property boundary. The proposed infrastructure improvements will require partial property acquisition of a portion of Subject Property to accommodate for the grading activities and removal of the current driveway access to the Subject Property off Philip Aziz Avenue. A new driveway is proposed to connect with the west end of the Subject Property. Below summarizes the anticipated adverse impacts as a result of the proposed infrastructure improvements to the cultural heritage value of the Subject Property at 150 Philip Aziz Avenue:

- Grading activities, the construction of the curb, sidewalk and retaining wall, property acquisition, and driveway removal along the northern boundary of the property will directly adversely impact the Subject Property by the removal of the entire pierced brick entrance feature that flanks the existing driveway (east and west side of the existing driveway).
- The removal and relocation the driveway will directly adversely impact the courtyard and its associated pierced brick low seat wall by removal of a section of the pierced brick low seat wall.
- Grading activities along the northern and western boundary of the Subject Property will indirectly impact the mature trees that screen the property from the surrounding urban landscape.

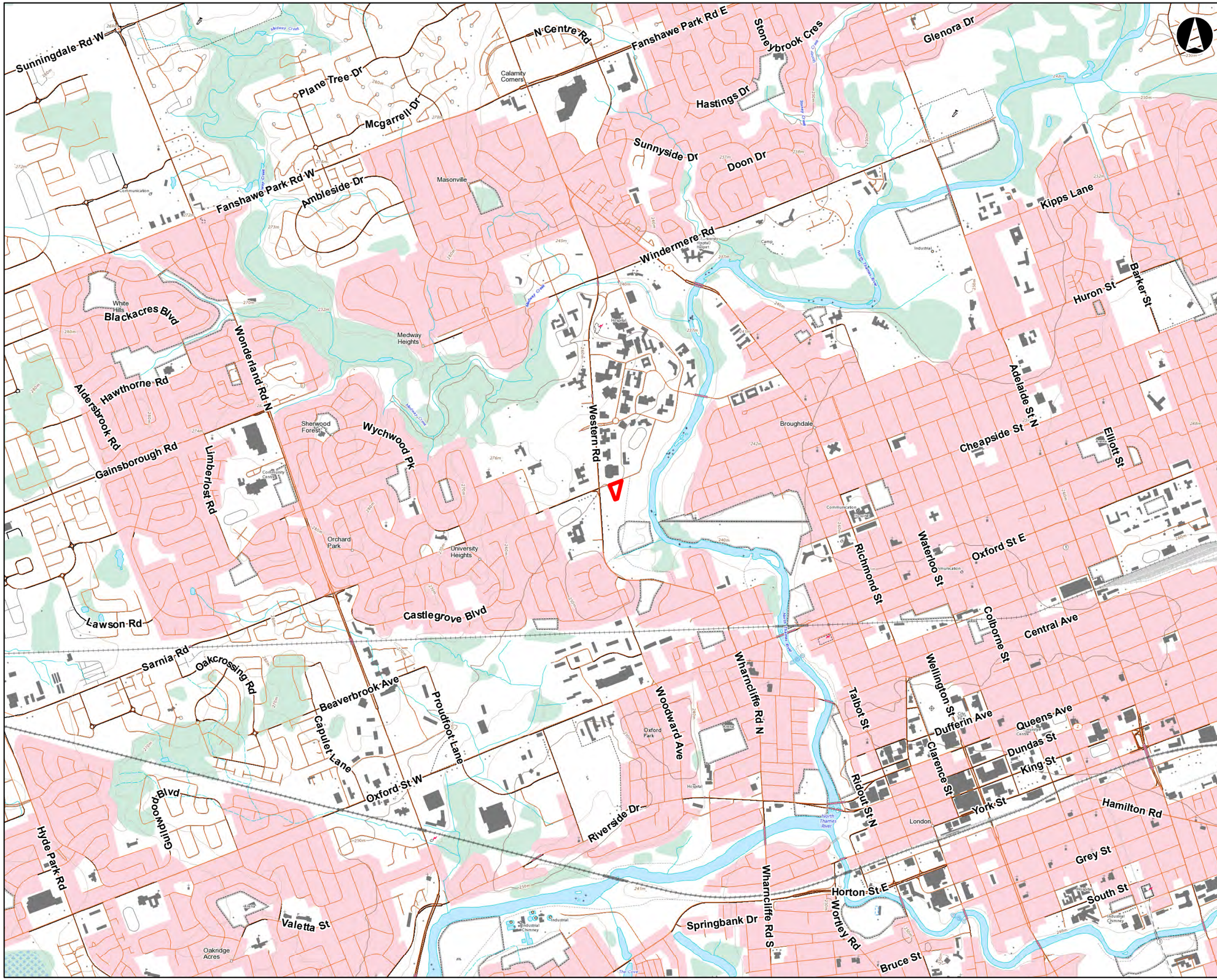
The full impact assessment is in **Section 6.2** of this report. The Mitigation Strategy is presented in **Section 7** and Recommendations are presented in **Section 8**.

1.3.1 Property Owner

The property located at 150 Philip Aziz Avenue is currently owned and maintained by Western University.

1.3.2 Cultural Heritage Status

The Subject Property is designated in Part IV under the *Ontario Heritage Act* (By-law L.S.P. – 3367-235). It was also listed on the Canadian Register in 2010-03-03.



Legend

Study Area

Heritage Impact Assessment
150 Phillip Aziz Ave.
London, Ont.

Location of the Subject Property
on Topographic Imagery

0 125 250 500 750 1,000 1,250 1,500 1,750
Meters
DATUM: NAD 1983 UTM Zone 17N

January 2023	1:25,000 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2019, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
P#: 60661402	V#:	

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Figure 1

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Map location: \\na.aecomnet.com\ifa\AMER\London-CALON1\DCS\Projects_TRN\60661402_CoL_WesternRd\EA\300_CAD_GIS\920_929_GIS_Graphics\Design\01_Reports\HIA\Fig1-StudyAreaTopo.mxd
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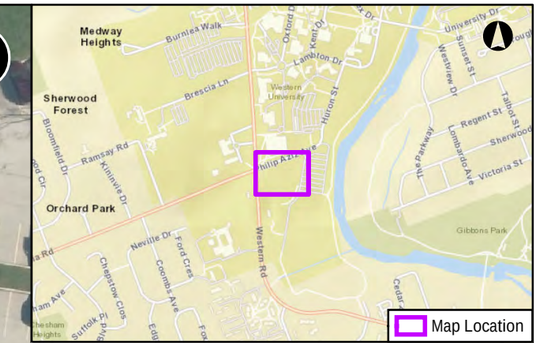

Legend

Study Area

Heritage Impact Assessment
150 Phillip Aziz Ave.
London, Ont.

Location of the Subject Property
on Aerial Imagery

0 25 50
Meters
DATUM: NAD 1983 UTM Zone 17N

January 2023	1:700 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2022, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
P#: 60661402	V#:	

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Figure 2

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Map location: \\na.aecomnet.com\ffs\AMER\London-CALON1\DCS\Projects_TRN\60661402_Col_ WesternRd\EA\00_CAD_GIS\20_929_GIS_Graphics\Design\01_Reports\HIA\Fig2-StudyArea.mxd
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1.4 Methodology

This HIA adheres to the guidelines set out in the Ministry of Citizenship and Multiculturalism (MCM) *InfoSheet #5 Heritage Impact Assessment and Conservation Plans* as part of the *Ontario Heritage Tool Kit* (2006). This HIA addresses the impacts of the proposed infrastructure improvements to Western Road and Philip Aziz Avenue on the Subject Property, which is designated Part IV of the *Ontario Heritage Act*.

For the purpose of this HIA, AECOM undertook the following key tasks:

- Reviewed appropriate background documents including the:
  - *Cultural Heritage Resource Assessment: Existing Conditions and Preliminary Impact Assessment: Western Road and Sarnia Road/Philip Aziz Avenue Improvements* (AECOM, 2021)
  - *Historicplaces.ca: Phillip Aziz Property*
  - *Ontario Heritage Act – Register: Designation of 1180 Western Road*

- Consulted with the City of London Heritage Planner to confirm the scope of the HIA;

- Conducted a field review to document the exterior existing conditions of the Subject Property from within the property on August 26, 2021, and December 22, 2022.

- Identified and prepared a description of the proposed undertaking;

- Assessed the proposed development impacts, based on the proposed infrastructure improvements, on the cultural heritage value and heritage attributes of the Subject Property;

- Prepared mitigation options and mitigation measures with recommendations to avoid or reduce any negative impacts to the Study Area.

This HIA was completed by a team of AECOM's Cultural Resource Management staff including Liam Ryan, MES (Cultural Heritage Planner), Tara Jenkins, MA, CAHP (Cultural Heritage Specialist, Lead), and Adria Grant, MA, CAHP (Associate Vice President, Impact Assessment and Permitting). The HIA was developed in consultation with the City of London Heritage Planner, Kyle Gonyou.

1.5 Consultation

The subsection below includes a summary of the consultation activities, as well as relevant consultation and feedback undertaken for the development of this HIA.

1.5.1 Stakeholder Consultation

The following stakeholders were contacted with inquiries regarding the background of the Subject Property (**Table 1**).

Table 1: Record of Stakeholder Consultation

Contact	Contact Information	Date	Notes
Kyle Gonyou / City of London / Heritage Planner	Kgonyou@london.ca	September 15, 2021	Kyle Gonyou was contacted to confirm the scope of work and to provide background information on the Subject Property. Kyle Gonyou confirmed the

Contact	Contact Information	Date	Notes
			scope of work and provided AECOM with historical information and resources on the Subject Property.
Mark Richardson / London Public Library / Public Services Librarian	Mark.Richardson@lpl.ca	September 16, 2021	A request for photographs and newspaper articles was made to gain background information on 150 Philip Aziz Avenue. Mark Richardson provided AECOM with materials from the following sources: ▪ Conversations with the Artist Philip Aziz, by Kym Wolfe (2016) ▪ London City Life Magazine (October/November 2005, pp. 28-3) ▪ London Free Press, Feb. 4, 2016 ▪ City of London Heritage Designation no. 256
Jean Hung / Western University / Archives Assistant	Archives@uwo.libanswers.ca	September 20, 2021	A request for photographs was made to see if there were newspaper pictures that captured the brick entrance of 150 Philip Aziz Avenue. Jean Hung searched the London Free Press negatives and there were no pictures that captured the entrance of the property.

This report will be reviewed by Community Advisory Committee on Planning (CACP) and all input/feedback will be incorporated into the final draft of this HIA.

2. Policy Context

The authority to request an HIA arises from the *Environmental Assessment Act* (R.S.O. 1990, Chapter E. 18), *Ontario Heritage Act*, Section 2(d) of the *Planning Act*, the Provincial Policy Statement (2020) and the City of London's Official Plan: *The London Plan* (June 23, 2016).

2.1 Planning Act and Provincial Policy Statement

This report was prepared to satisfy cultural heritage reporting requirements undertaken as part of the Ontario MCEA process. Pursuant to the *Environmental Assessment Act* (R.S.O. 1990, Chapter E. 18), applicable infrastructure improvements and development projects are subject to appropriate studies to evaluate and assess the potential related impacts of a project on the social, economic, or cultural environment, (i.e., the cultural heritage of an area). Infrastructure improvement projects have the potential to impact cultural heritage resources in various ways including, but not limited to:

- Direct Impact: Loss or displacement of cultural resources through removal or demolition; and,
- Indirect Impact: Disruption of cultural resources due to the introduction of physical, visual, audible, or atmospheric elements that are not in keeping with the significance of the resource and its contextual surroundings.

2.2 Planning Act and Provincial Policy Statement

The *Planning Act* (1990) and the associated Provincial Policy Statement (2020) provide a legislative framework for land use planning in Ontario. Both documents identify matters of provincial interest, which include the conservation of significant features of architectural, cultural, historical, archaeological, or scientific interest. The *Planning Act* requires that all decisions affecting land use planning matters "shall be consistent with" the Provincial Policy Statement. In general, the Provincial Policy Statement recognizes that Ontario's long-term prosperity, environmental health, and social well-being depend on protecting natural heritage, water, agricultural, mineral, cultural heritage, and archaeological resources for their economic, environmental, and social benefits.

Pursuant to Section 2.6 of the 2020 Provincial Policy Statement, Policy 2.6.1 states "Significant built heritage resources and significant cultural heritage landscapes shall be conserved." The 2020 Provincial Policy Statement issued under the authority of the *Planning Act* defines "conserved" as "means the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment that has been approved, accepted, or adopted by the relevant planning authority and/or decision designated and available for the purposes of this definition."

To conserve a cultural heritage resource, a municipality or approval authority may require a heritage impact assessment and/or a conservation plan to guide the approval, modification, or denial of a proposed development or site alteration that affects a cultural heritage resource. Using tools such as heritage impact assessments, municipalities and approval authorities can further enhance their own heritage preservation objectives.

Furthermore, a policy in Section 2.6 of the 2020 Provincial Policy Statement, Policy 2.6.3, states "Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property except where the proposed development and site alteration has been evaluated and it had been demonstrated that the heritage attributes of the protected heritage property will be conserved."

2.3 Ontario Heritage Act

The *Ontario Heritage Act* enables municipalities the tools to protect the heritage attributes of heritage designated property from replacement, removal, alteration, damage and/or destruction. A Heritage Alteration Permit is required to change a heritage designated property.

A Heritage Alteration Permit approval is required for the Subject Property pursuant to Section 33 of the *Ontario Heritage Act.* Section 33 of the *Ontario Heritage Act* outlines the process under which proposed alterations, demolition, or removal of properties designated under Part IV must follow, including the statutory process for appeals. Consultation with the CACP is required, and Municipal Council may decide to approve, approve with terms and conditions, or refuse the Heritage Alteration Permit application. The refusal of a Heritage Alteration Permit, or the terms and conditions on the approval of a Heritage Alteration Permit, may be appealed to the Ontario Land Tribunal. Given that direct adverse impacts are anticipated to impact the property's identified heritage attributes, a Heritage Alteration Permit will be required for the proposed project.

2.4 The London Plan

The London Plan, the City of London's Official Plan, is the City of London's new Official Plan. *The London Plan* sets out a new approach for planning in London which emphasizes growing inward and upward so that the City can reduce the costs of growth, create walkable communities, revitalize urban neighbourhoods and business areas, protect farmlands, and reduce greenhouse gases and energy consumption. The plan sets out to conserve the City's cultural heritage and protect environmental areas, hazard lands, and natural resources.

Specifically related to heritage conservation, *The London Plan* outlines a number of policies related to the conservation of cultural heritage resources within the city. The following General Cultural Heritage Policies are applicable to this project:

> *(565_) New development, redevelopment, and all civic works and projects on and adjacent to heritage designated properties and properties listed on the Register will be designed to protect the heritage attributes and character of those resources, to minimize visual and physical impact on these resources. A heritage impact assessment will be required for new development on and adjacent to heritage designated properties and properties listed on the Register to assess potential impacts and explore alternative development approaches and mitigation measures to address any impact to the cultural heritage resource and its heritage attributes.*
>
> *(566_) Relocation of cultural heritage resources is discouraged. All options for on-site retention must be exhausted before relocation can be considered.*
>
> *(567_) In the event that demolition, salvage, dismantling, relocation, or irrevocable damage to a cultural heritage resource is found necessary, as determined by City Council, archival documentation may be required to be undertaken by the proponent and made available for archival purposes."*
>
> *(568_) Conservation of whole buildings on properties on the Register is encouraged and the retention of facades alone is discouraged. The portion of a cultural heritage resource to be conserved should reflect its significant attributes including its mass and volume.*
>
> *(569_) Where, through the process established in the specific Policies for the Protection Conservation and Stewardship of Cultural Heritage resources section of this chapter and in accordance with the Ontario Heritage Act, it is determined that a building may be removed, the retention of architectural or landscape features and the use of other interpretive techniques will be encouraged where appropriate.*

(586_) The City shall not permit development and site alteration on adjacent lands to heritage designated properties or properties listed on the Register except where the proposed development and site alteration has been evaluated and it has been demonstrated that the heritage attributes of the heritage designated properties or properties listed on the Register will be conserved.

(590_) Where a property has been identified on the Register and an application is submitted for its demolition or removal, the Heritage Planner and the Clerks Department will be notified in writing immediately. A demolition permit will not be issued until such time as City Council has indicated its approval, approval with conditions, or denial of the application pursuant to the Ontario Heritage Act. Council may also request such information that it needs for its consideration of a request for demolition or removal.

(591_) Where a heritage designated property or a property listed on the Register is to be demolished or removed, the City will ensure the owner undertakes mitigation measures including a detailed documentation of the cultural heritage features to be lost and may require the salvage of materials exhibiting cultural heritage value for the purpose of re-use or incorporation into the proposed development.

3. Statements of Cultural Heritage Value

3.1 Designating By-Law

The property was designated, by the City of London, in 2004, for its historic or contextual value or interest, under Part IV of the *Ontario Heritage Act*, By-law L.S.P. – 3367-235 (revised- 22 July 2004). The following Statement of Cultural Heritage Value has been directly excerpted from the Designation By-law.

Description of the Property- By-Law

1180 Western Road is significant to the cultural heritage of London and area as the home and studio of artist Philip Aziz, renowned in art circles of Canada and internationally, particularly in New York City and Yale University Art Department. His studio and ground hold not only many pieces of his art, but also his collection of architectural artifacts salvaged form several of London's landmark buildings of the past.

Historical Reasons

Mr. Aziz's house on this property appears to be renovated around an original Ontario Farmhouse which has been updated and enlarged but still exhibits several features of the original construction in the basement and attic areas. Research into the property did not confirm the date of the original building of the house, but the construction features lead one to believe that the house dates to circa 1875.

Cultural Reasons

This property's main significance is as Philip Aziz's art studio and gallery. Mr. Aziz was born in St. Thomas, Ontario and began art studies at H.B. Beal Secondary School. After graduating from Yale University with a Bachelor's and Master's Degree in Fine Arts, he returned to establish a studio at his home in London.

A quote from the catalogue for a 1996 show of Mr. Aziz's work at the London Regional Art and Historical Museum (now Museum London) reads, "In a career spanning 40 years he has made his mark as a painter, not only here in London, but elsewhere in Canada. He has also earned a wide international reputation, and his works are to be found in public and private collections in the United States, in France and Italy, and as far away as Japan and Australia."

"Like his predecessors in the Renaissance, Aziz has also turned his hand to the design of sculpture, either on a monumental scale or in fine metalwork, or of a private house and its furniture, or of a chapel and its liturgical vessels and furnishings. Whatever he touches reveals his feeling for rich and precious materials, and his meticulous attention to detail."

With a deep interest in liturgical art, several pieces of Mr. Aziz's art can be found in chapels of St. Peter's Basilica here in London.

Architectural Reasons

Mr. Aziz's artistic eye and sense of design lead him to salvage interesting features from many of London's earlier landmark buildings, even as the building were being demolished. These artifacts

have been incorporated into the construction of his studio and courtyard in a way that is reminiscent of Mackenzie King's collection of ruins featured in Gatineau Park outside Ottawa.

Several of these artifacts are worthy of note and serve preservation in their current context. Flanking the driveway are brick walls adorned with stone brackets taken from the former Prevost Building. The courtyard surface is paved with bricks from the early London Street Railway tracks in downtown Dundas Street. Around the courtyard is a brick fence highlighted with carved stone capitals taken from the previous Bank of Montreal building at Dundas and Wellington Streets. Several other capitals decorate courtyard as free-standing planter bases or plain pieces. The studio on the west side if the courtyard is finished in salvaged London clay brick adorned with more stone capitals from the Bank of Montreal. Many of the windows in the Studio were taken from various old homes in the city.

Inside the studio, the architectural artifacts continue among the collection of Philip's art. A large, hammered copper sink taken from the old home that is now the Mocha Temple building on Colborne Street, decorative cut and bevelled glass windows from several old homes and more carved stone capitals in brick walls and columns. One pair of capitals, taken from the Prevost building, form the bases of two stone columns at the south end of the studio. The fireplace in the west wall of this area is formed in two-tone green, marble salvaged from an altar that was being removed from the chapel in St. Peter's Seminary.

Several other artifacts can be found around the studio and courtyard where Mr. Aziz has not yet found the place to incorporate them in the building.

Contextual Reasons

At this location, the intersection of Western Road with Sarnia Road and Huron Drive, the house courtyard and studio sit in contrast with the hustle and traffic of the roads busy with University traffic. The rural, "bucolic" atmosphere denies the pressure of the UWO that surrounds it.

3.2 Parks Canada – Canadian Register of Historic Places

The Canadian Register of Historic Places provides a single source of information about all historic places recognized for their heritage value at the local, provincial, territorial, and national levels throughout Canada.

The Subject Property was added to the register in 2010. It provides a Statement of Significance based on the City of London By-Law L.S.P. – 3367-235. Further to the designation by-law it provides a list of Character-Defining Elements (or heritage attributes). The list has been used in this HIA as supplementary information to *Ontario Heritage Act*, By-law L.S.P. – 3367-235 (revised- 22 July 2004). The heritage designation by-law will remain the source of identifying and understanding the property's heritage attributes.

Character-defining elements that contribute to the heritage value of the Philip Aziz Property include its:

- scale, massing and elevations of the residence and art studio
- brick walls and courtyard
- stone brackets from the former Prevost Building that adorn the brick walls which flank the driveway
- bricks from the early London Street Railway tracks which pave the courtyard
- carved stone capitals from the Bank of Montreal building which highlight the brick fence around the courtyard and finish the west elevation of the studio
- windows from old homes in the city
- large hammered copper sink salvaged from the Smallman residence

- two-tone green marble from St. Peters Seminary that forms the fireplace in the west wall of the studio

4. Summary of Background Research and Analysis

The Subject property is historically located within a portion of Lot 17, Concession II, in the former Township of London, Middlesex County, Ontario.

4.1 Historical Overview

4.1.1 Brief Property History

The Designation By-law does not confirm the construction date of the house located on the Subject Property, however architectural features, including hand-hewn timbering and framing in the basement and attic, suggest that the house was constructed circa 1875 (By-law L.S.P. – 3367-235).

Philip Aziz purchased the Subject Property for $15,000 dollars in 1953 (Carruthers, 2016). At this time the Subject Property was located at the edge of Western University. In 1957, Aziz built an art studio on the Subject Property (Carruthers, 2016) and extended the studio in 1967 to add a gallery space (Wolfe, 2016, p. 32). The art studio and gallery contain several architectural artifacts from sites that were being demolished throughout London (Carruthers, 2016). Below is a list of several salvaged artifacts that Aziz incorporated into the studio/gallery and courtyard (historicplaces.ca):

- Bricks from the London Street Railway tracks on Dundas Street which pave the driveway
- Carved Stone Capitals from the Bank of Montreal building at Dundas and Wellington Streets which highlight the brick fence around the courtyard and finish the west elevation of the studio
- London clay brick and bevelled glass windows from several old North London homes
- Marble for the fireplace in the west wall of the studio from an altar at St. Peter's Seminary
- Stone brackets from the former Prevost Building adorn the brick walls which flank the driveway
- Large hammered copper sink salvaged from the Smallman house

In 1990, Aziz constructed an addition to the circa 1875 one-and-a-half storey house which in turn doubled the size of the house. In 2004, the Subject Property, including the house, art studio and gallery and courtyard were designated by the City of London as a heritage property.

In 2016, Western University purchased the Subject property from the Philip Aziz Foundation of Art (Carruthers, 2016). The Philip Aziz Foundation of Art sold the property due to high legal fees and the cost of upkeep on the property. A member of the Philip Aziz Foundation of Art said that the late London artist would not have approved of the sale of the property as Philip Aziz would have wanted "to turn the house and gallery into a place where his paintings would be displayed alongside works by other artists" (Carruthers, 2016, p. A2). Western University agreed to preserve Aziz's gallery forever and entomb his ashes on the site (Carruthers, 2016).

4.1.2 Brief Biography – Philip Aziz

Philip Aziz (**Image 1)** was born on April 15, 1923, in St. Thomas, Ontario and moved to London, Ontario at an early age (Wolfe, 2005). From the age of six, Aziz aspired to be an artist. This aspiration eventually led him to Yale University, where he completed his BA and MA in fine arts (Wolfe, 2005). It was at Yale that he discovered egg tempera[1], which "became his preferred medium for painting throughout his career" (Wolfe, 2005, p. 29).

[1] *Egg tempera is a permanent, fast-drying painting medium consisting of coloured pigments mixed with a water-soluble binder medium, usually glutinous material such as egg yolk.*

After graduating from Yale University in 1949, Aziz studied at Harvard, lectured at various colleges and museums in Canada and the United States and traveled extensively through Europe (Wolfe, 2005). Aziz's returned to London in 1950 where he lectured at the University of Western Ontario (UWO) and taught art and art history as well as helped to expand the collection at UWO's McIntosh Gallery (Wolfe, 2005). Aziz would teach at UWO from 1950 to 1955. During his time, he purchased the Subject Property as he wished to have a studio that was easily accessible to his students (Wolfe, 2005). Philip Aziz purchased the property as he:

> "*wanted art students to be able to learn outside of the classroom, to really get an idea of what went into making art, to come to my studio and see me at work*" (Wolfe, 2016, p. 31).

Following his time working at Western University, "Aziz spent most of his time between 1955 to 1987 outside of Canada, mainly in New York, Detroit, and Europe" (Wolfe, 2005, p. 29). During this time Aziz began to explore "abstract and modern art both through his painting and in sculpture, promoting rave reviews from New York critics, curators, and gallery owners" (Wolfe, 2005, p. 30). He often returned to his home in London as it acted as a creative refuge away from the big cities, where he normally operated (Wolfe, 2005).

Following an aneurysm in 1987, Aziz spent two full years in London where he discovered that during the decades he had been disengaged from the city, London had developed culturally (Wolfe, 2005). Having discovered this cultural evolution, Aziz planned to donate his entire property and artwork to the Philip Aziz Foundation of Art, with the goal of establishing an artistic centre.

In 2005, the City of London Council voted to change the short stretch of Huron Street outside his home to Philip Aziz Avenue. In 2009, at the age of 86, Philip Aziz died of cancer (Carruthers, 2016). His death sparked a legal battle over his estate as family members claimed, "there were suspicious circumstances surrounding his final will written a month before his death that left the bulk of his estate to the Philip Aziz Foundation of Art" (Carruthers, 2016, p. A2). This legal battle between family members would rage on for six years (Carruthers, 2016).

Image 1:
Philip Aziz, 2005[2]

[2] *Retrieved from: https://www.thelondoner.ca/2016/02/29/artist-revealed-in-new-book*

5. Assessment of Existing Conditions

5.1 Introduction

A field review of the Subject Property was undertaken by Tara Jenkins, Cultural Heritage Specialist, Lead with AECOM on August 26, 2021, and December 22, 2022, to document the existing conditions within the Subject Property. The exterior of the Subject Property was photo documented from within the property boundaries. Permission-to-Enter into the buildings on the Subject Property was not permitted at the time of the field review, therefore an interior assessment of the buildings has not been completed.

Photographs of the landscape features and other heritage attributes located within the Subject Property are located in the section below. However, the assessment focuses on the existing conditions of the portions of the Subject Property that have the potential to be directly impacted by the proposed infrastructure improvements. The heritage attributes of the Subject Property that have the potential to be directly adversely impacted are the landscape features that screen and define the courtyard. The landscape features that screen and define the courtyard include the pierced brick low seat wall, the pierced brick entrance feature along the driveway, the pierced brick high wall and entrance feature that also marks the entrance to the art studio and gallery, and the mature trees and dense brush that screen the property from the surrounding urban landscape. The circa 1875 one-and-a-half storey house and the art studio and gallery are not anticipated to be directly adversely impacted by the project and therefore will not be assessed in this section.

It is important to note that a portion of the pierced brick entrance feature associated with the gravel driveway is only partially located within the boundaries of the Subject Property. However, this HIA will treat the pierced brick entrance feature as if it is completely located within the boundary of the Subject Property as it is directly associated with the cultural heritage value of the Subject Property (defines the driveway).

5.2 Description of Surrounding Context

The Subject Property is an irregularly shaped lot, approximately 0.13 hectares in size, and is located on high ground that generally slopes towards Philip Aziz Avenue (**Photograph 1**). The property is comprised of a circa 1875 one-and-a-half storey house, an art studio and gallery that was constructed in 1957, a large courtyard, a gravel driveway, a number of brick landscape features and mature trees and dense brush that screen the property from the surrounding urban landscape. The mature trees and dense brush largely surround the art studio and gallery and other landscape features located within the Subject Property. The landscape of the property in December 2022 can be interpreted as a rural “bucolic” property, despite the property being surrounded by intuitional buildings associated with Western University.

Photograph 1:
A view of Philip Aziz Avenue, looking east

5.3 Landscape Features

5.3.1 Gravel Driveway

A short curved gravel driveway leads from Philip Aziz Avenue into the Subject Property. Flanking on both sides of the gravel driveway is a decaying pierced brick entrance feature (**Photograph 2** and **Photograph 3**). The pierced brick entrance feature is partially located within the boundary of the Subject Property, but it is directly associated with the cultural heritage value or interest (CHVI) of the Subject Property The pierced brick entrance feature acts as a wall. The wall consists of several different base heights that are dependent on the elevation of the land.

In general, the brickwork follows an alternating pattern of a double width of buff brick stretchers laid in a pierced brick pattern with integrated columns. The columns add strength to the pierced brick entrance feature and are constructed of buff brick that are laid with a pattern of stretchers and headers. The foundation of the pierced brick entrance feature is constructed on a course of headers. In general, the length of the pierced brick entrance feature is capped with two

continuous rows of bricks (without piercing). The brick used in the wall varies in tones and colours of buff brick with seemingly random orange brick accents and some dark red brick[3], while the mortar used is a consistent grey colour.

Historical images found on Google Street View illustrate that the pierced brick entrance feature was adorned with stone brackets that may have been salvaged from the former Bank of Montreal building (**Photograph 4**). The stone brackets are no longer adorned on the pierced brick entrance feature (**Photograph 5**) and their locations are unknown**.**

The pierced brick entrance feature's current condition is illustrated by crumbling, spalling, and cracked bricks, deteriorating mortar joints, missing embellishments (i.e., spolia), and an overgrowth of foliage that weaves through the cracks of the feature (**Photograph 6** and **Photograph 7**).

Photograph 2:
A view of the pierced brick entrance feature that flanks the gravel driveway, looking south (AECOM 2022)

[3] *The various tones of the brick can be attributed to the salvaged nature of the material*

Photograph 3:
A view of the pierced brick entrance feature that flanks the gravel driveway, looking north (AECOM 2022)

Photograph 4:
A 2015 image of the pierced brick entrance feature, illustrating the two stone brackets (Google Maps, 2015)

Photograph 5:
A view of the pierced brick entrance feature, illustrating the missing stone brackets, looking south (AECOM 2021)

Photograph 6:
A view of the pierced brick entrance feature, illustrating crumbling, spalling, and cracked bricks, deteriorating mortar joints, and an overgrowth of foliage, looking north at the pierced brick entrance feature east of the driveway (AECOM, 2022)

Photograph 7:
A view of the pierced brick entrance feature on the east side of the driveway, illustrating its decaying condition, looking north (AECOM, 2022)

5.3.2 Courtyard

The gravel driveway leads into the Subject Property and ends at the courtyard. The circa 1875 one-and-a-half storey house is located east of the courtyard and the art studio and gallery is located southwest of the courtyard. Portions of the courtyard have been reclaimed by nature as foliage including grass and weeds obscure the boundaries of the courtyard. The courtyard is entered through the pierced brick entrance feature and is largely defined on the west end by a pierced brick low seat wall.

The pierced brick low seat wall consists of an alternating pattern of a double width of buff brick stretchers laid in a pierced brick pattern, with grey mortar (**Photograph 8** and **Photograph 9**). In general, the seat wall is capped with stone slabs which provides the surface area for seating. Different from the pierced brick entrance feature, there is a space between the brickwork and the brickwork essentially forms piers to the capstone. The foundation of the pierced brick low seat wall is constructed on a course of headers. The pierced brick low seat wall is in poor condition with crumbling, cracked and spalled bricks, cracked stone slabs, deteriorating mortar joints and sections of the wall that have collapsed (**Photograph 10** and **Photograph 11**).

The northern portion of the pierced brick low seat wall is not believed to have been connected to the pierced brick entrance feature that flanks the gravel driveway (**Photograph 10**).

The designating by-law identifies the bricks from the early London Street Railway which pave the courtyard are a heritage attribute of the property. Current existing conditions show the majority of the courtyard surface as gravel. Therefore, it is believed that the early London Street Railway brick from the tracks which pave the courtyard are no longer extant.

Photograph 8:
A view of the pierced brick low seat wall, looking west (AECOM, 2022)

Photograph 9:
A view of the pierced brick low seat wall, looking southwest marking the west boundary of the courtyard area (AECOM, 2022)

Photograph 10:
A view of the pierced brick low seat wall, illustrating a collapsed portion of the seat, looking west along the west boundary of the courtyard area (AECOM, 2022)

Photograph 11:
A view of the low pierced brick seat wall, illustrating a large crack located on a stone slab (AECOM, 2022)

Defining the south end of the courtyard is another pierced brick entrance feature to the art studio and gallery. This brick feature is in fair condition. The walls have experienced little deterioration and are largely intact. Similar, to the other walls on the property these walls consist of an alternating pattern of a double width of buff brick stretchers laid in a pierced brick pattern with grey mortar. The pierced brickwork is integrated with columns. Similar to the driveway pierced brick entrance feature, the columns add strength to the pierced brick high wall and are constructed of buff brick that are laid with a pattern of stretchers and headers. The foundation of the pierced brick entrance features consists of a course of headers. Different from the driveway pierced brick entrance features, the south end brick feature is capped with a row of headers and a flat concrete cap (**Photograph 12** and **Photograph 13**).

Photograph 12:
A view of the pierced brick high wall and art studio and gallery pierced brick entrance feature, looking south (AECOM, 2022)

Photograph 13:
A view of the art studio and gallery through the entrance of the pierced brick entrance feature, looking south (AECOM, 2022)

Located within the vicinity of the circa 1875 one-and-a-half storey house and defining the southeastern boundary of the courtyard, is another section of a pierced brick wall. Unlike the pierced brick high wall found surrounding and protecting the art studio and gallery, this section of the pierced brick high wall is in poor condition. The wall consists of crumbling brick, deteriorating mortar joints and sections of the wall that are no longer extant (**Photograph 14** and **Photograph 15**). The construction of this section is consistent with the brickwork in the south end pierced brick entrance features. The foundation of this section is obscured by foliage however, it is assumed that they are constructed on a course of buff brick headers.

Photograph 14:
A view of the pierced brick high wall located within the vicinity of the circa 1875 one-and-a-half storey house, looking east (AECOM, 2022)

Photograph 15:
A view of the pierced brick high wall located within the vicinity of the circa 1875 one-and-a-half storey house, looking east (AECOM, 2022)

Located in the vicinity of the courtyard are a number of piles of rumble that consist of bricks of various tones, mortar, and stone (**Photograph 16**). It is believed that these piles of rubble would have at one point in time been a section of one of the missing pierced brick walls.

Photograph 16:
A view of one of the rubble piles found throughout the Subject Property, looking south (AECOM, 2022)

5.3.3 Mature Trees and Dense Brush

A number of mature trees and dense brush are located along Philip Aziz Avenue and along the northern, eastern, southern, and western boundaries of the Subject Property. The mature trees and dense brush that surround the property screen the interior of the property from the surrounding urban landscape (**Photograph 9** and **Photograph 17**).

Photograph 17:
A view of the mature trees and dense brush that are located along the northern and western boundary of the Subject Property (AECOM, 2022)

5.4 Adjacent Properties

The properties adjacent to Subject Property are dominated by institutional lands associated with Western University. 1200 Western Road surrounds the Subject Property along the east, south and north edge of the property and consists of institutional buildings, parking lots and a sports field associated with Western University. To the north of the Subject Property is Listed Heritage Property with the municipal address of 1151 Richmond Street. 1151 Richmond Street consists of institutional buildings, parkland and parking lots associated with Western University.

6. Impact Assessment

6.1 Description of the Proposed Project

The Preliminary Design illustrating the proposed infrastructure improvements for this segment of the road is overlaid in **Figure 3** and the design is presented in **Appendix A.** Philip Aziz Avenue will be evenly widened on both sides to accommodate the infrastructure improvements associated with the Western Road and Sarnia/Philip Aziz Avenue Improvements. The figures show that the proposed infrastructure improvements along Philip Aziz Avenue on the south side of the road include the construction of a bicycle lane, curb and sidewalk, and a retaining wall. The north side will include a bicycle lane and curb and sidewalk. The infrastructure improvements are anticipated to temporarily acquire a 550 m² portion of the Subject Property for grading activities and permanently acquire approximately 107 m² section of the Subject Property along the northern boundary as shown on **Figure 3**.

The roadway is approximately 11 m wide is currently substandard in width, functionality and safety. There are no sidewalks and the area stormwater sewers are undersized. To update the roadway to current standards and to suit all modes of transportation including sidewalks and bicycle lanes, a general road platform widening to approximately 20 m is required, necessitating a property line shift of more than 5 m on both the north and south sides of Philip Aziz Avenue.

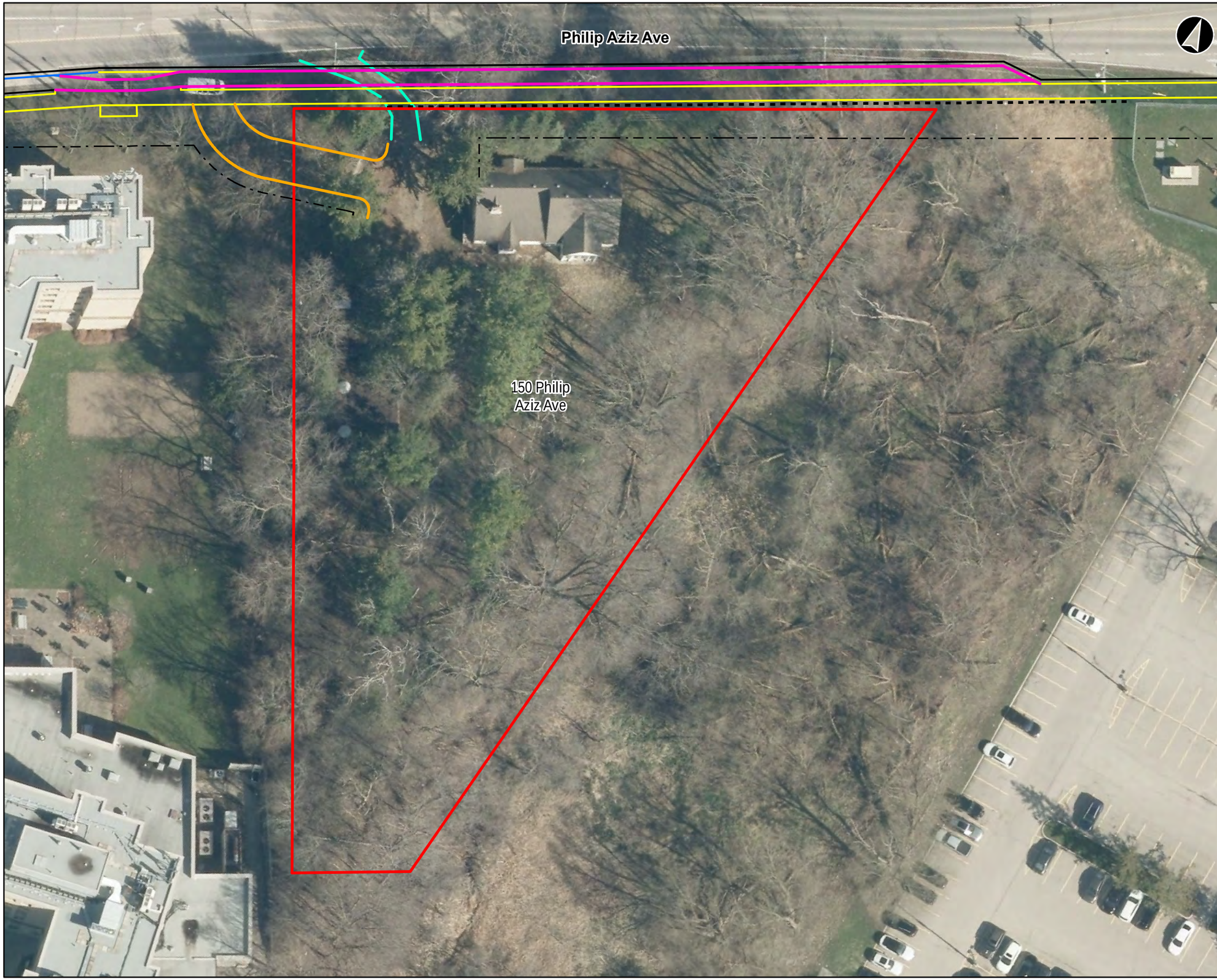
Given the natural sloping topography, which increases in elevation toward the Subject Property, a retaining wall system (with varying height of 1.5 m to 2.5 m) is required to suit the proposed widened roadway cross-section. Its proposed location (south of the sidewalk) would effectively cut through the existing entrance and entire pierced brick entrance wall on both sides of the entrance.

Maintaining the existing driveway entrance in its current location would require an excessive driveway vertical grade in excess of 8%, which exceeds City of London design standards, and generally makes access difficult and potentially unsafe. Accordingly, Preliminary Design includes the relocation and reconstruction of the entrance driveway to the Subject Property approximately 20 m to the west of the current entrance, onto the western adjacent property with the municipal address of 1200 Western Road. Preliminary Design also includes a proposed entrance width of 5.5 m and vertical grade of 3%, which improve access to the property compared to the existing. The relocation of the driveway will also require entire removal of the pierced brick entrance feature and the removal of a portion of the pierced brick low seat wall (located on the west side of the property) and will alter the context of the Subject Property by the removal of some vegetation. The full assessment of impacts is undertaken in **Section 6.2** below.

Shifting the entire road alignment 10 m to the north thereby avoiding impacts to the Subject Property at 150 Philip Aziz Avenue was also reviewed by the AECOM design team and the option was screened out early in the review process for the following reasons:

- Given that a relocation of the Sarnia Road/Philip Aziz Avenue intersection is not feasible, the shift in the road alignment would have to occur east of the intersection. There is a relatively short distance to the existing entrance from the intersection to implement to required shift alignment. As such, the road arrangement would not be fully compliant with geometric design standards, between the east and west extents of the realignment.
- There are greater negative impacts to various buried services, including storm sewers.
- The retaining wall system along the north side of the roadway would be significantly higher.
- There would be a significant impact to the Thompson Arena facility. Underpinning and reinforcement of the building foundations would likely be required given the significant cut to existing embankment.

- Western University's preference is to avoid functionality impacts along the south side of Thompson Arena.
- In general, the cost of a shift exclusively to the north would be significantly highly.



Legend

- Edge of Pavement
- Curb
- Property (Easement) Line
- Retaining Wall
- Edge of Sidewalk
- Existing Driveway
- Edge of Bike Path
- Proposed Driveway
- Study Area

Heritage Impact Assessment
150 Phillip Aziz Ave.
London, Ont.

Subject Property Overlaid
on the Preliminary Design

0 15 30
Meters
DATUM: NAD 1983 UTM Zone 17N

March 2023	1:500 * when printed 11"x17"	Source: MNRF 2020, City of London 2021 Image: City of London 2022, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User
P#: 60661402	V#:	

AECOM

Figure 3

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or relied upon by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent.

Map location: \\na.aecomnet.com\fs\AMER\London-CALON1\DCS\Projects_TRN\60661402_Col._WesternRIEA\900_CAD_GIS\920_929_GIS_Graphics\Design\01_Reports\HIA\Fig3-Results.mxd
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6.2 Assessment of Impacts

6.2.1 Screening for Potential Impacts

To assess the potential impacts of the undertaking, identified cultural heritage resources are considered against a range of possible impacts based on the *Ontario Heritage Tool Kit, Heritage Resources in the Land Use Planning Process, Info Sheet #5 Heritage Impact Assessments and Conservation Plans* (MCM 2006:3) which include, but are not limited to:

- Destruction, removal, or relocation of any, or part of any, significant heritage attributes or features
- Alteration that is not sympathetic, or is incompatible, with the historic fabric or appearance
- Shadows created that alter the appearance of a heritage attribute or change the exposure or visibility of a natural feature or plantings, such as a garden
- Isolation of a heritage attribute from its surrounding environment, context, or a significant relationship
- Direct or indirect obstruction of significant views or vistas from, within, or to a built or natural heritage feature
- A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource[4]

The MCM document defines “impact” as a change, either positive or adverse, in an identified cultural heritage resource resulting from a particular activity. This HIA identifies *direct (physical) impacts*, *indirect impacts*, and/or *positive impacts* as the impact types that a construction component and/or activity may have on cultural heritage resources.

A direct (physical) adverse impact has a permanent and irreversible negative effect on the cultural heritage value or interest of a property or results in the loss of a heritage attribute on all or part of the heritage property. An indirect adverse impact is the result of an activity on or near the property that may adversely affect its cultural heritage value or interest and/or heritage attributes. Any land disturbance, such as a change in grade and/or drainage patterns may indirectly adversely affect a heritage property, including archaeological resources. A positive impact will conserve or enhance the cultural heritage value or interest and/or heritage attributes of the property.

6.2.2 Anticipated Impacts

The conservation of cultural heritage resources in planning is a matter of public interest. Changes to a roadway such as widening projects and modifications to intersections have the potential to adversely affect cultural heritage resources, by direct or indirect impacts during and after construction. Other landscape features associated with a heritage property may experience displacement, such as temporary or permanent removal if they are located within or close to the proposed right-of-way of the undertaking.

Appendix A includes the Preliminary Design of the proposed road improvements. **Figure 3** shows the Preliminary Design components overlaid on the Subject Property. Note, **Figure 4**, in **Section 7**, shows the impact to the heritage attributes on a proposed site plan with mitigation measures.

[4] This HIA only examines impacts to above-ground cultural heritage resources within the Subject Property. Archaeological resources are presented in separate reporting.

The following impact assessment utilizes the *Ontario Heritage Tool Kit, Heritage Resources in the Land Use Planning Process*, *Info Sheet #5 Heritage Impact Assessments and Conservation Plans* (MCM 2006:3) as discussed in **Section 6.2.1** above, and the heritage attributes outlined in the City of London By-law L.S.P. – 3367-235 (revised-22 July 2004).

Table 2: Impact of Assessment – 150 Philip Aziz Avenue

Heritage Attribute (By-law L.S.P. – 3367-235)	Discussion of Impacts
Historical Reasons	
Ontario Farmhouse ca. 1875	**No direct adverse impacts anticipated**. **Potential indirect impacts**. Given the proximity of the 1875 Ontario farmhouse to the project, vibration impacts may be anticipated. See **Section 8.2.4** of the recommendations on vibration and monitoring. Given the proximity of the 1875 one-a-half storey Ontario Farmhouse to the infrastructure improvements, protection measures should be employed to protect this heritage attribute during construction to avoid unanticipated impacts or damage. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.
Association with artist Philip Aziz	**No direct or indirect adverse impacts anticipated**. Philip Aziz's house, studio and gallery will not be impacted by the property. The associative historical value of the property will not be impacted and will be conserved. No further mitigation is required.
Cultural Reasons	
Presence of the Philip Aziz's art studio and gallery	**No direct adverse impacts anticipated**. **Potential indirect impacts**. Given the proximity of the 1957 studio and gallery to the project, vibration impacts may be anticipated. See **Section 8.2.4** of the recommendations on vibration and monitoring. Given the proximity of the 1957 studio and gallery to the project, protection measures should be employed to protect this heritage attribute during construction to avoid unanticipated impacts or damage. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.
Architectural Reasons	
Brick wall flanking driveway adorned with stone brackets from the former Provost Building[5]	**Direct Adverse Impact – Destruction of Pierced Brick Entrance Feature** Based on the Preliminary Design (**Figure 3** and **Appendix A**), the pierced brick entrance feature that flanks the existing driveway will be directly impacted due to grading activities, the construction of the bicycle lane, sidewalk, and curb, and the retaining wall. These changes will necessitate the removal of the entire pierced brick entrance feature on the east and west sides of the existing driveway. Note, the stone brackets are no longer extant. The pierced brick entrance feature is a heritage attribute of the Subject Property. Therefore, the full removal of the pierced brick entrance feature is a direct adverse impact to the cultural heritage value of the property. Mitigation is required (see **Sections 7** and **Section 8**).

[5] This HIA refers to this heritage attribute as the "pierced brick entrance feature" for consistency through the report.

Heritage Attribute (By-law L.S.P. – 3367-235)	Discussion of Impacts
Courtyard surface paved with bricks from the early London Street Railway tracks in downtown Dundas Street	**No direct or indirect adverse impact anticipated.** Current existing conditions show the majority of the courtyard surface as gravel. Therefore, it is believed that the early London Street Railway brick from the tracks which pave the courtyard are no longer extant. No further mitigation is required.
Brick fence around the courtyard highlighted with carved stone capitals taken from the previous Bank of Montreal building at Dundas and Wellington Streets[6]	**Potential Direct Adverse Impact – Partial Destruction of the Pierced Brick Low Seat Wall** Based on the Preliminary Design (**Figure 3** and **Appendix A**), the pierced brick low seat wall will be directly impacted by the reconstruction of the driveway which is proposed to pass through the western edge of the property. The proposed new driveway will remove a portion of the pierced brick low seat wall to the amount of 11.1 metres. The rest will remain *in-situ*. The seat wall that defines the courtyard is a heritage attribute of the property. In the portion proposed for removal, there are no carved stone capitals. Therefore, the partial removal of the pierced brick low seat wall is a direct adverse impact to the cultural heritage value of the property. Mitigation is required (see **Section 7** and **Section 8**).
Several other capitals decorate the courtyard as free-standing planter bases or plain pieces	**No direct or indirect adverse impact anticipated.** Current existing conditions show that the capitals that decorate the courtyard as free-standing planter base or plain pieces are not within the area anticipated to be impacted by the property. It is believed they are no longer extant. No further mitigation required.
The studio on the west side of the courtyard finished in salvaged London clay brick adorned with more stone capitals from the Bank of Montreal	**No direct adverse impacts anticipated**. **Potential indirect impacts**. Given the proximity of the 1957 studio and gallery to the project, vibration impacts may be anticipated. See **Section 8.2.4** of the recommendations on vibration and monitoring. Given the proximity of the 1957 studio and gallery to the project, protection measures should be employed to protect the heritage attribute during construction in order to avoid unanticipated impacts or damage. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.
Windows in the Studio that were taken from various old homes in the city	**No direct or indirect adverse impacts anticipated**. Given the proximity of the 1957 studio and gallery to the project, vibration impacts may be anticipated. See **Section 8.2.4** of the recommendations on vibration and monitoring. Given the proximity of the 1957 studio and gallery to the project, protection measures should be employed to protect the heritage attribute during construction in order to avoid unanticipated impacts or damage. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.

[6] This HIA refers to this heritage attribute as the “pierced brick low seat wall” for consistency through the report.

Heritage Attribute (By-law L.S.P. – 3367-235)	Discussion of Impacts
Architectural artifacts inside the studio	**No direct or indirect adverse impact anticipated.** The infrastructure improvements do not impact the interior of the studio and gallery. Given the proximity of the 1957 studio and gallery to the project, protection measures should be employed to protect the heritage attribute during construction in order to avoid unanticipated impacts or damage. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.
Several other artifacts around the studio and courtyard where Mr. Aziz had not yet found the place to incorporate them in the building	**No direct or indirect adverse impact anticipated.** Current existing conditions show that there are no artifacts (i.e., remnants of salvaged material like bricks from the early London Street Railway tracks) in the courtyard area that is within the area anticipated to be impacted by the infrastructure improvements. However, there may be artifacts buried or currently obscured. See **Section 8.2** for Special Provisions during construction to prevent unanticipated impacts.
Contextual Reasons	
The rural, “bucolic” atmosphere	**Potential direct adverse impact – Land Disturbance (Grading)** Although there is no change in land use of the property, the grading activities are anticipated to remove a number of mature trees and vegetation along the portion of northern and western boundaries that will be directly impacted by the construction of the new driveway and retaining wall on Philip Aziz Avenue. Based on the Preliminary Design (**Figure 3** and **Appendix A**), a 550m² portion of the Subject Property along the northern boundary will be impacted by grading activities. Of this 550m² portion of the Subject Property, it is proposed that a roughly 107m² section of land along the northern boundary will be permanently acquired by the City of London to accommodate the retaining wall. All the grading activities for the proposed road improvements will remove mature trees and vegetation that contribute to the contextual value of the property as a rural, “bucolic” atmosphere. Therefore, land disturbance along the northern and western portions of the Subject Property is considered an indirect adverse impact. Mitigation is required (see **Section 7** and **Section 8**).

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7. Conservation Strategy

7.1 Mitigation Summary

The Subject Property is currently designated Part IV of the *Ontario Heritage Act* as a property of cultural heritage value or interest under the City of London By-law (By-law L.S.P. – 3367-235). Based on the results of the impact assessment, the proposed infrastructure improvements will alter and affect the following heritage attributes:

- The pierced brick entrance feature that lines the existing driveway
- A portion of the pierced brick low seat wall, which defines the courtyard
- The rural 'bucolic' atmosphere

Based on the direct adverse impacts to heritage attributes of the project, a conservation strategy was created by the AECOM project team for these heritage attributes to ensure the protection of the other heritage attributes and landscape features located within the Subject Property. As such, a site plan (**Figure 4**) and conceptual design (**Figure 5**) were drafted for the project as a way to mitigate the direct adverse impacts in order to conserve the cultural heritage value or interest of the Subject Property.

7.1.1 Conservation Approach

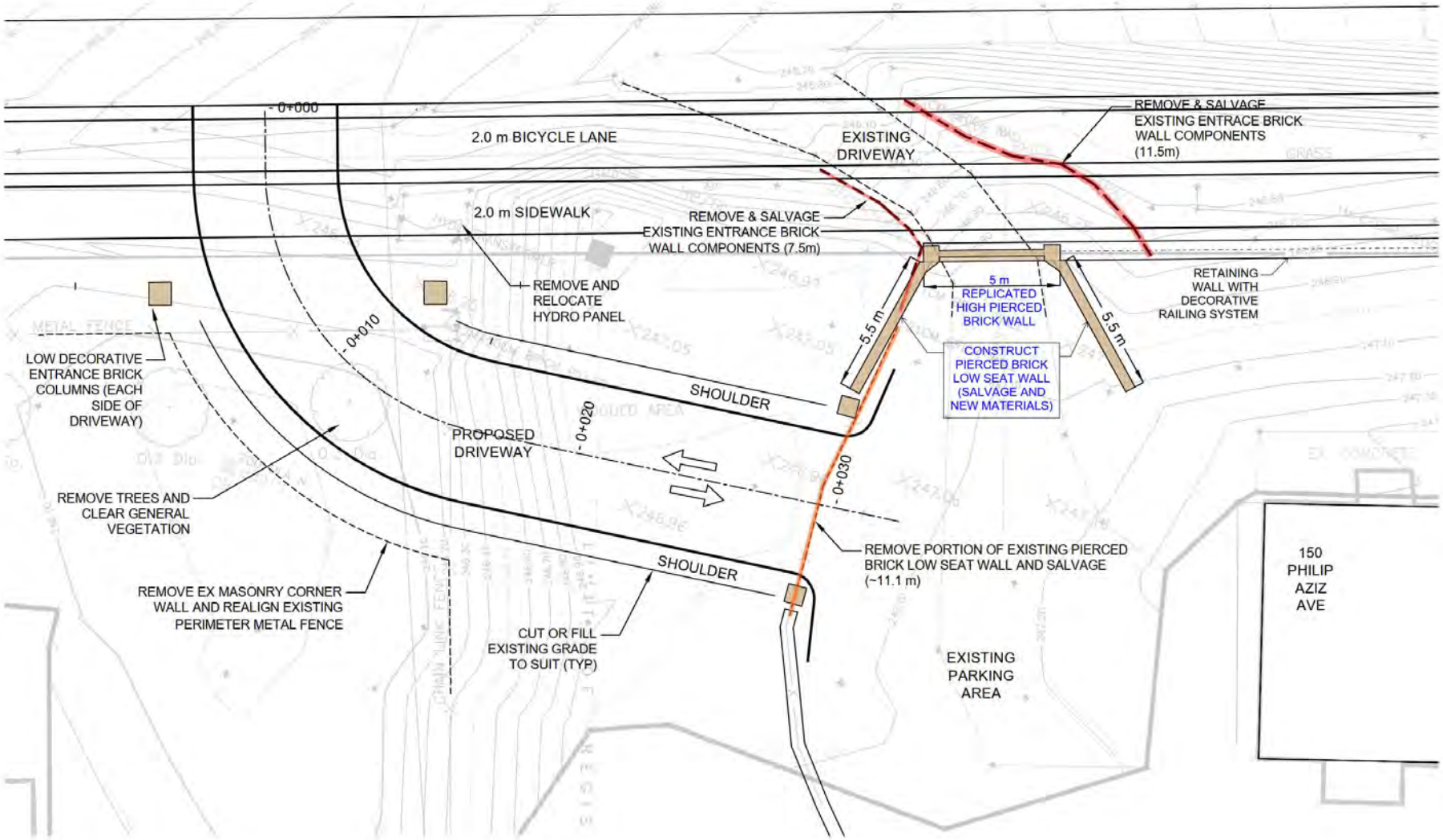
Based on the impact assessment in **Section 6,** and to mitigate the removal of the entire pierced brick entrance feature associated with the existing driveway as well as the 11.1 m section of the pierced brick low seat wall associated with the courtyard, relocation/reconstruction of these heritage attributes is recommended using both salvaged material and sympathetic contemporary materials. **Figure 4** illustrates that new buff brick features will be built using the essential characteristics of the current designs but sympathetically modifying the design to reflect current design, durability, safety and construction standards.

Figure 4 illustrates that four sympathetically designed new low decorative entrance brick columns will be built. The two brick entrance columns will help define the new driveway at the edge of the Philip Aziz Avenue right-of-way and at the top of the property marking the entrance to the courtyard. The brick entrance columns will be stand-alone features approximately 0.6 m to 0.7m in height.

As illustrated within **Figure 4**, a new high pierced brick wall will be constructed across the former entrance driveway and join to two 5.5 m sections of pierced brick low seat wall (constructed from salvaged materials of 11.1 m section of removed pierced brick low seat wall, as well as with new materials as required). This will form a brick fence around the northern boundary of the Subject Property which will conserve the courtyard, a heritage attribute of the Subject Property by maintaining its delineation. The design considerations for the proposed high new high pierced brick wall, the relocated pierced brick low seat wall, and the new low decorative entrance brick columns can be found in **Section 7.2**.

It is important to remember that proposed infrastructure improvements change the character of the Subject Property and as such require further conservation strategies are discussed in **Sections 7.2** to **7.5** to ensure that the impacts are mitigated in a way that minimizes the direct adverse impacts identified in **Table 2**. Furthermore, recommendations in **Section 8.2**, have been proposed to inform the next steps in project planning.

Figure 4: Proposed Site Plan – Philip Aziz Property Section



7.2 Design Consideration of the Proposed New High Pierced Brick Wall

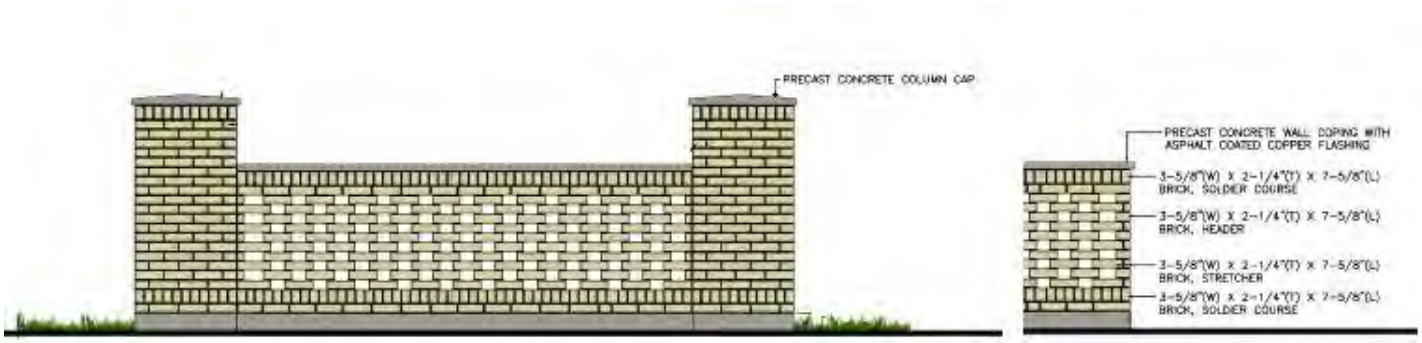
The current brick of the pierced brick entrance feature is in poor condition and the original design has been compromised. The brick is not suitable for reuse in the new structural high pierced brick wall. Furthermore, the arrangement of existing pierced brick entrance feature is not suitable by current structural perspectives. Since direct relocation and reconstruction with replication is not possible, a new high pierced brick wall has been proposed with the original design sympathetically modified to incorporate the essential characteristics into the design. The proposed concept is shown in **Figure 5** below.

The new high pierced brick wall is considered “new work” and should be physically and visually compatible with, subordinate to and distinguishable from the historic place (Parks Canada, Standard 11, pp. 23). New structures should be recognized products of their own time and there should be no blur in distinction between old and new (MCM Infosheet, Guiding Principle 7). **Figure 5** demonstrates a proposed design which is sympathetic and compatible with the existing pierced brick high wall that encloses much of the courtyard near the studio on the south side of the courtyard which will remain *in-situ*. The essential characteristics which have been carried into the proposed design, as shown in **Figure 5**, are:

- The buff brick columns with grey mortar laid in stretcher bond with a course of headers at the top and bottom of the columns.
- The buff brick wall with grey mortar connecting to the columns with stretchers laid in a pierced brick pattern with a course of headers at the top and bottom of the wall.
- Concrete column and wall caps similar to those that are present on the existing pierced brick high wall that encloses much of the south side of the courtyard near the studio

Therefore, although the concept does not show an exact replication of the existing pierced brick entrance feature or its reconstruction along the new driveway as an entrance wall, it will be mitigated through commemoration in the design of the new high pierced brick wall along the top of the former driveway entrance and will redefine the courtyard, a heritage attribute of the property.

Figure 5: Proposed Conceptual Design of the New High Pierced Brick Wall and Column



7.3 Design Considerations for the Relocated Pierced Brick Low Seat Wall

Figure 5 shows that the removed section of the 11.1 m of the pierced brick low seat wall will be relocated to each side of the new high pierced brick wall (5.5 m on each side). The existing pierced brick low seat wall will be removed and reconstructed as close as possible to the current configuration of the seat wall. The relocation and reconstruction will use salvaged brick from the relocated seat wall and from the brick salvaged from the pierced brick entrance feature. The stone caps/seats will also be salvaged and reinstated. It is understood the replication will include the pierced brick pattern which follows the alternating pattern of a double width of buff brick stretchers laid in a pierced brick pattern. The foundation will also be sympathetic to the existing pierced brick walls with a row of headers along the bottom of the low seat wall. The following mitigation measures should be considered in the reconstruction of the pierced brick low seat wall:

- If cleaning is required of the salvaged brick after removal, then use the gentlest means possible (i.e., no abrasive methods, no sandblasting). Low-pressure water clean with a soft natural bristle brush is recommended.
- Use mortar with similar colour and characteristics to the existing gray mortar.
- If it is determined in the Pre-conditions Assessment (see **Section 8.2**) that there is not enough salvaged brick or stone due to deterioration to build the new low seat wall, replacement material must be similar in form, material, and detailing, preferably from the same source used for the new high wall.
- Consult with the City of London Heritage Planner if any new additions are planned to ensure that new additions do not conflict with the existing architectural feature.

7.4 Design Considerations for the Proposed New Low Decorative Entrance Brick Columns

The proposed new low decorative entrance brick columns will be designed to respect and remain sympathetic to the heritage character of the property and the existing brick fence around that courtyard that will remain *in situ*. The columns are considered new additions to the property and will use new materials. The current brick of the pierced brick entrance feature is in poor condition and is not suitable for reuse in structural columns.

The new low decorative entrance brick columns are considered “new work” and should be physically and visually compatible with, subordinate to and distinguishable from the historic place (Parks Canada, Standard 11, pp. 23). New structures should be recognized products of their own time and there should be no blur in distinction between old and new (MCM Infosheet, Guiding Principle 7). The columns will be designed to be approximately 0.6 m to 0.7m in height and although stand-alone, they will be designed the same as the columns shown in **Figure 5** for the new high wall. This demonstrates the proposed design is sympathetic and compatible with the existing pierced brick high wall that encloses much of the courtyard at the south end near the studio which will remain *in-situ*. The essential characteristics which have been carried into the proposed design, as shown in **Figure 5**, are:

- The buff brick columns laid in stretcher bond with a course of headers at the top and bottom of the columns.
- Concrete column caps are present on the existing pierced brick high wall that encloses much of the south side of the courtyard near the studio.

Therefore, although the proposed new columns do not replicate the existing pierced brick entrance feature, the proposal for new buff brick columns along the new driveway will continue to define the entrance to the property which

mitigates the removal of the existing pierced brick entrance feature, a heritage attribute, while conserving the cultural heritage value of the property.

7.5 Landscape Considerations

7.5.1 Vegetation

Where possible, the vegetative screening should be preserved along the northern and western boundaries of the Subject Property. If possible, new vegetative screening (i.e., trees and shrubbery) post-construction is recommended in a Landscape Plan in order to re-instate the screening of the property from the surrounding urban landscape (i.e., public right-of-way and the adjacent property). Vegetative screening helps conserve the contextual value of the Subject Property as having a rural 'bucolic" atmosphere.

7.5.2 Retaining Wall

The retaining wall will be situated on the edge of the right-of-way to the immediate north of the Subject Property (**Figure 3**). The preliminary design proposed a retaining wall designed as a cantilever soldier pile wall with concrete caisson foundations, varying in height from 1.5 m to 2.5 m. For the portion of the retaining wall that will not be protected by the pierced brick wall, a railing will need to be installed at the top of the retaining wall to prevent the public from potential falls and injuries. Therefore, **Figure 4** shows a decorative metal fence at the top of the retaining wall on the northern boundary of the Subject Property as a way prevent falls and injuries, but also appeals to the aesthetic characteristic of the property.

8. Conclusions and Recommended Next Steps

8.1 Conclusions

The Subject Property is currently designated Part IV of the *Ontario Heritage Act* as a property of cultural heritage value or interest under the City of London By-law (By-law L.S.P. – 3367-235). Based on the results of the impact assessment, the project will result in alteration of the property by the removal of the existing driveway and its associated pierced brick entrance feature, by the removal of a portion of the pierced brick low seat wall that defines the courtyard. Both brick features are heritage attributes of the property. The project will also remove a number of mature trees and brush located along the northern and western boundary of the Subject Property, which helps screen the property from the surrounding institutional environment of Western University. Removing the screening material impacts the contextual value of the property. As such, a site plan and conceptual design were drafted for the project as a way to mitigate the direct adverse impacts in order to conserve the cultural heritage value or interest of the Subject Property. In addition, given the proximity of the 1875 Ontario farmhouse and the 1957 studio and gallery to the proposed infrastructure improvements, there may be indirect adverse impacts from the project in the form of vibration.

Based on the impact assessment and conservation strategies, the following recommendations have been made to help inform the next steps in project planning:

8.2 Recommended Next Steps

8.2.1 Pre-Conditions Assessment

Pre-Conditions Assessment is required by both the detailed design consultant and the Contractor during construction. Therefore, the Pre-Conditions Assessment will be completed in two phases.

Prior to the tendering of the project, the detailed design consultant shall provide Phase 1 of the Pre-Conditions Assessment. The assessment should include documentation and assessment of conditions to review general constraints. The objective of the review shall inform the construction level drawings on how to best incorporate the new pierced brick high wall with the pierced brick low seat wall. This involves the following:

- A survey and verification of all dimensions and design details of the brickwork for the pierced brick entrance feature and the pierced brick low seat wall.
- Determine the portions of the pierced brick low seat wall that can remain *in-situ*.
- Determine if the bricks from the early London Street Railway tracks are still present within the courtyard space.

During construction, the Contractor shall provide Phase 2 of the Pre-Conditions Assessment. The Contractor shall complete an assessment with a Qualified Mason of the pierced brick entrance feature and the pierced brick low seat wall. The Pre-Conditions Assessment report should include, but is not limited to the following:

- Determine salvageable items from the impacted brick features (the existing pierced brick entrance feature and a portion of the pierced brick low seat wall), that can be incorporated into the new pierced brick low seat wall (i.e., stone, and buff brick). Determine the quantity of salvageable material to reconstruct the relocated pierced brick low seat wall.

- If during the Pre-conditions Assessment determines the original material as too deteriorated for reuse/repair and new material is required for the construction of the new pierced brick low seat wall, the Special Provisions should include the sourcing for all new material (refer to Section 8.2.2 on Special Provisions).

The results of the Pre-conditions Assessment should be reviewed by a qualified heritage professional and/or the City of London Heritage Planner, Kyle Gonyou, prior to commencing the construction level drawings.

8.2.2 Construction Level Drawings and Special Provisions

The Detailed Design for the road improvements shall include the construction level drawings of the new entrance columns, the new pierced brick high wall with the pierced brick low seat wall and how these features are integrated with the property. This step is dependent on the results of the Pre-Conditions Assessment. The key characteristics summarized in **Section 7.2 to 7.4** should be carried into the construction level drawings.

The Detailed Design should also include a Landscape Plan which considers the reinstatement of vegetative screening and a decorative railing system along the northern boundary. See **Section 7.5** for further details on the design and landscape considerations.

The Contractor is required to retain a Qualified Person experienced in heritage renovations to complete the construction level drawings and Special Provisions. The Contractor should review this HIA, paying specific attention to the design and landscape consideration. Special Provisions shall consider the following:

- Written instructions on how to structurally stabilize and protect the pierced brick low seat wall that will remain *in situ* during demolition of the portion to be removed.
- A demolition plan for the removal of the pierced brick entrance feature and the partial removal of the pierced brick low seat wall. This includes the methodology for the removal and storage of the salvageable material.
- A protection plan to ensure other remaining heritage attributes or landscape features of the Subject Property (i.e., the circa 1875 one-and-a-half storey house and the 1957 art studio and gallery) will not be negatively impacted during construction. This plan should include the establishment of a “no-go” buffer (minimum 1 metre from the exterior of the buildings or features) for the remainder of the Subject Property and how those zones will be protected (i.e., temporary construction fencing).
- Determine the source of new material for the pierced brick high wall and the pierced brick low seat wall if required. The new material should be similar in form, material and detailing to the existing (i.e. buff brick and stone). Consider procuring salvaged buff brick from another location in London before using newly manufactured brick.
- The contractor is responsible for monitoring during construction for artifacts around the studio and the courtyard.

8.2.3 Approvals Process

Given the Subject Property is designated under Part IV of the *Ontario Heritage Act* and the proposed infrastructure improvements will alter and affect heritage attributes of the property, the following approvals are required for this project, prior to any construction related activities:

1. Consult with the Property Owner on the proposed conservation strategy.
2. Complete a Heritage Alteration Permit, pursuant to Section 33 of the *Ontario Heritage Act.* Section 33 of the *Ontario Heritage Act* outlines the process under which proposed alterations, demolition, or removal of properties designated under Part IV must follow, including the statutory process for appeals.

3. The recommendations made by CACP on the Heritage Alteration Permit application will be presented at the PEC monthly meeting.
4. City Council considers CACP recommendation and makes a decision on approval of the Heritage Alteration Permit.

8.2.4 Vibration Impacts and Monitoring

Evaluation of impacts related to vibration activities requires an assessment based on the identification of specific construction methods proposed, the distance between the sensitive receptor (i.e., a cultural heritage resource) and the construction activity, and anticipated vibration levels (mm/s). Therefore, given the proximity to the 1875 Ontario farmhouse and the 1957 studio and gallery located within 150 Philip Aziz Avenue, to the proposed Western Road and Sarnia Road/Philip Aziz Avenue Infrastructure Improvements, it is possible that vibration limits may be exceeded from mechanical vibration. Prior to construction, determine if the buildings within 150 Philip Aziz Avenue are susceptible to vibration impacts by documenting the structural condition of the buildings to determine if it is vulnerable to vibration impacts from the project. Should this vibration assessment determine that the buildings will be adversely impacted by vibration, a vibration monitoring plan should be prepared and implemented.

9. Sources

Primary and Secondary Sources:

AECOM

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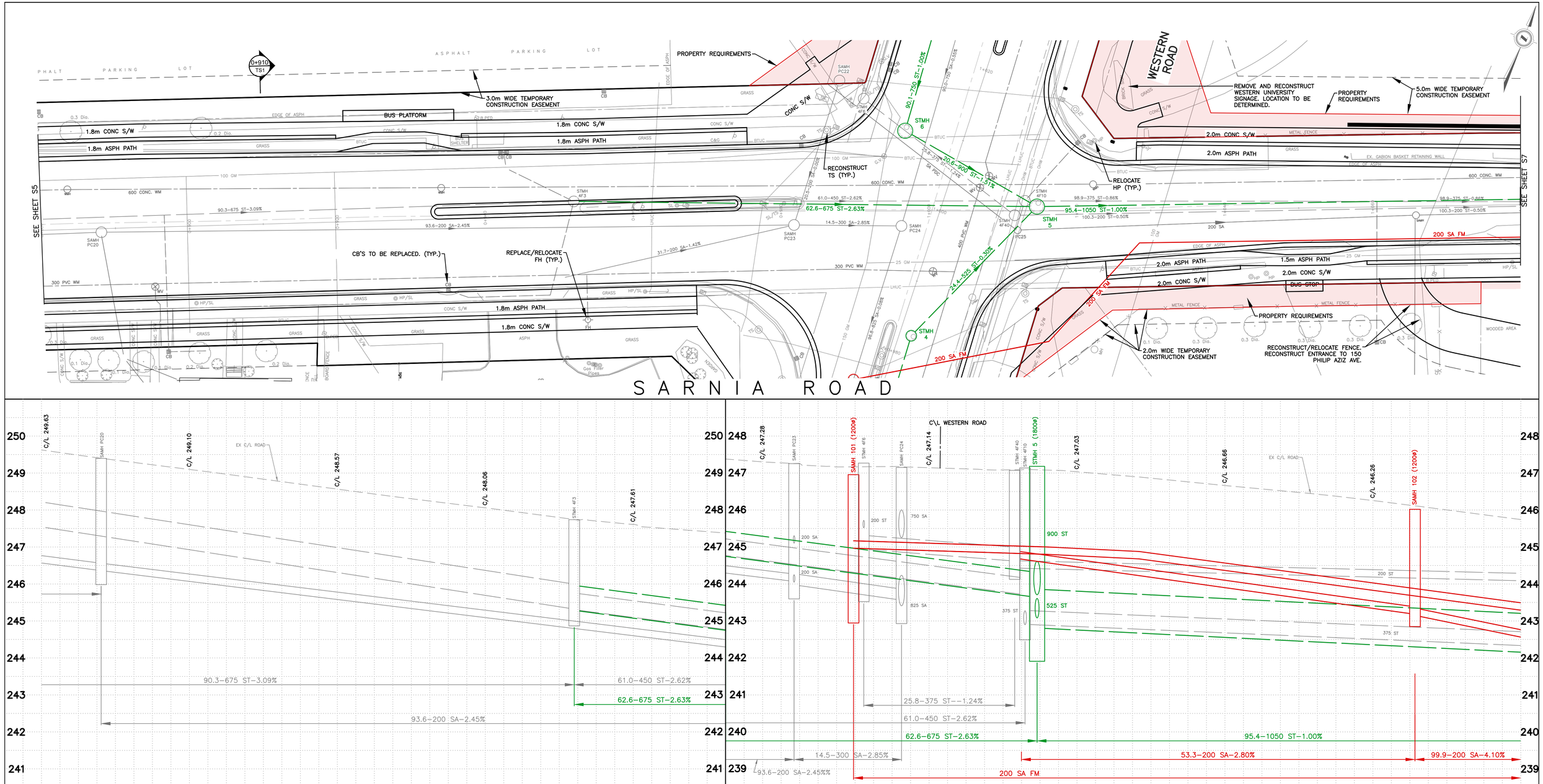
Appendix A

Select Preliminary Design



PRELIMINARY

STATION	0+880	0+888.08	0+900	0+920	0+940	0+952.04	0+960	0+980	0+981.77	0+974.78	1+011.18	0+996.43	1+000	1+002.59	1+004.88	1+004.65	1+020	1+040	1+060	1+080
C/L WATERMAIN ELEVATION																				
STORM SEWER INVERT						245.31E 245.31W 245.32W					245.52N 244.94E				242.91OE 242.91OW 243.684SW 243.638W	242.91E 243.71W 242.90S				
SANITARY SEWER INVERT		246.35E 246.35W						243.98E 244.01W 244.05W 245.10N		243.39S 244.28NE 243.35N		243.41S 243.56W 245.23N							243.18W 243.151E	

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	
DRAWN BY	MDB/JMP
CHECKED	DCC
APPROVED	
DATE	OCT. 2022

No.	REVISIONS	DATE	CONSULTANT

CONSULTANT OR DIVISION

AECOM
London, Ontario
519.673.0510

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CORPORATION OF THE CITY OF LONDON
London CANADA

SCALE
HORIZONTAL – 1:250
2.5 0 5m
VERTICAL – 1:50
0.5 0 1m

WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

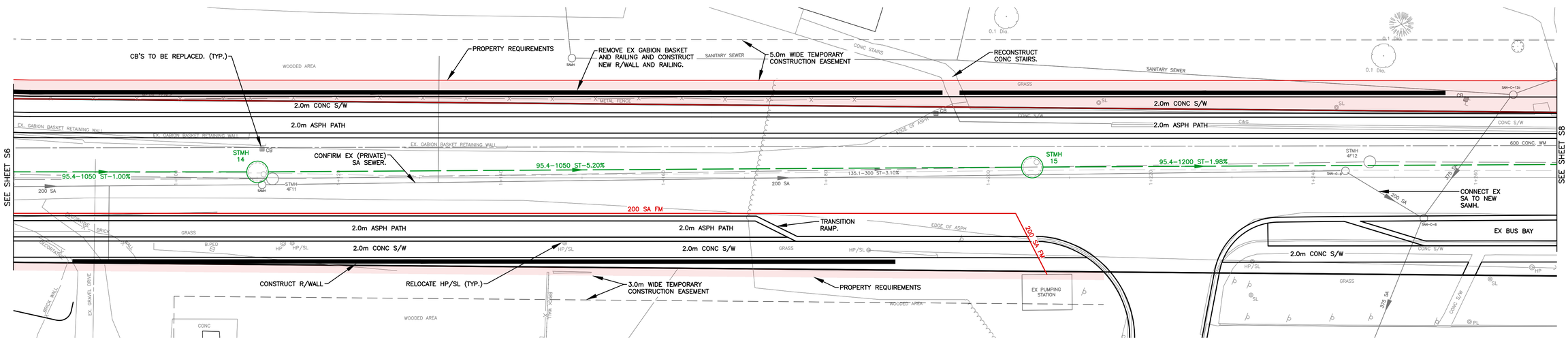
SARNIA ROAD / PHILIP AZIZ AVENUE

FROM STA 0+880 TO STA 1+080

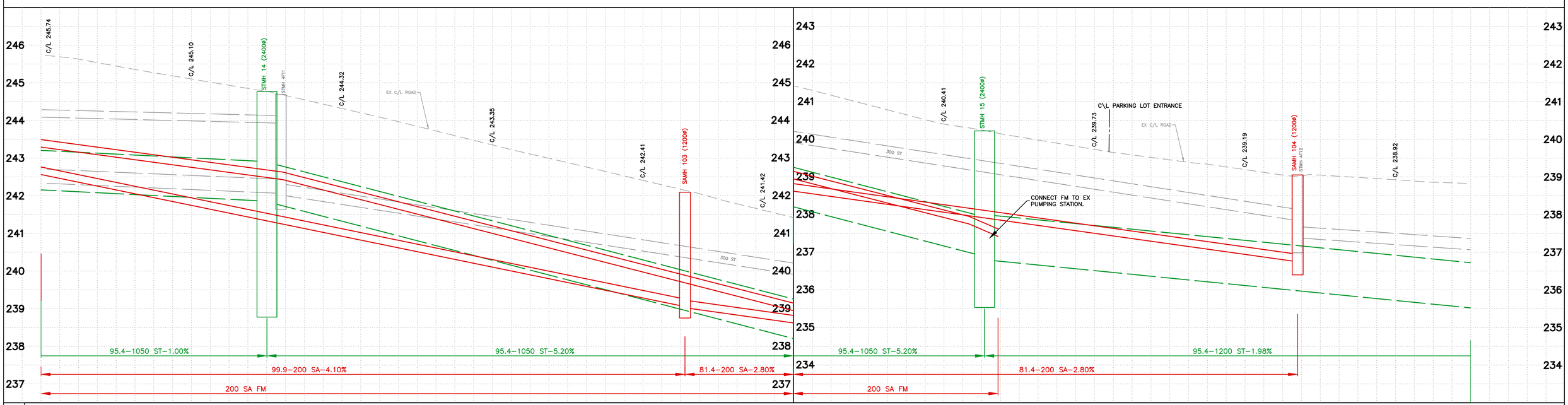
PROJECT No. 60661402

SHEET No. S6

PLAN FILE No.



PHILIP AZIZ AVENUE



PRELIMINARY

C/L WATERMAIN ELEVATION																						
STORM SEWER INVERT							241.842E 241.835W											236.800E 236.835W				
SANITARY SEWER INVERT													239.055W 239.025E								236.745W	
STATION	1+080		1+100		1+110.05	1+111.89		1+120		1+140		1+160		1+180		1+200	1+205.42		1+220		1+240	1+246.96	1+260	1+280

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION

DETAILS		No.	REVISIONS	DATE	CONSULTANT
DESIGN					
DRAWN BY	MDB/JMP				
CHECKED	DCC				
APPROVED					
DATE	OCT. 2022				

CONSULTANT OR DIVISION

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SCALE
HORIZONTAL – 1:250
2.5 0 5m
VERTICAL – 1:50
0.5 0 1m

WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

PHILIP AZIZ AVENUE

FROM STA 1+080 TO STA 1+270

PROJECT No. 60661402

SHEET No. S7

PLAN FILE No.

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Appendix B

B.4 Stage 1 Archaeological Assessment

Environment

City of London

Stage 1 Archaeological Assessment

Western Road and Sarnia Road/Philip Aziz Avenue Improvements
Part of Lots 17 & 18, Concessions II & III, Geographic Township of London, now City of London, Middlesex County, Ontario

Licensee: **Samantha Markham**

License: **P438**

PIF Number: **P438-0022-2015**

Prepared by:

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Project Number:

60339161

Date:

July 31, 2015
ORIGINAL REPORT

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
	yes	City of London
	yes	Ontario Ministry of Tourism, Culture and Sport
	yes	AECOM

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

AECOM Signatures

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Professional Archaeologist

Report Reviewed By:

Adria Grant, BA, CAHP
Senior Archaeologist, Archaeology Practice Lead

Executive Summary

AECOM Canada Ltd. (AECOM) was contracted by the City of London to conduct the required Stage 1 archaeological assessment for proposed road improvements within a corridor 80 metres (m) wide along Western Road, from the junction at Platts Lane north to Burnlea Walk on the University of Western Ontario campus, and an 80 m corridor along Sarnia Road/Philip Aziz Avenue (Ave) from the Thames River southwest to just past Kininvie Drive. The study area also includes Brescia Lane, Ramsay Road and Kininvie Drive residential areas. The study area is legally described as part of Lots 17 and 18, Concessions II and III, Geographic Township of London, now the City of London, Middlesex County, Ontario (Figures 1 and 2).

The Stage 1 archaeological assessment was conducted as part of a Municipal Class Environmental Assessment Schedule C during the planning stage of the project and was triggered by the requirements of the *Environmental Assessment Act* (Ontario Government 1990a). This project is also subject to the *Ontario Heritage Act* (Ontario Government 1990b).

The Stage 1 archaeological assessment of the 80 m corridor of Western Road and Sarnia/Philip Aziz Avenue in the City of London was conducted between March 4 and April 30, 2015 under PIF number P438-0022-2015 issued to Samantha Markham of AECOM.

The evaluation of archaeological potential has resulted in the determination that there is high potential for the recovery of both First Nations and Euro-Canadian archaeological resources within undisturbed parts of study area. Due to extensive urban development the majority of the study area has been extensively disturbed; however, there are a number of small sections of manicured lawn or other green space where archaeological integrity could remain intact and the potential for the recovery of archaeological resources in these areas is high (Figure 6). The Philip Aziz Property is listed on the Canadian Register of Historic Places, and the proximity of the property, and the other historic buildings listed on the City of London Heritage Resources Inventory (2006), to the study area increases the potential of Euro-Canadian archaeological remains. **Stage 2 archaeological assessment is recommended for any impacts that are planned on undisturbed land (see** Figure **6).**

The Stage 2 archaeological assessment must be conducted by a licensed archaeologist and must follow the requirements set out in the *Standards and Guidelines for Consultant Archaeologists* (Ontario Government 2011), including:

- Test pit survey at 5 m intervals in all areas that will be impacted by the project and where ploughing is not possible (e.g., woodlots, overgrown areas, manicured lawns);
- Poorly drained areas, areas of steep slope and areas of previous disturbance (e.g., pipelines, railways, road ROWs, buildings) are to be mapped and photo-documented, but are not recommended for Stage 2 survey as they possess low to no archaeological potential.

Should deeply buried sites be discovered, a Stage 2 assessment will be conducted according to the standards appropriate for survey in deeply buried conditions as per Section 2.1.7 in the Ministry of Tourism, Culture and Sport's *Standards and Guidelines for Consultant Archaeologists* (Ontario Government 2011).

The Ministry of Tourism, Culture and Sport is asked to accept this report into the Ontario Public Register of Archaeological Reports thereby concurring with the recommendations presented herein. As further archaeological assessments are required, archaeological concerns under land use planning and development processes have not fully been addressed.

Project Personnel

Project Manager	Antony Fediw, Manager of Transportation, AECOM
Technical Lead	Adria Grant, BA, CAHP (R131), Archaeology Practice Lead
Licensed Archaeologist	Samantha Markham, MES (P438)
Report Production	Samantha Markham, MES (P438)
Office Assistance	Jennifer Brennan
GIS Analyst	Paul Adams
Senior Review	Adria Grant, BA, CAHP (R131)

Acknowledgements

Proponent Contact	Karl Grabowski, P. Eng, Transportation Design Engineer, City of London
Approval Authority	TBD, Ministry of Environment
Ministry of Tourism, Culture and Sport	Robert von Bitter, Archaeological Data Coordinator

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Project Personnel

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1. Project Context

1.1 Development Context

AECOM Canada Ltd. (AECOM) was contracted by the City of London to conduct the required Stage 1 archaeological assessment for proposed road improvements within a corridor 80 metres (m) wide along Western Road, from the junction at Platts Lane north to Burnlea Walk on the University of Western Ontario campus, and an 80 m corridor along Sarnia Road/Philip Aziz Avenue (Ave) from the Thames River southwest to just past Kininvie Drive. The study area also includes Brescia Lane, Ramsay Road and Kininvie Drive residential areas. The study area is legally described as part of Lots 17 and 18, Concessions II and III, Geographic Township of London, now the City of London, Middlesex County, Ontario (Figures 1 and 2).

The Stage 1 archaeological assessment was conducted as part of a Municipal Class Environmental Assessment Schedule C during the planning stage of the project and was triggered by the requirements of the *Environmental Assessment Act* (Ontario Government 1990a). This project is also subject to the *Ontario Heritage Act* (Ontario Government 1990b).

The Stage 1 archaeological assessment of the 80 m corridor of Western Road and Sarnia/Philip Aziz Avenue in the City of London was conducted between March 4 and April 30, 2015 under PIF number P438-0022-2015 issued to Samantha Markham of AECOM.

1.1.1 Objectives

The Stage 1 archaeological assessment has been conducted to meet the requirements of the MTCS's *Standards and Guidelines for Consultant Archaeologists* (Ontario Government 2011). The Stage 1 research information is drawn from:

- MTCS's Archaeological Sites Database (ASDB) for a listing of registered archaeological sites within a 1 kilometre (km) radius of the study area;
- Reports of previous archaeological assessment within 50 m of the study area;
- Recent and historical maps of the study areas; and
- Archaeological management plans or other archaeological potential mapping, where available

The objective of the Stage 1 background study is to document the archaeological and land use history and present conditions within the study area. This information will be used to support recommendations regarding cultural heritage value or interest as well as assessment and mitigation strategies.

1.2 Historical Context

Previous archaeological research and surveys have led to a thorough understanding of past settlement practices in this portion of the province. The following sections provide a background of the land use history of Middlesex County including the City of London.

1.2.1 Pre-Contact Aboriginal Settlement

It has been demonstrated that pre-contact First Nation people began occupying Middlesex County as the glaciers receded from the land, as early as 11,000 B.C. Table 1 provides a breakdown of the cultural and temporal history of the past occupations in the City of London.

Table 1: Cultural Chronology for the City of London

Archaeological Period	Characteristics	Time Period	Comments
Early Paleo	Fluted Points	9000-8400 BC	Arctic tundra and spruce parkland, caribou hunters
Late Paleo	Holcombe, Hi-Lo and Lanceolate Points	8400-8000 BC	Slight reduction in territory size
Early Archaic	Notched and Bifurcate base Points	8000-6000 BC	Growing populations
Middle Archaic	Stemmed and Brewerton Points, Laurentian Development	6000-2500 BC	Increasing regionalization
Late Archaic	Narrow Point	2000-1800 BC	Environment similar to present
	Broad Point	1800-1500 BC	Large lithic tools
	Small Point	1500-1100 BC	Introduction of bow
Terminal Archaic	Hind Points, Glacial Kame Complex	1100-950 BC	Earliest true cemeteries
Early Woodland	Meadowood Points	950-400 BC	Introduction of pottery
Middle Woodland	Dentate/Pseudo-scallop Ceramics	400 BC – AD 500	Increased sedentism
	Princess Point	AD 550-900	Introduction of corn horticulture
Late Woodland	Early Ontario Iroquoian	AD 900-1300	Agricultural villages
	Middle Ontario Iroquoian	AD 1300-1400	Increased longhouse sizes
	Late Ontario Iroquoian	AD 1400-1650	Warring nations and displacement
Contact Aboriginal	Various Algonkian and Iroquoian Groups	AD 1600-1875	Early written records and treaties
Historic	French and English Euro-Canadian	AD 1749-present	European settlement

Note: taken from Ellis and Ferris, 1990

As Chapman and Putnam (1984) illustrate, the modern physiography of southern Ontario is largely a product of events of the last major glacial stage and the landscape is a complex mosaic of features and deposits produced during the last series of glacial retreats and advances prior to the withdrawal of the continental glaciers from the area. Southwestern Ontario was finally ice free by approximately 12,500 years ago. With continuing ice retreat and lake regressions the land area of southern Ontario progressively increased while barriers to the influx of plants and animals steadily diminished (Karrow and Warner 1990).

The first human settlement can be traced back 11,000 years; these earliest well-documented groups are referred to as Paleo which literally translates to old or ancient. Paleo period people were non-agriculturalists who depended on hunting and gathering of wild food stuffs, they would have moved their encampments on a regular basis to be in the locations where these resources naturally became available and the size of the groups occupying any particular location would vary depending on the nature and size of the available food resources (Ellis and Deller 1990). The picture that has emerged for early and late Paleo people is of groups at low population densities who were residentially mobile and made use of large territories during annual cycles of resource exploitation (Ellis and Deller 1990).

The next major cultural period following the Paleo is termed the Archaic, which is broken temporally into the Early, Middle and Late. There is much debate on how the term Archaic is employed; general practice bases the designation off assemblage content as there are marked differences in artifact suites from the preceding Paleo and subsequent Woodland periods. As Ellis et al (1990) note, from an artifact and site characteristic perspective the Archaic is simply used to refer to non-Paleo manifestations that pre-date the introduction of ceramics. Throughout

the Archaic period the natural environment warmed and vegetation changed from closed conifer-dominated vegetation cover, to mixed coniferous and deciduous forest to the mixed coniferous and deciduous forest in the north and deciduous vegetation in the south we see in Ontario today (Ellis et al 1900). During the Archaic period there are indications of increasing populations and decreasing size of territories exploited during annual rounds; fewer moves of residential camps throughout the year and longer occupations at seasonal campsites; continuous use of certain locations on a seasonal basis over many years; increasing attention to ritual associated with the deceased; and, long range exchange and trade systems for the purpose of obtaining valued and geographically localized resources (Ellis et al 1990).

In the 17th century two major language families, Algonquian and Iroquoian were represented by the diverse people of North America. Iroquoian speaking people were found in southern Ontario and New York State, with related dialects spoken in the mid-Atlantic and interior North Carolina, while Algonquian speaking peoples were located along the mid-Atlantic coast into the Maritimes, throughout the Canadian Shield of Ontario and Quebec and much of the central Great Lakes region (Ellis et al 1990). Linguists and anthropologists have attempted to trace the origin and development of these two language groups and usually place their genesis during the Archaic (Ellis et al 1990).

The Early Woodland period is distinguished from the Late Archaic period primarily by the addition of ceramic technology, which provides a useful demarcation point for archaeologists but is expected to have made less difference in the lives of the Early Woodland peoples. The settlement and subsistence patterns of Early Woodland people shows much continuity with the earlier Archaic with seasonal camps occupied to exploit specific natural resources (Spence et al 1990). During the Middle Woodland well-defined territories containing several key environmental zones were exploited over the yearly subsistence cycle. Large sites with structures and substantial middens appear in the Middle Woodland associated with spring macro-band occupations focussed on utilizing fish resources and created by consistent returns to the same site (Spence et al 1990). Groups would come together into large macro-bands during the spring-summer at lakeshore or marshland areas to take advantage of spawning fish; in the fall inland sand plains and river valleys were occupied for deer and nut harvesting and groups split into small micro-bands for winter survival (Spence et al 1990). This is a departure from earlier Woodland times when macro-band aggregation is thought to have taken place in the winter (Ellis et al 1988; Granger 1978).

The period between the Middle and Late Woodland period was both technically and socially transitional for the ethnically diverse populations of southern Ontario and these developments laid the basis for the emergence of settled villages and agriculturally based lifestyles (Fox 1990). The Late Woodland period began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture. Corn may have been introduced into southwestern Ontario from the American Midwest as early as 600 A.D. However, it did not become a dietary staple until at least three to four hundred years later. The first agricultural villages in southwestern Ontario date to the 10th century A.D. Unlike the riverine base camps of the Middle Woodland period, these sites are located in the uplands, on well-drained sandy soils. Categorized as "Early Ontario Iroquoian" (900-1300 A.D.), many archaeologists believe that it is possible to trace a direct line from the Iroquoian groups which inhabited southwestern Ontario at the time of first European contact, to these early villagers.

Village sites dating between 900 and 1300 A.D., share many attributes with the historically reported Iroquoian sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were actually not all that large, averaging only 12.4 metres (m) in length. It is also quite common to find the outlines of overlapping house structures, suggesting that these villages were occupied long enough to necessitate re-building. The Jesuits reported that the Huron moved their villages once every 10-15 years, when the nearby soils had been depleted by farming and conveniently collected firewood grew scarce. It seems likely that Early Ontario Iroquoians occupied their villages for considerably longer, as they relied less heavily on corn than did later groups, and their villages were much smaller, placing less demand on nearby resources.

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the Early Ontario Iroquoian economy. However, it had not reached the level of importance it would in the Middle and Late Ontario Iroquoian periods. There is ample evidence to suggest that more traditional resources continued to be exploited, and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities, have all been identified. While beans are known to have been cultivated later in the Late Woodland period, they have yet to be identified on Early Ontario Iroquoian sites. There are 20 sites which have been assigned to the Early Ontario Iroquoian period within the City of London. None of these sites are located within the limits of the study area.
The Middle Ontario Iroquoian period (1300-1400 A.D.) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 hectares in extent during the Early Ontario Iroquoian period, now consistently range between one and two hectares.

House lengths also change dramatically, more than doubling to an average of 30 metres, while houses of up to 45 metres have been documented. This radical increase in longhouse length has been variously interpreted. The simplest possibility is that increased house length is the result of a gradual, natural increase in population. However, this does not account for the sudden shift in longhouse lengths around 1300 A.D. Other possible explanations involve changes in economic and socio-political organization. One suggestion is that during the Middle Ontario Iroquoian period small villages were amalgamating to form larger communities for mutual defense. If this was the case, the more successful military leaders may have been able to absorb some of the smaller family groups into their households, thereby requiring longer structures. This hypothesis draws support from the fact that some sites had up to seven rows of palisades, indicating at least an occasional need for strong defensive measures. There are, however, other Middle Ontario Iroquoian villages which had no palisades present. Another researcher has suggested that the longest houses may be associated with families that were more successful in trade and other forms of economic activity. More research is required to evaluate these competing interpretations.

The lay-out of houses within villages also changes dramatically by 1300 A.D. During the Early Ontario Iroquoian period villages were haphazardly planned at best, with houses oriented in various directions. During the Middle Ontario Iroquoian period villages are organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses. It has been suggested that this change in village organization may indicate the initial development of the clans which were a characteristic of the historically known Iroquoian peoples. There are three documented Middle Ontario Iroquoian sites in London, all of which are located along the western edge of the City in Byron and Oakridge.

Initially at least, the Late Ontario Iroquoian period (1400-1650 A.D.) continues many of the trends which have been documented for the proceeding century. For instance, between 1400 and 1450 A.D. house lengths continue to grow, reaching an average length of 62 metres. One longhouse excavated on a site southwest of Kitchener stretched an incredible 123 metres. After 1450 A.D., house lengths begin to decrease, with houses dating between 1500-1580 A.D. averaging only 30 metres in length. Why house lengths decrease after 1450 A.D. is poorly understood, although it is believed that the even shorter houses witnessed on historic period sites can be at least partially attributed to the population reductions associated with the introduction of European diseases such as smallpox.

Village size also continues to expand throughout the Late Ontario Iroquoian period, with many of the larger villages showing signs of periodic expansions. The Late Middle Ontario Iroquoian period and the first century of the Late Ontario Iroquoian period was a time of village amalgamation. One large village situated just north of Toronto has been shown to have expanded on no fewer than five occasions. These large villages were often heavily defended

with numerous rows of wooden palisades, suggesting that defence may have been one of the rationales for smaller groups banding together.

Late Ontario Iroquoian village expansion has been clearly documented in the London area. The ongoing excavations at the Lawson site, a large Late Iroquoian village located on the grounds of the Museum of Ontario Archaeology, has shown that the original village was expanded by at least twenty percent to accommodate the construction of nine additional longhouses. The London area was densely occupied by the Late Ontario Iroquoians until approximately 1525 A.D.

Archaeologists are able to trace archaeologically known groups from this time period to the historically documented people identified when French fur traders first arrived (Wright 1994). The Ontario Iroquois from southern Ontario gave rise to the Huron, Petun, Neutral and Erie; the St. Lawrence Iroquois, a distinct population encountered by Jaques Cartier in 1535 that had disappeared by the time Samuel de Champlain returned to the same area in 1603; and from northern Ontario the groups that gave rise to the Algonquian speaking Cree, Ojibwa and Algonquin people (Wright 1994).

During the late 1600's and early 1700's, the French explorers and missionaries reported a large population of Iroquoian peoples clustered around the western end of Lake Ontario. They called these people the "Neutral", because they were not involved in the ongoing wars between the Huron and the League Iroquois located in upper New York State. It has been satisfactorily demonstrated that the Late Ontario Iroquoian communities which were located in the London area were ancestral to at least some of the Neutral Nation groups. For this reason the Late Ontario Iroquoian groups which occupied southwestern Ontario prior to the arrival of the French are often identified as "Pre-contact Neutral".

In addition to the Iroquoian people in the City of London area a distinct cultural occupation was present during the Late Woodland in the western-most corner of southern Ontario in the modern counties of Kent, Essex and Lambton as well as portions of Middlesex and west Elgin. This cultural manifestation is classified as Western Basin Tradition and has also been observed in south-eastern Michigan and north-western Ohio. The inhabitants of these communities are considered distinct from Iroquoian groups to the east and Mississipian to the south. In recent years research has indicated that there was more variability in settlement-subsistence patterns within Western Basin Tradition groups than previously thought, the most surprising being evidence of significant maize consumption (Watts et al 2011). Western Basin Tradition people had previously been thought to maintain seasonal hunting and gathering cycles and non-sedentary lifestyles and much evidence has been recorded from seasonal occupation sites (Murphy and Ferris 1990); however, recent research in the Arkona area of Lambton County has uncovered large agriculturally based villages (Golder 2012). We now understand the Western Basin Tradition as Late Woodland people who combined seasonal hunting and gathering along with maize horticulture who lived in short-term camps, large palisaded villages and everything in between. The radical changes that agricultural practice brought to the Early Ontario Iroquoian people living to the east did not have the same impact on settlement-subsistence patterns in the Western Basin Tradition.

1.2.2 Post-Contact Aboriginal and Euro-Canadian Settlement

The post-contact Aboriginal occupation of southern Ontario was heavily influenced by the dispersal of Iroquoian speaking peoples, such as the Huron, Petun and Neutral by the New York State Confederacy of Iroquois. This dispersal was followed by the arrival of the Mississaugas, an Alonquian speaking people, who are known to have moved into southern Ontario and the Great Lakes watersheds (Konrad 1981), while at the same time the members of the Three Fires Confederacy, the Chippewa, Ottawa and Potawatomi were immigrating from Ohio and Michigan (Feest and Feest 1978). This is the situation as recorded by European visitors and is a reflection of what was found upon their arrival. In the long history of First Nations people before Europeans began recording there were

significant population movements back and forth, for example the Chippewa, Ottawa and Potawatomi were immigrating from Ohio and Michigan at the time but had previously left Ontario to go there. A similar situation is true of the Mississauga who assert that they were in southwestern Ontario prior to and contemporaneously with Iroquoian groups. First Nations people lived mobile lifestyles and occupations were fluid over time, this is understood in Ontario as different Algonquian and Iroquoian speaking groups occupied, left and reoccupied the province over time.

The City of London area first entered Euro-Canadian documentation in 1793 as Lieutenant John Graves Simcoe, on his journey through Middlesex County on route from Detroit to Niagara, first drew attention to the area as he endeavoured to have it named Canada's capital. During Governor Simcoe's visit the presence of First Nation burial grounds and the depiction of figures on trees is noted by Major Edward B. Littlehales. In addition to these observations a preliminary survey of London in 1800 prepared by A. Jones and Lewis Grant identifies the presence of First Nations agricultural fields "Old Indian Cornfields" on the flats of the Thames River. Instead of providing a strategic military position, the scenic Thames River drew settlers in as early as 1797 for its lush, densely forested woods and fertile lands for cultivation (H.R. Page & Co. 1878).

This part of Ontario was purchased by the British Crown as part of Treaty No. 6 on September 7, 1796 (Figure 3). Treaty No. 6 was made between the principal Chiefs, Warriors and People of the Chippewa Nation and Alexander McKee, Esquire, Deputy Superintendent General and Deputy Inspector General of Indians and of their affairs on behalf of His Britannic Majesty King George the Third His heirs and successors (AANDC 2013). The tract of land lying on the north side of the River Thames, or River La Tranche, and known to First Nations by the name Escunniesepe:

> …beginning at a certain station on the north bank of the said river about nineteen miles above the Deleware Village following the windings of the said river and about twelve miles distant from the said village in a direct northerly course, being about two miles above a lime stone rock and spring on the said river which station will be more perfectly found by a line run from the main or lower fork at London six miles on a course south, sixty-eight degrees thirty miles; thence north sixty-eight degrees thirty minutes east twelve miles' thence south twenty-one degrees thirty minutes east till it intersects a right line running from the upper forks of the said river at Oxford to the main or lower forks of the said river at London; thence along the said line to the said upper forks on a course north sixty-eight degrees thirty minutes east; thence down the said River Thames following the several winding and courses with the stream to the place of beginning.
>
> AANDC 2013

The land was purchased for the sum of twelve hundred pounds of goods at the Quebec currency value of the day. The closest First Nations communities to the study area today are the Oneida of the Thames, Chippewa of the Thames and the Munsee-Delaware Nation.

1.2.3 Euro-Canadian Settlement

The Township of London was first surveyed by Colonel Mahlon Burwell in 1810. The lots were divided by the double-front system which was commonly used by the Crown between 1815 and 1829 (Government of Ontario 1969). Col. Burwell was required to put the survey on hold during the War of 1812 but resumed once peace had been re-established and a total of 3,850 acres of land was reserved by Lieutenant Governor Simcoe for the future town of London. In 1826, the town plot was surveyed by Mahlon Burwell with settlement beginning shortly after around the Forks of the Thames along Ridout Street and the Talbot Block. Settlement in London began to expand rapidly after the construction of the courthouse in 1827 with the population reaching 1,000 by 1835. Concession 1 began at Dundas Street, named in honour of Henry Dundas and, moving north along Proof Line (now Richmond Street), Concession 2 was marked by a stand of pine trees which is now present-day Oxford Street. The Hamlet of Hyde

Park Corners, located northeast of downtown London, developed on Concessions 3 and 4 on either side of present-day Gainsborough Road around Hyde Park Road. London was incorporated as a Village in 1840 and by 1855 the population had leapt to 10,000 at which time it officially became a city.

London underwent a number of population booms throughout its history beginning when the 32nd Regiment was stationed in London in 1838. Development of saw, cording, and grist industry powered by the Thames River and Medway Creek burgeoned the city's growth in the mid 1800's, bolstered by the arrival of the railways in the 1850s with the Great Western Railway in 1853, the London Port Stanley Railway in 1856, and the Grand Trunk Railway in 1858. Steady growth in London continued as the city was established as a financial centre for the surrounding regions with large manufacturing industries taking root, including the Carling and Labatt's Brewery and the London Cigar Industry.

The H.R. Page and Co's 1878 *Illustrated Historic Atlas of the County of Middlesex,* map of the Township of London lists several property owners for Lots 17 and 18, Concession II and III; C.C.Coombs in Concession II, and D.Bogue, I. Marshall, and some illegible owners are listed for Concession III. The mapping also illustrates the development of London, including the division of lots into smaller parcels, within the study area as well as within surrounding lots (Figure 4). The current road system is recognizable and the 1878 map demonstrates the high level of Euro-Canadian settlement in London Township by the late 1800s. The original Western Road and Sarnia Road are shown as constructed. There are multiple structures located at the corner of Western and Sarnia Roads, as well as to the north along Western Road (Figure 4).

Located within the study area is the Philip Aziz Property, located at 150 Philip Aziz Avenue south of the University of Western Ontario, on the southeast corner of Western Road and Philip Aziz Avenue. The property was purchased by Philip Aziz in 1950, and included a one-and-a-half storey brick residence constructed in approximately 1875. Philip Aziz, a lifelong Londoner and internationally known artist, originally hailed from St. Thomas but, after securing two degrees in Fine Arts from Yale University in 1947 and 1949, he relocated to London in 1950. In 1957 he added an adjoining studio. Contained within both the house and studio is an impressive collection of architectural materials salvaged from significant buildings in the London area. Much of the salvaged material has been incorporated into the design of the house. Many of the windows in the studio were originally from older homes within the city. The large hammered copper sink was salvaged from the Smallman Residence at 468 Colborne Street. The two-tone green marble, which forms the fireplace, was salvaged from an old altar from the Chapel of St. Peter's Seminary. Other noteworthy items are the stone brackets from the former Prevost Building, which now adorn the brick walls flanking the driveway (City of London By-Law L.S.P. – 3367-235). The property was designated by the City of London in 2004 under Part IV of the Ontario Heritage Act, By-law L.S.P. – 3367-235. It was listed within the Canadian Register of Historic Places in 2010 (Parks Canada 2001). There are also multiple structures listed on the City of London Inventory of Heritage Resources (2006) in close proximity to the study area

1.2.4 Reports with Relevant Background Information

Previously conducted archaeological investigations and assessments have informed the current Stage 1 archaeological assessment; however, no archaeological reports relating to properties within 50 m of the current study area were found. Table 2 provides a detailed list of the relevant archaeological reports identified during the background research conducted for this study.

Table 2: Previous Archaeological Assessment Reports

Year	Title	Author	PIF Number
1981	*Site Report MIA Newsletter Vol. 3, No.3*	Robert Pearce	N/A
1994	*Mud Creek Area Plan: Archaeological and Heritage*	LMA, R. Pearce	N/A

Year	Title	Author	PIF Number
	Assessment		
2001	*Archaeological Assessment (Stage 3) of Blackfriars Mill, Harris Park, City of London, Middlesex County, Ontario*	Archaeologix Inc.	N/A
2001	*Archaeological Assessment (Stages 1 & 2) #1 Beaufort Street, OZ-6102, City of London, County of Middlesex, Ontario*	Archaeologix Inc.	N/A

The majority of the reports listed above provide details on the archaeological assessments that have been conducted on sites in the vicinity. In addition to the site reports listed above, rough notes and sketches of assessments conducted by the Museum of Indian Archaeology (MIA), now Museum of Ontario Archaeology (MOA), in 1981 and 1985 contain information on archaeological assessments that resulted in the identification of pre-contact Aboriginal archaeological campsites within a 1 km radius of the current study area. These reports could not be located for review for the current Stage 1 archaeological assessment.

The City of London Archaeological Master Plan was adopted by council in 1996 to ensure the identification, evaluation, and conservation of archaeological resources through long-term planning. The primary goal of the Master Plan was the development of an Archaeological Potential Model for the City of London. The model identified 19,088 ha of the City of London with moderate to high potential for the recovery of archaeological resources (Wilson and Horne 1995). The entire study area on part of Lots 17 and 18, Concessions II and III were identified as an area with archaeological potential in the Archaeological Master Plan for the City of London due to the close proximity of the Thames River (Wilson and Horne 1995). It should be noted that the City of London Archaeological Master Plan was written in 1995 and does not necessarily reflect current archaeological potential modelling standards. The City of London Inventory of Historic Resources (2006) was also consulted, and identified multiple structures with a heritage designation within close proximity to the study area but none other than the Philip Aziz residence within the study area limits.

1.3 Archaeological Context

1.3.1 Natural Environment

The study area falls within the Mount Elgin Ridges physiographic region as described by Chapman and Putnam (1966). The Mount Elgin Ridges physiographic region is:

> Between the Thames Valley and the Norfolk sand plain lies a succession of ridges and vales which are called the Mount Elgin Ridges….South of the Westminster and St. Thomas Moraines the country drains to Lake Erie by means of the tributaries of Kettle, Catfish and Otter Creeks….The two major landform components of this region provide obviously contrasting soils. The ridges are well drained while imperfect and even poor drainage characterize the hollows. The ridges are formed from clay till similar to that of the Wyoming Moraine and the Stratford plain.
>
> Chapman and Putnam 1966:145

The topography of the study area is relatively level and the closest source of potable water is the Thames River which is situated directly east. Figure 5 illustrates the agricultural suitability, based on drainage capability, of the soil within the study area.

1.3.2 Known Archaeological Sites and Surveys

A request was made on March 3, 2015 to examine the Archaeological Sites Database (ASDB) to determine the presence of archaeological sites within and surrounding the study area. A response was received on March 22, 2015 from Robert Von Bitter, indicating ten sites are located within 1 km of the study area. Of the ten sites, eight are pre-contact, and two are Euro-Canadian. Two of the pre-contact sites (AgHh-49 and AgHh-74) are located directly within the study area. Table 3 provides additional information on these archaeological sites.

Table 3: Registered Archaeological Sites within 1 km of the study area

Borden	Site Name	Site Type	Cultural Affiliation	Researcher
AfHh-16	*None given*	Campsite	Pre-contact	P. Timmins, MIA
AfHh-17	*None given*	Campsite	Pre-contact	P. Timmins
AfHh-224	Mud Creek	Findspot	Pre-contact	R. Pearce
AfHh-321	North Branch Mills	Foundation	Euro-Canadian	Archaeologix Inc.
AgHh-10	Ronto	Hamlet	Woodland	D.R. Poulton, MIA
AgHh-16	*None given*	Campsite	Late Woodland	D.R. Poulton
AgHh-49	***None given***	**Campsite**	**Pre-contact**	**MOA**
AgHh-72	*None given*	Findspot	Euro-Canadian	MIA, now MOA
AgHh-74	***None given***	**Findspot**	**Pre-Contact**	**MIA, now MOA**
AgHh-9	Windermere	Hamlet	Woodland	D.R. Poulton, MIA

The Ronto (AgHh-10) and Windermere (AgHh-9) sites were remnants of a Woodland hamlet. The sites were excavated in 1981, and the artifacts are currently located at the MOA. Before excavations could commence however, a portion of the site was destroyed during the construction of Windermere Road.

Information concerning specific site locations is protected by provincial policy, and is not fully subject to the Freedom of Information Act. The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MTCS will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

1.3.3 Existing Conditions

The study area consists of primarily developed lots within the City of London and is comprised of the University of Western Ontario campus, and associated parking lots, multiple residential areas of manicured lawns, with some areas of undeveloped green space and agricultural fields (Figure 4). The Stage 1 archaeological assessment for the proposed Western Road and Sarnia Road/Aziz Avenue improvements was conducted between March 4 and April 22, 2015 under Professional license P438 issued by the MTCS to Samantha Markham, Professional Archaeologist at AECOM, under PIF number P438-0022-2015.

2. Property Inspection

A Stage 1 property inspection was conducted within a corridor 80 m wide along Western Road, from the junction at Platts Lane north to Burnlea Walk on the University of Western Ontario campus, and an 80 m corridor along Sarnia Road/Philip Aziz Ave from the Thames River southwest to Stirrup Crescent. The study area also includes the residential area that includes Brescia Lane, Ramsay Road and Kininvie Drive, within the city of London, Ontario. This property inspection consisted of a visit to the study area to gain first-hand knowledge of the geography, topography, and current conditions.

The Stage 1 property inspection of the Western Road and Sarnia Road/Philip Aziz Ave was conducted on May 7, 2015 under PIF number P438-0022-2015 issued to Samantha Markham of AECOM. The weather on May 7, 2015 was sunny with a high of 34° Celsius, and there were no conditions that were detrimental to the visibility of land features or the identification of archaeological features. Photographs 1-34 provide documentation of the current conditions, as found during the property inspection. Figure **6** indicates the results of the property inspection.

3. Analysis and Conclusions

3.1 Determination of Archaeological Potential

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Criteria commonly used by the Ontario MTCS (Ontario Government 2011) to determine areas of archaeological potential include:

- Proximity to previously identified archaeological sites;
- Distance to various types of water sources;
- Soil texture and drainage;
- Glacial geomorphology, elevated topography and the general topographic variability of the area;
- Resource areas including food or medicinal plants, scarce raw materials and early Euro-Canadian industry;
- Areas of early Euro- Canadian settlement and early transportation routes;
- Properties listed on municipal register of properties designated under the *Ontario Heritage Act* (Government of Ontario 1990b);
- Properties that local histories or informants have identified with possible archaeological sites, historical events, activities or occupants; and
- Historic landmarks or sites.

Distance to modern or ancient water sources is generally accepted as the most important element for past human settlement patterns and when considered alone may result in a determination of archaeological potential. In addition any combination of two or more of the criteria listed above, such as well drained soils or topographic variability, may indicate archaeological potential.

Certain features indicate that archaeological potential has been removed, such as land that has been subject to extensive and intensive deep land alterations that have severely damaged the integrity of any archaeological resources. This includes landscaping that involves grading below the topsoil level, building footprints, quarrying and sewage and infrastructure development (Government of Ontario 2011).

3.2 Summary and Conclusions

The Stage 1 archaeological assessment determined that the potential for pre-contact and contact period First Nation archaeological resources is high based on the proximity to the Thames River, an important source of potable water, the presence of two pre-contact sites (AgHh-49 and AgHh-74) within the study area boundaries, and the proximity to multiple Woodland hamlet locations. In addition, the historical documentary evidence of the first European settlers and surveyors to the area indicate the long history of occupation here by First Nations people.

The potential for Euro-Canadian archaeological resources is also judged to be high based off of the early settlement of London by Euro-Canadian pioneers. The presence of historic roadways including Western and Sarnia Roads, the

close proximity of the study area to the Great Western Railway, and the presence of early 20th century historic structures indicate significant early settlement and development in the area. In addition to archaeological criteria the Philip Aziz Property brings heritage significance as it is currently listed on the Canadian Register of Historic Places.

Construction of Western Road, Sarnia Road and Philip Aziz Avenue as well as the University of Western Ontario and the numerous residential and commercial developments has removed the potential for archaeological resources across most of the study area; however, it has been determined that the likelihood for archaeological resources to be present is high in areas of undisturbed land. There are several areas of manicured lawn and greenspace within the Study Area that may be undisturbed and will require further Stage 2 archaeological assessment

4. Recommendations

The evaluation of archaeological potential has resulted in the determination that there is high potential for the recovery of both First Nations and Euro-Canadian archaeological resources within undisturbed parts of study area. Due to extensive urban development the majority of the study area has been extensively disturbed; however, there are a number of small sections of manicured lawn or other green space where archaeological integrity could remain intact and the potential for the recovery of archaeological resources in these areas is high (Figure 6). The Philip Aziz Property is listed on the Canadian Register of Historic Places, and the proximity of the property, and the other historic buildings listed on the City of London Heritage Resources Inventory (2006), to the study area increases the potential of Euro-Canadian archaeological remains. **Stage 2 archaeological assessment is recommended for any impacts that are planned on undisturbed land (see** Figure **6).**

The Stage 2 archaeological assessment must be conducted by a licensed archaeologist and must follow the requirements set out in the *Standards and Guidelines for Consultant Archaeologists* (Ontario Government 2011), including:

- Test pit survey at 5 m intervals in all areas that will be impacted by the project and where ploughing is not possible (e.g., woodlots, overgrown areas, manicured lawns);
- Poorly drained areas, areas of steep slope and areas of previous disturbance (e.g., pipelines, railways, road ROWs, buildings) are to be mapped and photo-documented, but are not recommended for Stage 2 survey as they possess low to no archaeological potential.

Should deeply buried sites be discovered, a Stage 2 assessment will be conducted according to the standards appropriate for survey in deeply buried conditions as per Section 2.1.7 in the Ministry of Tourism, Culture and Sport's *Standards and Guidelines for Consultant Archaeologists* (Ontario Government 2011).

The Ministry of Tourism, Culture and Sport is asked to accept this report into the Ontario Public Register of Archaeological Reports thereby concurring with the recommendations presented herein. As further archaeological assessments are required, archaeological concerns under land use planning and development processes have not fully been addressed.

5. Advice on Compliance with Legislation

This report is submitted to the Ontario Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

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 must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act*.

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 Ontario Ministry of Consumer Services.

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7. Images

Photo 1: Manicured lawn, sidewalk, and ROW at intersection of Platts Lane and Western Road, facing northwest.

Photo 2: Steep slope along the east side of Western Road, facing north.

Photo 3: Manicured lawn, sidewalk, and ROW along west side of Western Road north of Platts Lane, facing south.

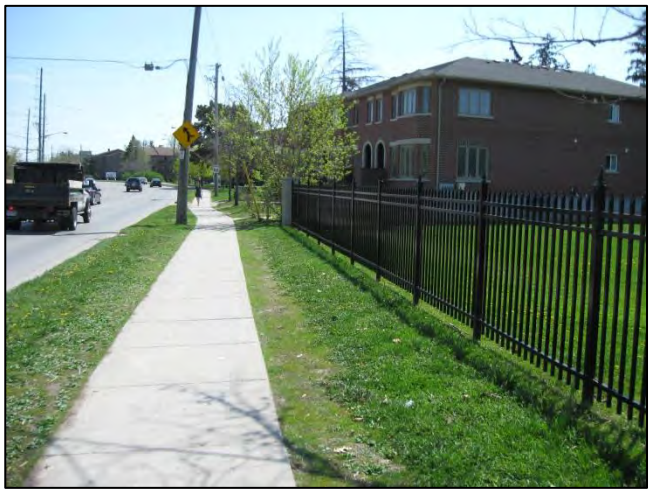


Photo 4: Sidewalk and ROW along west side of Western Road, facing south (note utility poles).

Photo 5: General soil/ground conditions of the grassed ROWs along Western Road (Note disturbance).

Photo 6: Manicured lawn along east side of Western Road, facing northeast.

Photo 7: Disturbed ROW along east side of Western Road at the entrance to Althouse College, facing north.

Photo 8: Evidence of water utilities disturbance along the east side of Western Road, facing east.

Photo 9: Sidewalk and ROW along west side of Western Road, facing south.

Photo 10: Developed commercial area on west side of Western Road south of the intersection of Sarnia Road/Philip Aziz Avenue, facing northwest.

Photo 11: Manicured lawn within ROW on east side of Western Road south of the intersection with Sarnia Road/Philip Aziz Avenue, facing north.

Photo 12: Disturbed ROW and area of manicured lawn along south side of Philip Aziz Avenue, facing east.

Photo 13: Retaining wall (disturbed) along north side of Philip Aziz Avenue, facing northeast.

Photo 14: Manicured lawn along north side of Philip Aziz Avenue, facing east.

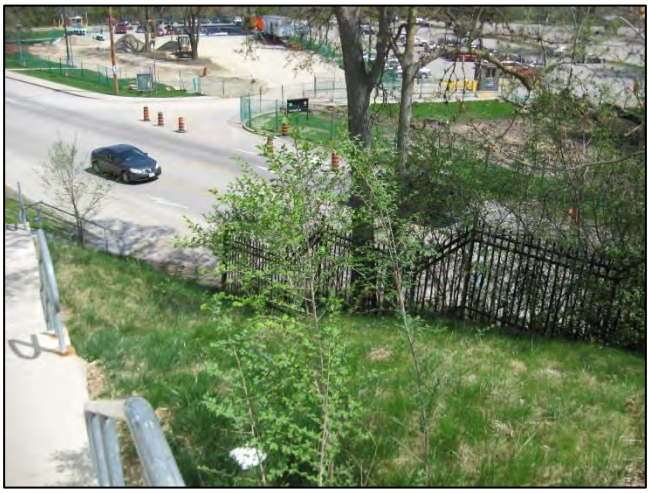


Photo 15: Area of steep slope and significant construction disturbance along Philip Aziz Avenue, facing southeast.

Photo 16: Commercial development at the intersection of Western and Sarnia Roads, facing southwest.

Photo 17: Built-up and disturbed ROW along north side of Sarnia Road, facing east.

Photo 18: Retaining wall and ROW along north side of Sarnia Road, facing east.

Photo 19: Manicured lawn and field along Brescia Lane north of Sarnia Road, facing southeast.

Photo 20: Manicured lawn along Brescia Lane north of Sarnia Road, facing northwest.

Photo 21: Slope along Brescia Lane north of Sarnia Road, facing northeast

Photo 22: Construction disturbance along Ramsay Road, facing south

Photo 23: Manicured lawn and forested area along north side of Ramsay Road, facing northwest.

Photo 24: Built-up lawn frontages along Kininvie Drive, facing south.

Photo 25: General conditions of the ROW along the south side of Sarnia Road, facing east (note utilities within the ROW).

Photo 26: Manicured lawn at the intersection of Western and Sarnia Roads, facing north.

Photo 27: Manicured lawn and small slope outside of the ROW along east side of Western Road, facing northeast.

Photo 28: General conditions of the ROW along the east side of Western Road, facing north.

Photo 29: Manicured lawn along the east side of Western Road, facing southeast.

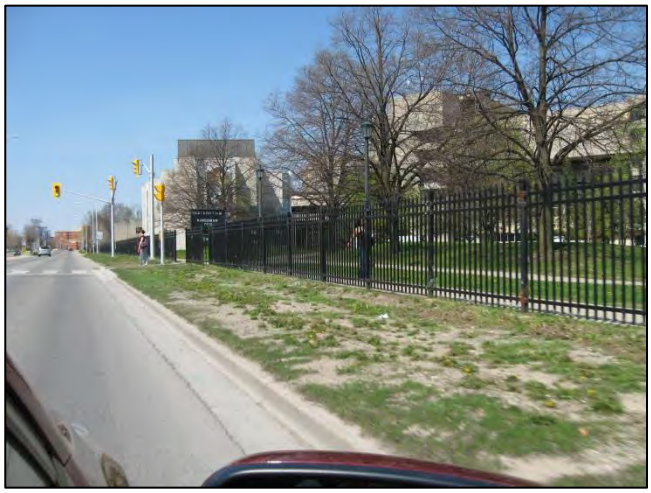


Photo 30: General conditions of the ROW along the east side of Western Road north of Lambton Drive, faing north.

Photo 31: Manicured lawn along west side of Western Road, potentially disturbed based on presence of water and hydro utilities, facing south.

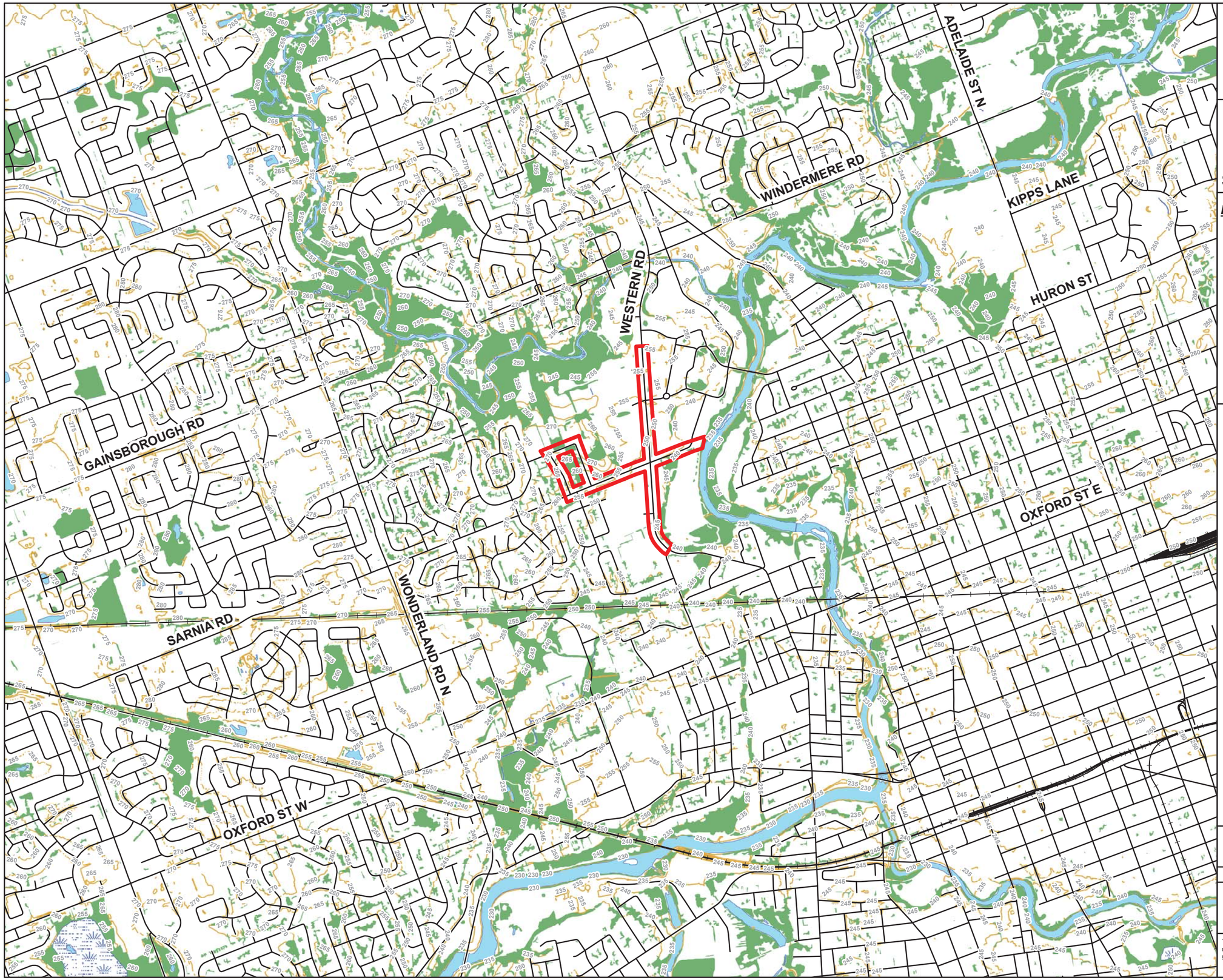
Photo 32: Visually confirmed disturbance at parking lot along west side of Western Road, facing southwest.

Photo 33: Manicured lawn at Lambton Drive, facing southwest.

Photo 34: Visually confirmed disturbance at parking lot along west side of Western Road, facing southwest.

8. Maps

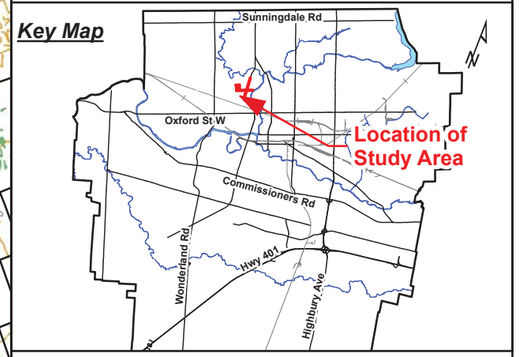
All maps pertaining to the Stage 1 archaeological assessment for improvements to Western Road and Sarnia Road/Philip Aziz Avenue are provided on the following pages.



London
CANADA

City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment

Key Map



Legend

- Study Area
- Railway
- Wetland
- Wooded Area
- Contours (5m)
- Water

N

0 400 800 1,600
Metres

March 2015	1:25,000	Datum: NAD '83 UTM 17N Source:City of London
P#: 60339161	V#: 001	

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Figure 1
Location of Study Area

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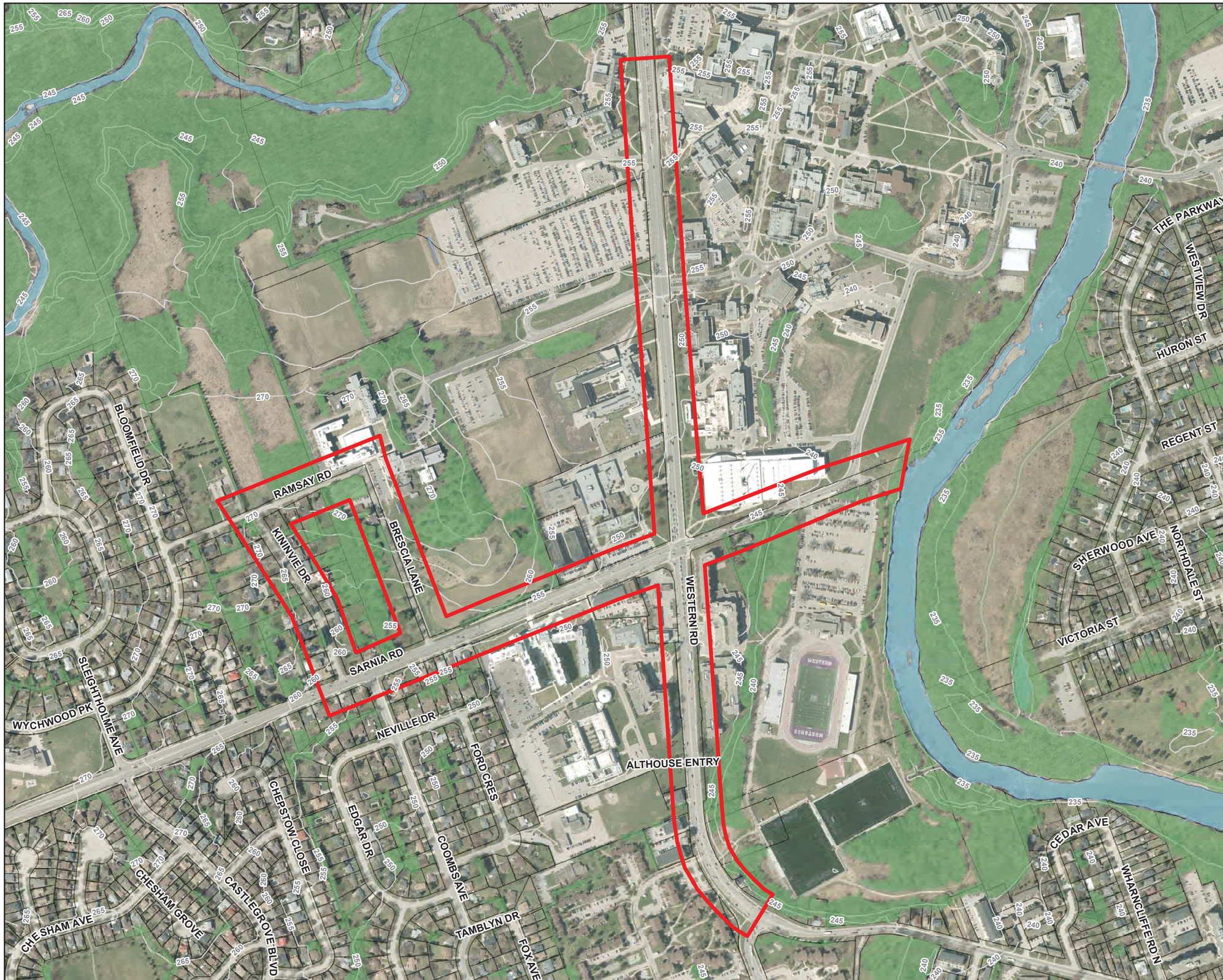
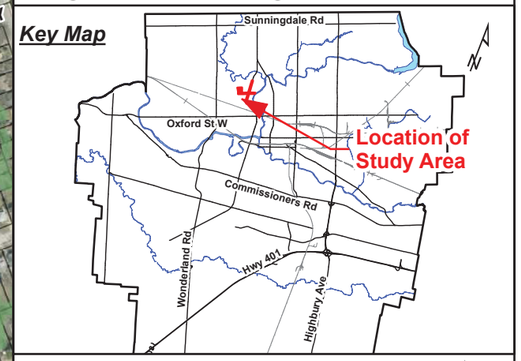
City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment



Key Map



Legend

- Railway
- Study Area
- Wooded Area
- 245 Contours (5m)
- Water

0 95 190 380
Metres

March 2015	1:6,000	Datum: NAD '83 UTM 17N Source:City of London
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Figure 2
Study Area in Detail

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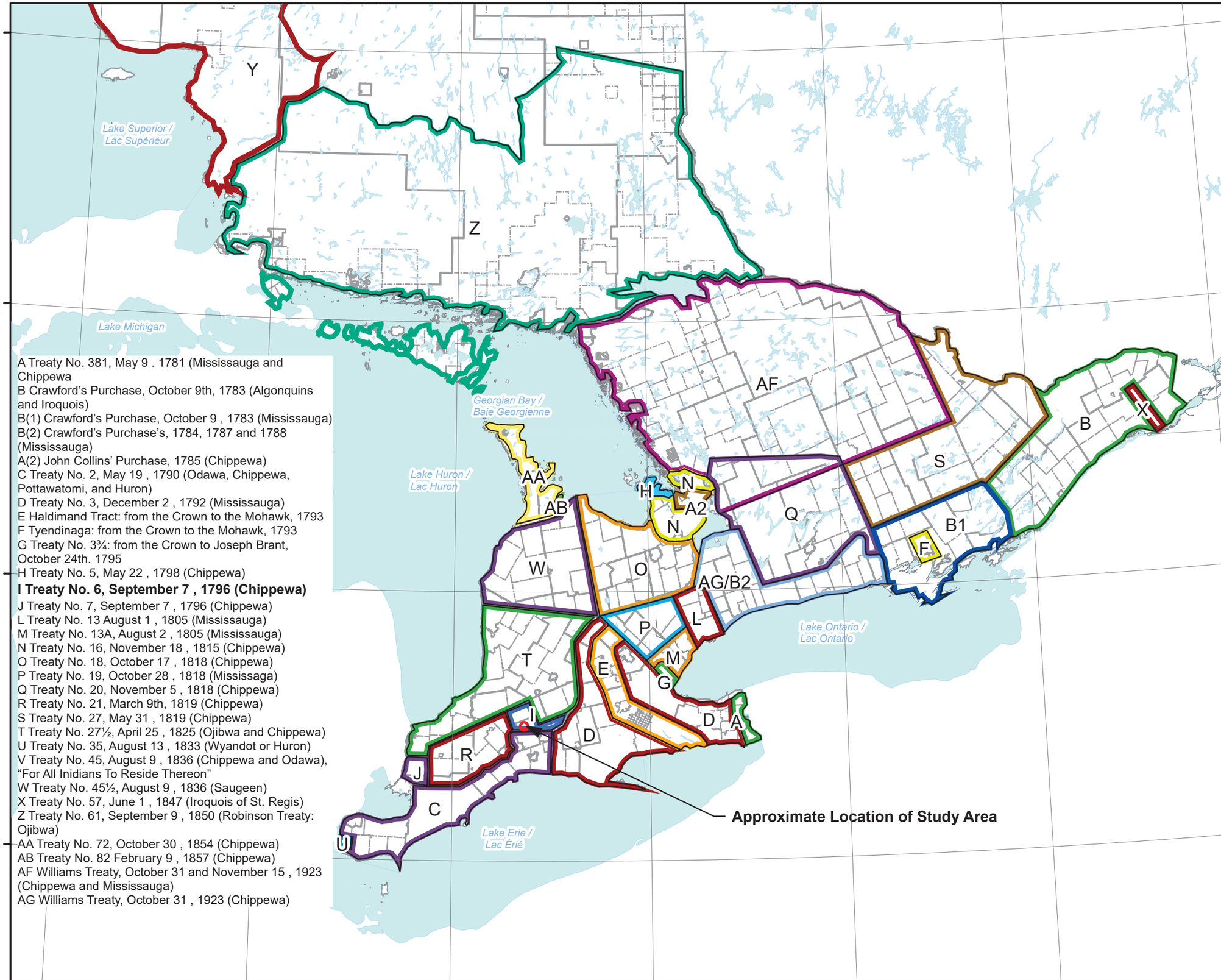
Date Saved: 3/27/2015 12:24:13 PM

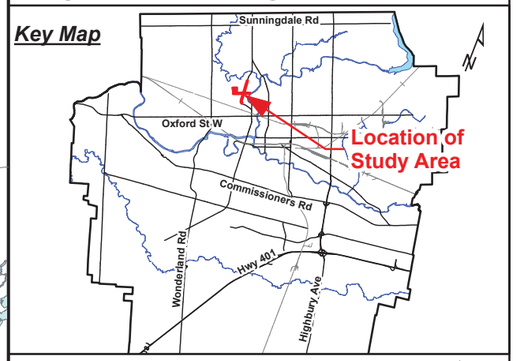


A Treaty No. 381, May 9 . 1781 (Mississauga and Chippewa
B Crawford's Purchase, October 9th, 1783 (Algonquins and Iroquois)
B(1) Crawford's Purchase, October 9 , 1783 (Mississauga)
B(2) Crawford's Purchase's, 1784, 1787 and 1788 (Mississauga)
A(2) John Collins' Purchase, 1785 (Chippewa)
C Treaty No. 2, May 19 , 1790 (Odawa, Chippewa, Pottawatomi, and Huron)
D Treaty No. 3, December 2 , 1792 (Mississauga)
E Haldimand Tract: from the Crown to the Mohawk, 1793
F Tyendinaga: from the Crown to the Mohawk, 1793
G Treaty No. 3¾: from the Crown to Joseph Brant, October 24th. 1795
H Treaty No. 5, May 22 , 1798 (Chippewa)
I Treaty No. 6, September 7 , 1796 (Chippewa)
J Treaty No. 7, September 7 , 1796 (Chippewa)
L Treaty No. 13 August 1 , 1805 (Mississauga)
M Treaty No. 13A, August 2 , 1805 (Mississauga)
N Treaty No. 16, November 18 , 1815 (Chippewa)
O Treaty No. 18, October 17 , 1818 (Chippewa)
P Treaty No. 19, October 28 , 1818 (Mississaga)
Q Treaty No. 20, November 5 , 1818 (Chippewa)
R Treaty No. 21, March 9th, 1819 (Chippewa)
S Treaty No. 27, May 31 , 1819 (Chippewa)
T Treaty No. 27½, April 25 , 1825 (Ojibwa and Chippewa)
U Treaty No. 35, August 13 , 1833 (Wyandot or Huron)
V Treaty No. 45, August 9 , 1836 (Chippewa and Odawa), "For All Inidians To Reside Thereon"
W Treaty No. 45½, August 9 , 1836 (Saugeen)
X Treaty No. 57, June 1 , 1847 (Iroquois of St. Regis)
Z Treaty No. 61, September 9 , 1850 (Robinson Treaty: Ojibwa)
AA Treaty No. 72, October 30 , 1854 (Chippewa)
AB Treaty No. 82 February 9 , 1857 (Chippewa)
AF Williams Treaty, October 31 and November 15 , 1923 (Chippewa and Mississauga)
AG Williams Treaty, October 31 , 1923 (Chippewa)

London CANADA

City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment

Key Map



Legend

- Study Area
- Water Body
- Municipal Boundary - Upper
- Municipal Boundary - Lower

N

0 47,000 94,000 188,000
Metres

March 2015	1:3,000,000	Datum: NAD '83 UTM 17N Source:City of London
P#: 60339161	V#: 001	Figure 3 Treaties and Purchases (Adapted from Morris 1943)

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London
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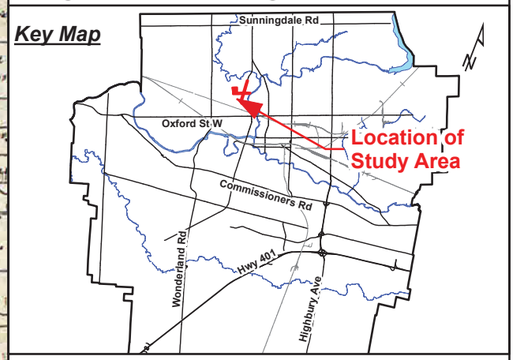
City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment

Key Map



Legend

Study Area

N

March 2015	NTS	Source:1878 Map of The Township of London H.R. Page and Co.
P#: 60339161	V#: 001	Figure 4 Portion of the 1878 Map of the Township of London

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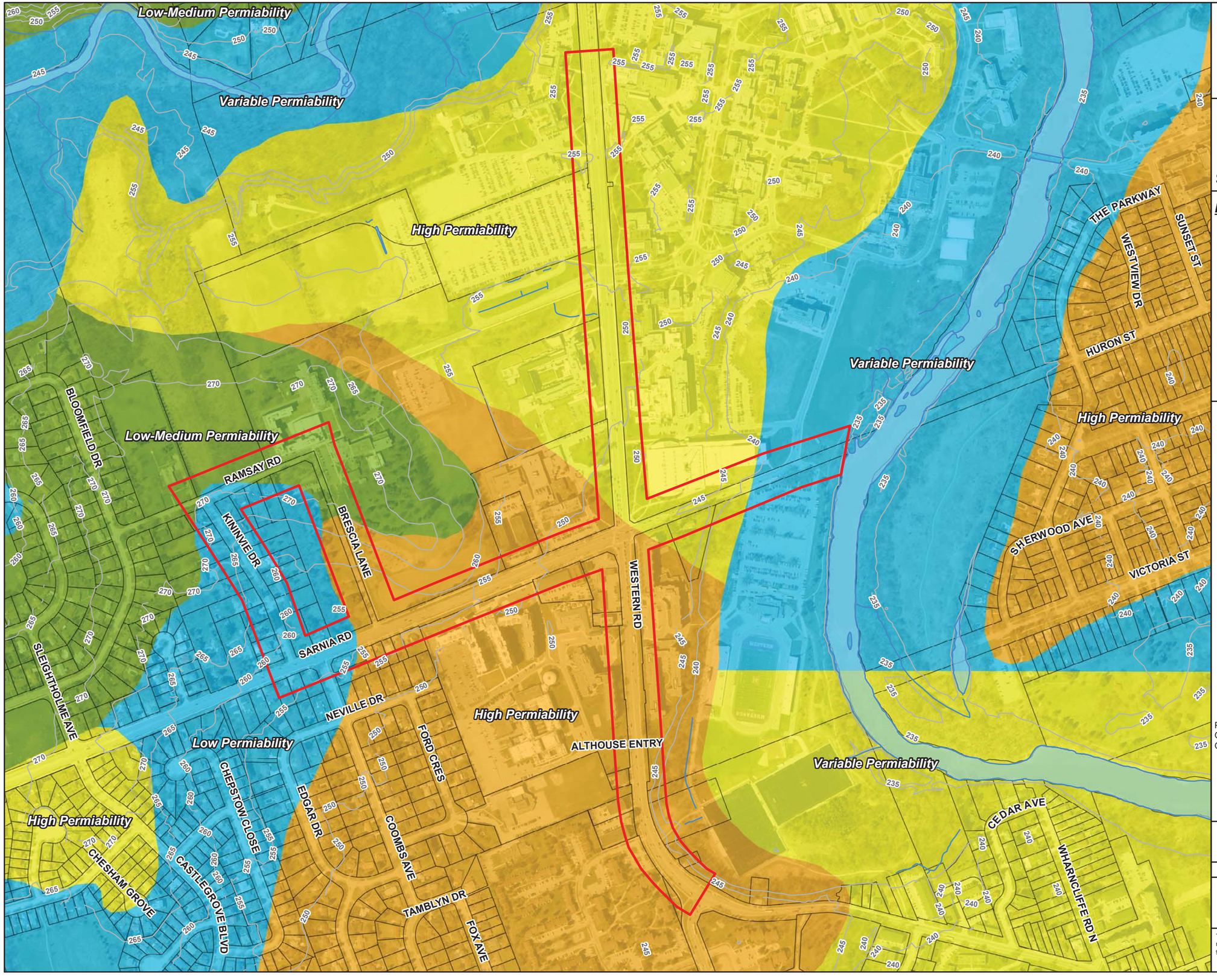
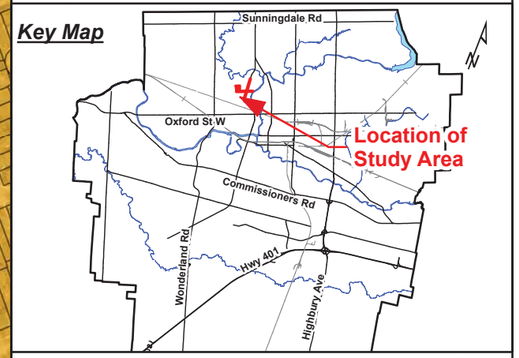


London
CANADA

City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment

Key Map



Legend

- Study Area
- Watercourse/Drain
- Contours (5m)
- Water
- Lot Lines

Primary Soil Material

- Diamicton
- Gravel
- Sand
- Silt

Primary Soils Material Source:
Ontario Geological Survey 2010. Surficial geology of southern Ontario;
Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised

0 100 200 400
Metres

March 2015	1:6,000	Datum: NAD '83 UTM 17N Source:City of London Natural Resources Canada
P#: 60339161	V#: 001	Figure 5 Soil Material and Drainage

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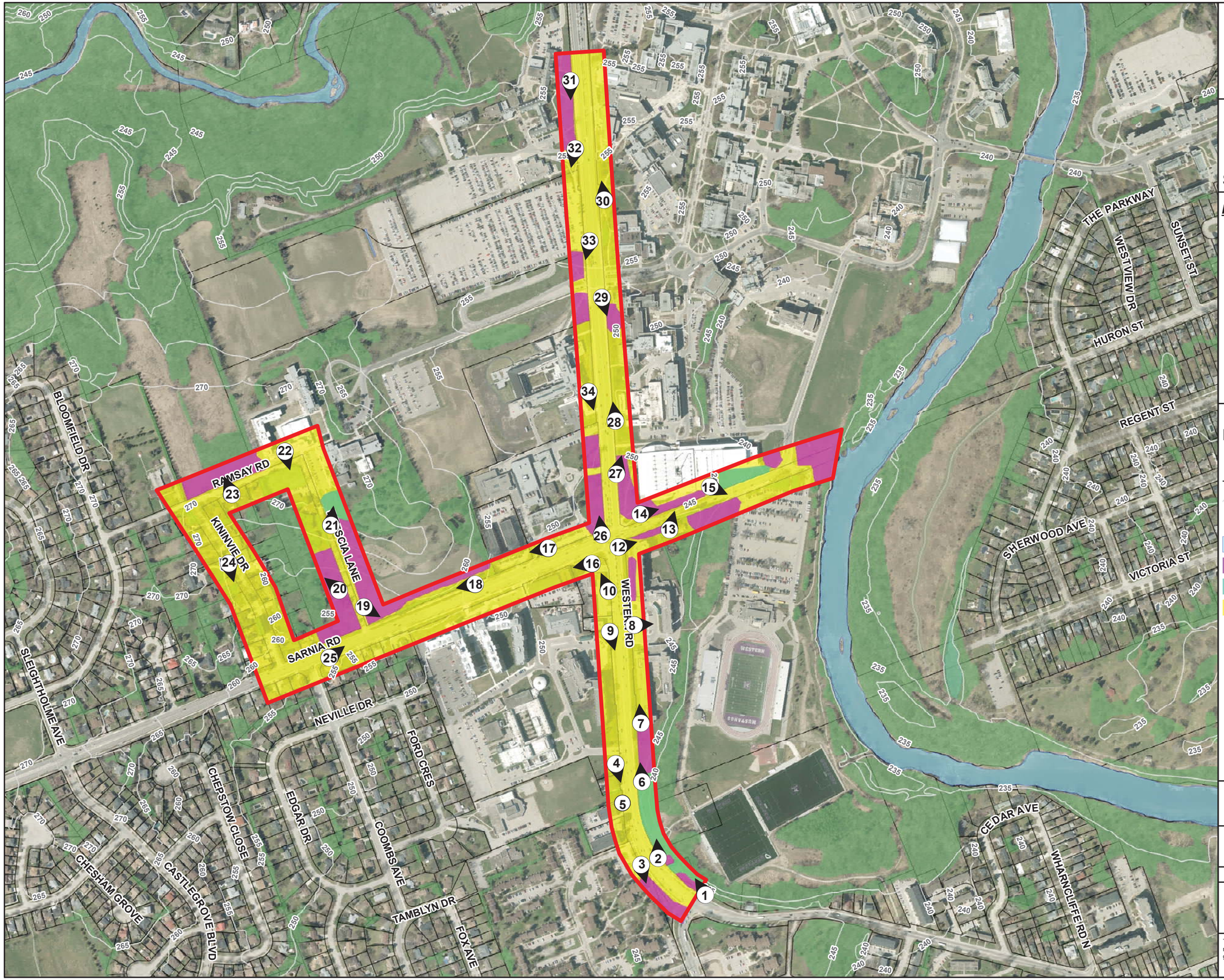

London
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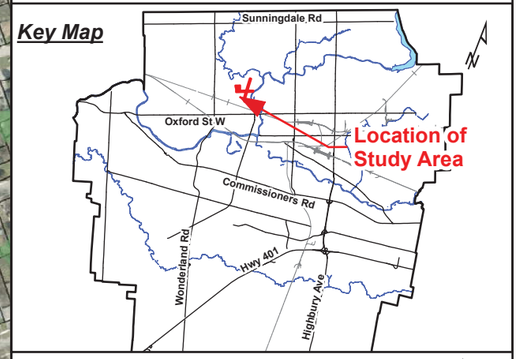
City of London
Western Road and Sarnia Road/ Philip Aziz Avenue Improvements
Stage 1 Archaeological Assessment

Key Map



Legend

- Study Area
- Railway
- Contours (5m)
- Wooded Area
- Water
- Stage 2 Archaeological Assessment Recommended
- Slope
- Previous Disturbance
- Photo Location and Direction

0 100 200 400
Metres

Stage 1 Archaeological Assessement

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Figure 6
Methods and Results

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Appendix B

B.5 Stormwater Management/Drainage Report

DRAFT

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Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Stormwater Management and Drainage

Corporation of the City of London

Project number: 60661402

March 02 2023

Copy 1 of 1

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- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
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Revision History

Revision	Revision date	Details	Authorized	Name	Position

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1. Introduction

1.1 background

The City of London (City) undertook a Municipal Class Environmental Assessment (MCEA) study to identify necessary improvements at the Western Road and Sarnia Road/Philip Aziz Avenue intersection and the Western Road corridor from Platts Lane to the Huron University College entrance. The Class EA identifies and balances the needs of the users within the community, including pedestrians, cyclists, and motorists. Refer to **Figure 1** for the project limits and study area.

In the period from 2014 to early 2016, AECOM initiated consultation work and conceptual design work as part of the MCEA for the study area. At that time, preliminary consultation was initiated with major stakeholders including Western University (Western), various Technical Agencies, Committees, and the Upper Thames River Conservation Authority (UTRCA). The project was placed on hold in 2016 when alternatives for transit routes through the study area were being considered as they related to the City's Rapid Transit (RT) program. Given that the north and west routes for RT have been deferred for future discussion and after the next update of the Transportation Master Plan in 2030, the city has chosen to reactivate this project.

The project study area remains almost identical to the previous assignment. The proposed study area will extend along Western Road from Platts Lane northerly to Huron College and the Sarnia Road/Philip Aziz Avenue corridor, extending from Coombs Avenue easterly to the Thames River. In some cases, the study area may also extend beyond the two corridors and include adjacent lands and/or roads. It is understood that the northerly limits of the study area may be slightly adjusted at the initiation of this project to suit recent developments.

The subject reconstruction will include a 25.0 m urbanized right-of-way (ROW) cross-section complete with curb and gutter, centre median, sidewalks, multi-use path, bike lane/buffer, storm sewer servicing, and suitable landscape enhancements.

The Existing Conditions Memorandum prepared previously by AECOM (July 2015) identified a number of drainage issues which exist throughout the Western Road corridor between the Platts Lane and Huron College study area limits. A summary of drainage issues impacting the study area under existing conditions include:

- Limited quantity control on adjacent University lands, with major system flows spilling into the Western Road ROW at several locations.
- Major system flows which pond and collect within the ROW at four locations (**Section 4.7**). There are also major system flows that will spill on to private properties at sag locations.
- Low topographic relief resulting in poor drainage throughout the Western Road Corridor from Platts Lane heading north to the Sarnia Road / Philip Aziz Avenue intersection.
- A section of the study area (the intersection of Philip Aziz Avenue and Huron Drive) is situated within UTRCA's Regulatory Floodplain.
- Storm sewer segments which decrease in size in the downstream direction.
- Lack of curb and gutter in the areas along Western Road between Lambton Drive/Brescia Lane and Sarnia Road/Philip Aziz.
- Spill of minor system flows from the right-of-way to private property adjacent to the corridor.

- Undersized storm sewer outlet and eroded and undercut existing storm sewer outfall.
- Integration of previous/current Western Studies/Projects, such as the 2019 Western Servicing Study (2019), completed by AECOM.
- Lack of water quality controls.

Existing stormwater catchment areas were assessed as part of the storm sewer servicing approach. LID water quality treatment and runoff volume reduction opportunities were reviewed for their suitability and for the extent to which different LID feature types could be incorporated within the locations with wide rights-of-way, and locations with open boulevard areas. The proposed improvements are not to negatively impact any private infrastructure, including building foundations and utility connections.

This report also identifies the screening evaluations and selection of the required stormwater management (SWM) system for Western Road and Sarnia Road / Philip Aziz Avenue improvements.

1.2 Goals and Objectives

The goals of the stormwater management (SWM) plan include:

- Compliance with the Ministry of Environment, Conservation and Parks (MECP, formerly MOE) 2003 Stormwater Management Planning and Design Manual
- Compliance with the City of London's March 2022 Stormwater Management Design Specification and Requirements Manual, including the stated control hierarchy;
- Provide a functional, low-maintenance and aesthetically pleasing boulevard design for the residents and users of the corridor;
- Safeguard existing water quality within the existing corridor drainage system, which receives runoff from this section of Western Road and Sarnia Road / Philip Aziz Avenue;
- Alignment with the City's Climate Change Adaptation and Infrastructure Vulnerability Initiatives;
- Adherence to the City of London's Complete Streets Design Manual (CSDM; 2018); and
- Identification and rectification of trapped areas within the roadway where no overland flow route exists.

Application of the available guidance and criteria provided within the above documents will provide for a SWM design that has multiple benefits and address the requirements of the MCEA update which includes:

- Provision of water balance (infiltration) and erosion control through the retention and infiltration of 5 mm of runoff per storm event (MECP, 2003) on a best-efforts basis;
- All discharge to the Thames River and major tributaries will be required to meet the normal enhanced water quality by providing a treatment equivalent to or exceeding MECP Normal (Level 2) treatment (long-term removal of 70% TSS) through control of the 25 mm event (City of London, March 2022);
- Improved flood control through the provision of peak flow attenuation and runoff volume reductions;
- Maintenance of a high-level of service for roadway and boulevard users (if applicable) within the ROW;
- Improved community aesthetics and lower maintenance of landscape features (if applicable) within the ROW;
- Confirm existing and proposed conditions land uses in consultation with the City and Western, and through review of appropriate background plans;

- Develop the existing conditions model using available storm sewer, topographic and drainage area information;
- Confirm anticipated future storm areas and prepare a proposed storm catchment plan for the preferred road configuration alternative;
- Develop a proposed conditions model based on the availability of future site use plans, transit, and related information within the vicinity of the Project limits;
- Confirm water quality control measures, sizing, and location of OGS and/or BMPs;
- Review alternatives and costs. Host and facilitate a value engineering exercise with the City and Western to identify opportunities to collaborate on the implementation of innovative LID measures which could enhance the aesthetic appeal of the road corridor, improve the stormwater level of service, and provide research/educational opportunities to students at the University;
- Coordinate the design of any ROW BMPs with Civil Engineering and Landscaping Disciplines;
- Provide review support regarding potential conflicts with existing utilities to remain;
- Prepare the preliminary design of a new outlet to the Thames River which will include appropriate scour protection and energy dissipation (rip rap sizing);
- Prepare preliminary construction cost estimates for LID/SWM measures; and,
- Prepare/update the Storm Drainage and Stormwater Management report.

To facilitate understanding of the proposed SWM design by all parties, this document summarizes the methodological screening process that was applied to evaluate potentially suitable LID features for Western Road and Sarnia Road / Philip Aziz Avenue Infrastructure Improvements project site and identifies the most feasible stormwater servicing option(s) for the relevant corridor segments.

2. Background Information

Prior to identifying a thorough list of potentially suitable stormwater servicing options, a background review of available site information was completed. Review of available information was also used to identify opportunities and constraints which may guide next steps related to the design.

AECOM completed a background review of all available information to understand the range of LID retrofit opportunities and constraints applicable to the site. Information reviewed during the background review included satellite and street imagery, available topographic and utility data, generic soil and groundwater mapping and available geospatial information. A general list of background resources and materials collected and reviewed is provided in **Table 1**. Findings from the background review process are detailed in the following section.

Table 1. Background Information Review

Resource
Utility location drawings*
as-built drawings* and Huron Street Watermain Replacement drawings
Storm Area Plan, Ditch Sizing Information
Relevant Geotechnical and Hydrogeological Studies (Revision 0 - September 2021 by Golder Associates Ltd.)
City of London and MTO Design Standards
Previous SWM Reports, Hydrologic and Hydraulic Studies
GIS, Orthoimagery, etc.

Resource
Master Servicing Study
Municipal Class EA's, Background Reports and Related Studies

**Updated Information not yet available for the current assignment*

2.1 Subject Area Overview

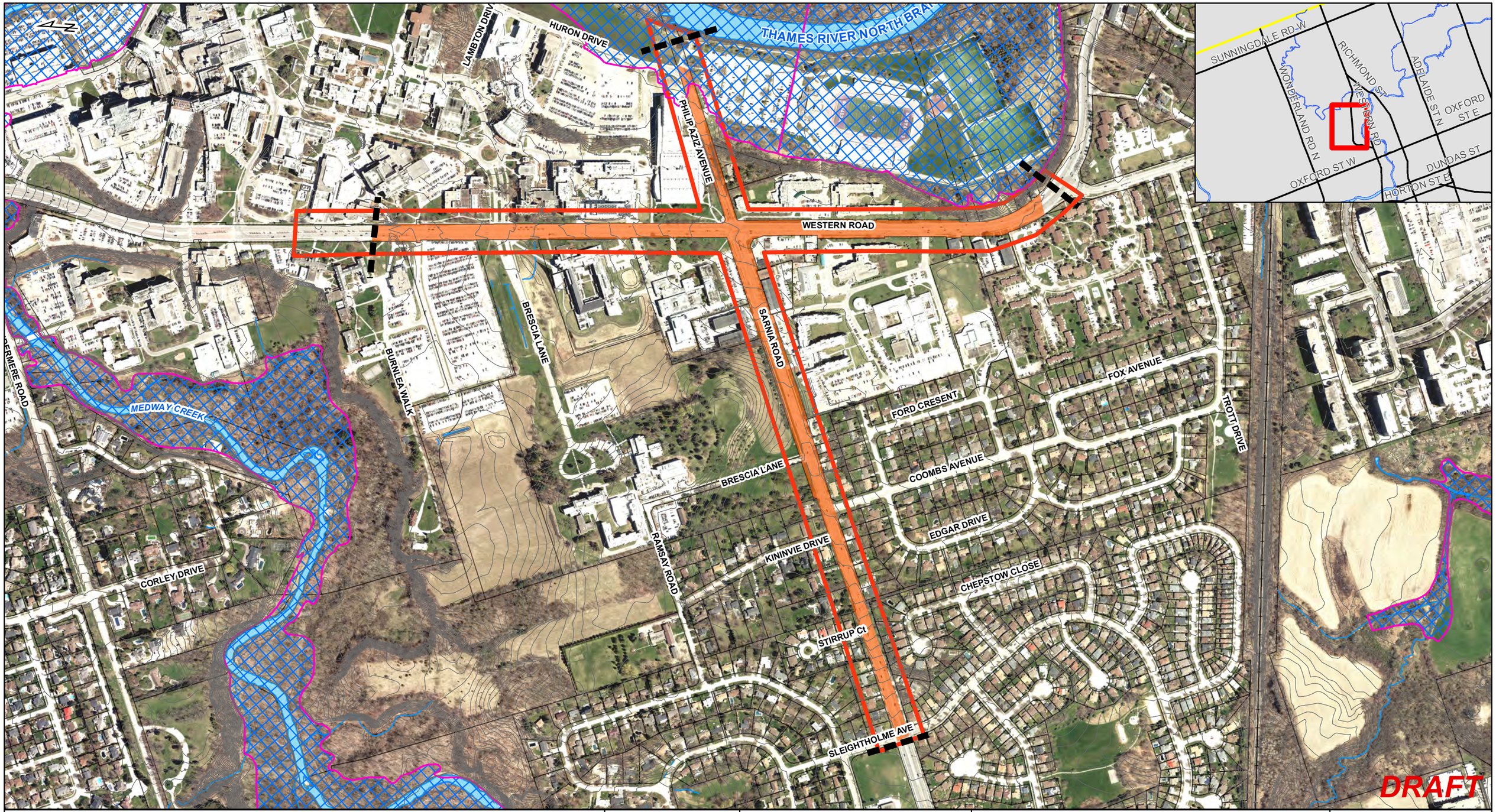
The subject area, shown in **Figure 1**, is approximately 22.0 ha in size and will proceed in four project segments. These four segments consist of:

- Segment 1- Sarnia Road for 980 m northeast towards Western Road;
- Segment 2- Philip Aziz Ave for 360 m southwest towards Western Road;
- Segment 3- Western Road for 660 m North of Sarnia Road/Philip Aziz Ave intersection
- Segment 4- Western Road for 620 m South of Sarnia Road/Philip Aziz Ave intersection.

These streets range from two lanes to four lanes, and range in slope from 0.5% to 2.2%, though most of the roadway throughout the corridor has a slope that is less than 2.0%. The existing road corridor has sidewalks on each side of the Saria Road and Western Road. However, there are no sidewalks along Philip Aziz Ave, only a sidewalk that extends for 20 metres up to the bus stop. There are currently no bike lanes within the project limits. Existing storm infrastructure consists of catch basins and storm sewers. The existing drainage provided by the sewers discharges to the Thames River under Philip Aziz Ave. Major flows follow overland flow routes along Philip Aziz Ave, outletting at Thames River. Further details about major overland flow are discussed in **Section 4.5**.

Land Information Ontario (LIO) maps show that the entire study area falls within an area of a Highly Vulnerable Aquifer, which has a vulnerability score of 6 for Groundwater Recharge Area (**Figure 2**). Percent managed lands (**Figure 3**) falls between 40-80 percent for the entire study area. Available Sourcewater Protection (SWP) mapping (from the Upper Thames River Conservation Authority (UTRCA)) shows that the study area (**Figure 4**) falls within 'Moderate' and 'Low' Threat Policy Areas. A tree protection area is located within the vicinity of Philip Aziz Ave (**Figure 5**).

Soils within the subject area are predominantly clayey silt at depths greater than 3.5 m and sand/gravel at depths between 1.4 and 3.5 m and sandy silt at depths of 0.2 to 1.4 m, which is classified as having a moderate to moderately-low permeability. Based on geotechnical survey data from nearby sites (Revision 0 - September 2021 by Golder Associates Ltd), local hydraulic conductivity is assumed at this time to be less than $5x10^{-5}$ cm/s, with an approximate infiltration rate of 25 mm/hr. Based on the borehole information from the as-built drawings from Oct 2011 for the Western Road watermain replacement, the soils are predominantly clayey silt till at depths greater than 1.0 m with a moderate to moderately-low permeability. There is sand material at depths greater than 3.0 m. Additional geotechnical investigations are recommended to confirm groundwater levels and infiltration rates along Saria Rd and Western Rd within the project limits. The groundwater levels and infiltration rates are only confirmed at the storm sewer outlet on Philip Aziz Ave.



Notes and Legend:

- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Conservation Authority Regulated Areas
- Study Area
- Study Limits
- Western Road Corridor Subject to Improvement

London CANADA

AECOM

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Study Area

Project No.	60661402
Sheet No.	Figure 1
Scale:	1:6,500
Date:	2023-02-27

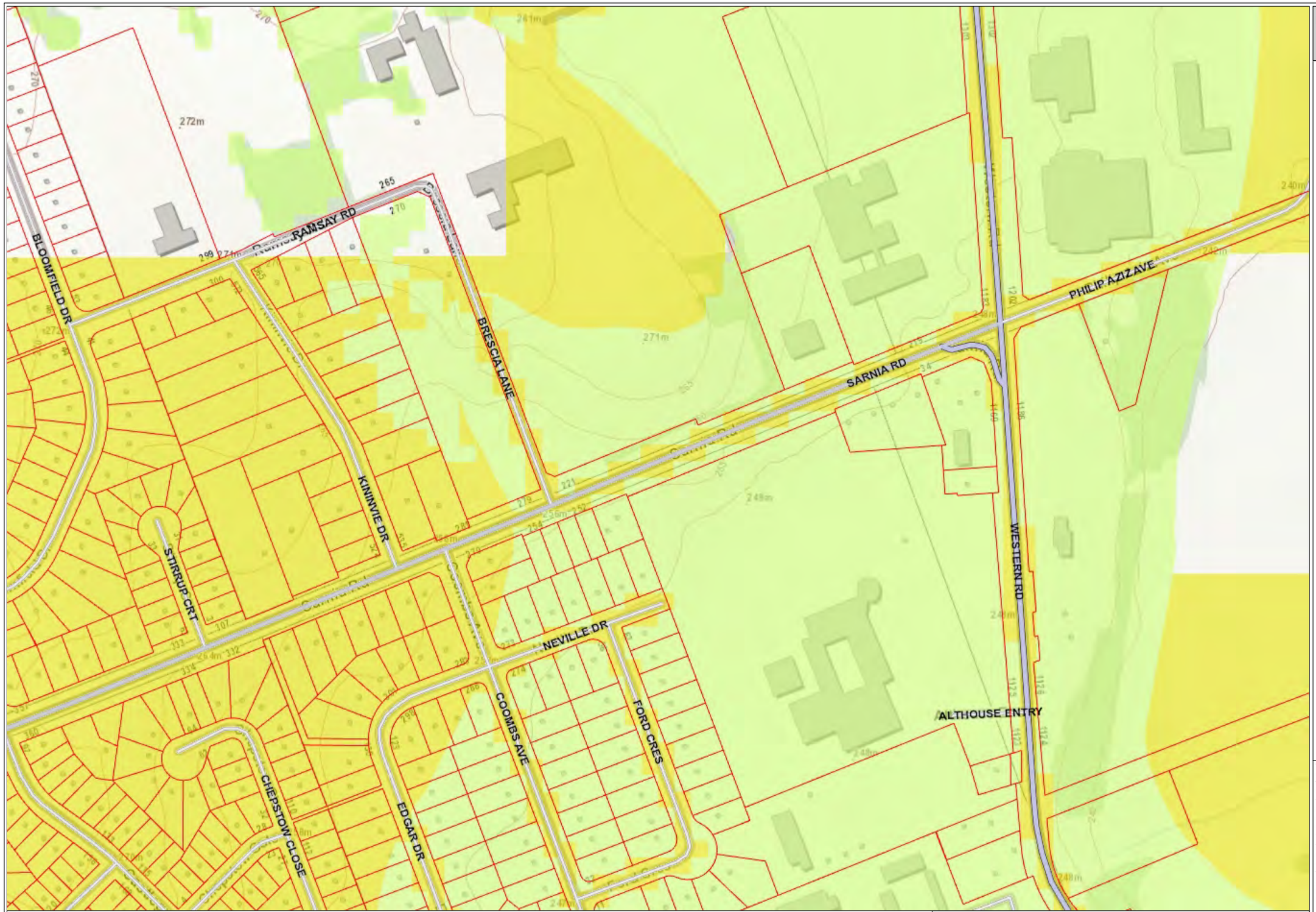


Figure 2:
Thames-Sydenham & Region Source Protection Region Online Mapping

Legend

- Assessment Parcel (MPAC)
- Significant Groundwater Recharge Area - Approved
- Highly Vulnerable Aquifer - Approved

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This document is not a Plan of Survey.

Sources:Base data, 2010 Aerial Photography used under licence with the Ontario Ministry of Natural Resources, Copyright © Queen's Printer for Ontario; City of London.

Notes:Western Road and Sarnia Road/Philip Aziz - Significant Groundwater Recharge Area

Created By: February 24, 2023

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Drinking Water Source Protection — Thames-Sydenham & Region
Upper Thames River Conservation Authority

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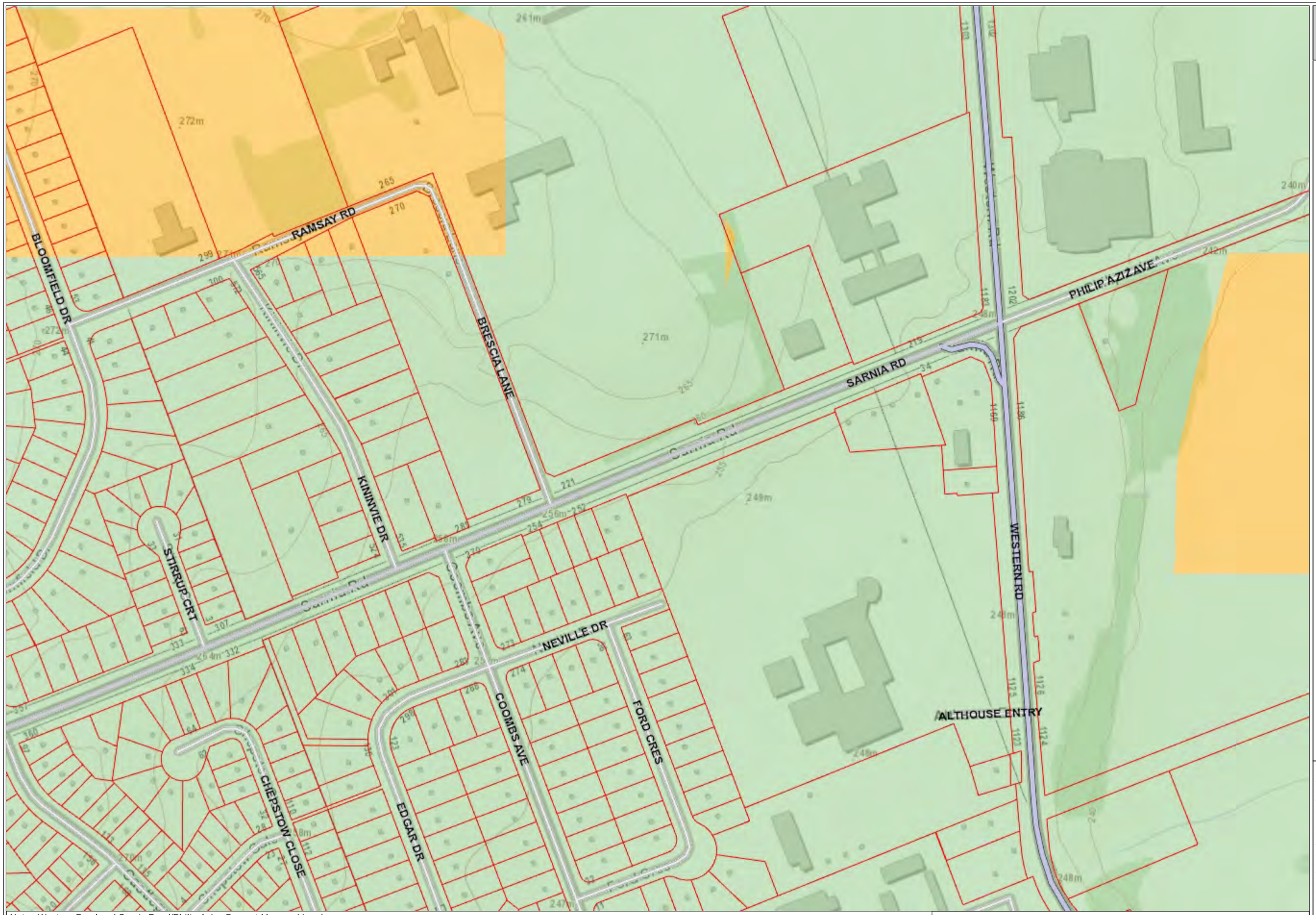

Figure 3:
Thames-Sydenham & Region Source Protection Region Online Mapping

Legend

- Assessment Parcel (MPAC)

Percent Managed Land - Approved

- 0.000000 - 40.000000
- 40.000001 - 80.000000
- 80.000001 - 100.000000

Livestock Density - Approved

- 0 to 0.5
- 0.51 to 1
- > 1.0

Percent Impervious - Approved

- 0 -1.0
- 1.1 - 8.0
- 8.1 - 80.0
- 80.1 -100

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Notes:Western Road and Sarnia Road/Philip Aziz - Percent Managed Lands

Created By: February 24, 2023

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Upper Thames River Conservation Authority

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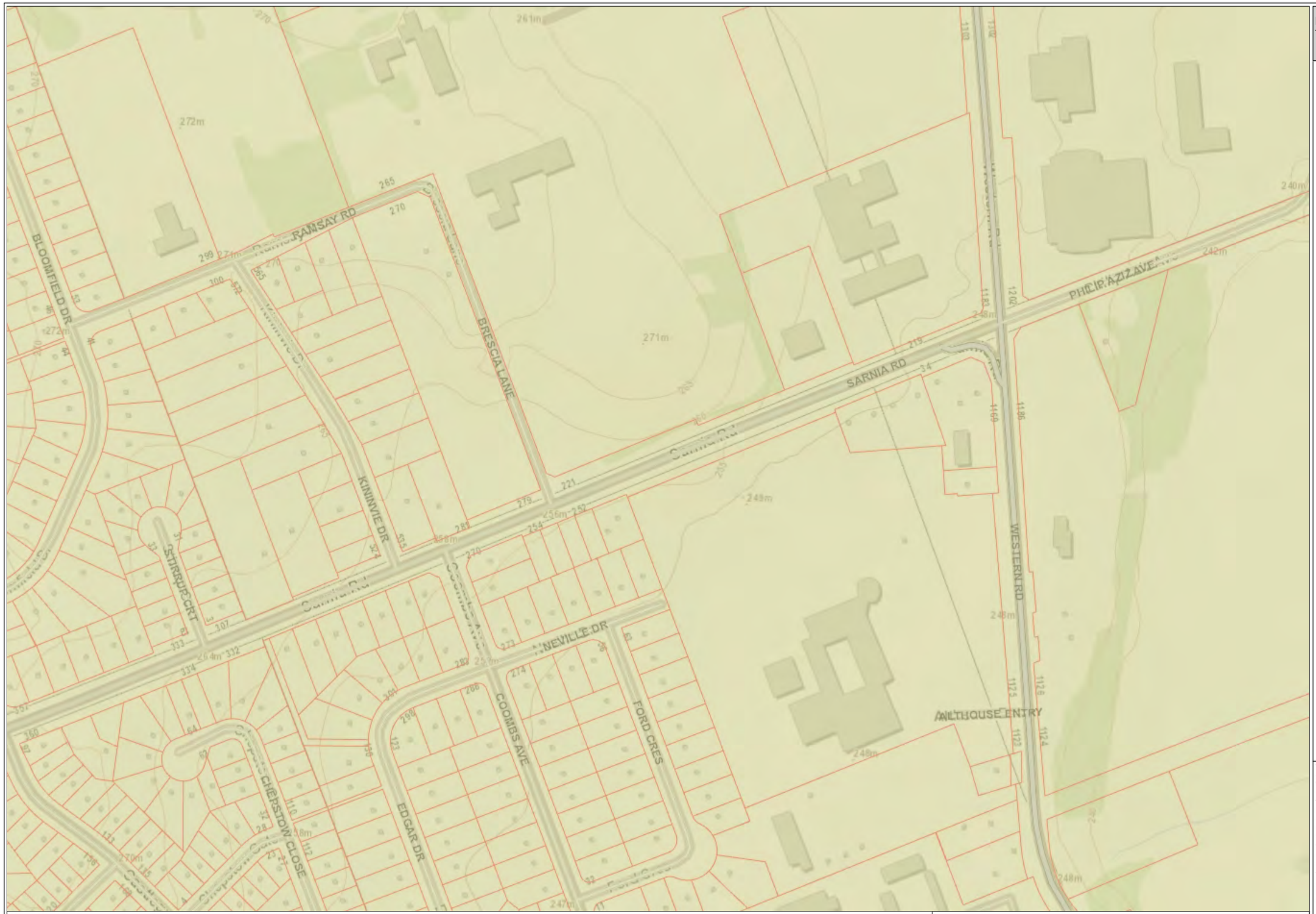

Notes:Western Road and Sarnia Road/Philip Aziz - Source Protection Region

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Figure 4:
Thames-Sydenham & Region Source Protection Region Online Mapping

Legend

- Lower Tier Municipality (MMAH)
- Source Protection Region
- Source Protection Areas
  - Lower Thames Valley
  - St. Clair Region
  - Upper Thames River
- Assessment Parcel (MPAC)

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Figure 5: London City Map - Tree Protection Area

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0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Subwatersheds (2 km buffer of City limit)

- Dingman Creek
- Dodd Creek
- Downstream Thames
- Fanshawe Reservoir
- Medway Creek
- Oxbow Creek
- Pottersburg Creek
- Sharon Creek
- South Thames
- Stoney Creek
- Upper Kettle Creek
- Waubuno Creek
- Wye Creek

Subwatersheds (City of London)

- Central London
- Dingman Creek
- Dodd Creek
- Downstream Thames
- Fanshawe Reservoir
- Masonville Creek
- Medway Creek
- Mud Creek
- Oxbow Creek
- Pottersburg Creek
- Sharon Creek
- South Thames
- Stanton Drain
- Stoney Creek
- The Coves
- Upper Kettle Creek
- Waubuno Creek
- Wye Creek
- Tree Protection Area

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3. Opportunities and Constraints

The following section describes the opportunities and constraints identified by AECOM for the project area. **Table 2** below outlines the subject areas reviewed, along with their attendant opportunities and constraints.

Table 2. Summary of Western Road and Sarnia Road/Philip Aziz Avenue Opportunities

Area of Review	Description	Opportunity or Constraint
Soils	Available geotechnical data from nearby sites suggests that the in-situ soils have moderate- to moderately-low permeability. Site-specific geotechnical data is still required.	Opportunity: • In-situ soil infiltration rate of 25 mm/h (approximate magnitude) allows for retention of some stormwater; and, Constraint: • Will require drawdown within 72 hours.
Groundwater	Site specific groundwater elevation data is still required for areas within Western Road and Saria Road. Groundwater data was available for Philip Aziz storm sewer outlet location.	Constraint: • Location within a Highly Vulnerable Aquifer area may require additional water quality consideration.
Bedrock	Available geotechnical data from nearby sites suggests that bedrock will not be encountered. Based on geotechnical data for Philip Aziz, bedrock elevation was not encountered for boreholes greater than 13 metres deep.	Opportunity: • Bedrock will not limit infiltration potential.
Grading (Existing and Proposed)	Shallow to moderate longitudinal grades are proposed throughout the subject area	Opportunity: • Moderate grades will allow for conveyance of drainage to LID feature.
Winter Maintenance	Average application rate of salt, liquid brine, salt/sand mixture remains to be determined through consultation with the city.	Constraint: • In the absence of free drainage, winter salt application raises risk of salt accumulation within LID features; and • Salt application likely to impact soil structure over long-term.
Existing Vegetation	Limited green space is found within the study area, as it is a primarily urban area. Grass and trees are present within isolated patches of the study area.	Constraint: • Due to the heavy traffic within the study area, improving existing green space through implementation of soil filtration cells is potentially infeasible due to maintenance considerations.
Safety and Sightlines	No site line issues were identified.	Not applicable – no sightline issues identified
Surface Drainage Patterns	Drainage throughout this section of road is characterized predominantly by catch basins and municipal sewer systems.	Opportunity: • Improvements to existing storm sewer capacity Constraint: • Project to consider overland flow management; and • Due to limited ROW within the study area, LIDs open to the surface are not feasible in most areas
Watercourse Flood Risk	Several locations within the study area do not have defined overland flow routes.	Not applicable – no watercourse flood risk identified.

Area of Review	Description	Opportunity or Constraint
Utilities and Infrastructure (Existing and Proposed)	The project area borders Western Road, which is an area slated for future development.	Opportunity: • Road reconstruction affords opportunity to install new utilities in desirable locations. • Installation of new storm sewers also allows for the installation of EES.
Utilities and Infrastructure (Existing and Proposed)	The project area borders Western Road, which is an area slated for future development.	Constraint: • Not all utilities to be relocated as part of this work and accommodations must be made; and, • Depth and location of buried infrastructure restricts areas where SWM measures can be placed

3.1 Data Gaps

Following the completion of the background information review, the following data gaps were identified:

- Native soil hydraulic conductivity and infiltration rates throughout the project corridor are not currently known for Western Road and Sarnia Road. This information is to be confirmed during detailed design and will be collected/provided by a third-party geotechnical engineering firm. Soil infiltration rate of 10 mm/h is assumed.
- Groundwater elevation profiles within the project area are not currently known Western Road and Sarnia Road. This information helps with the determination of whether or not acceptable separation from seasonally high groundwater exists, or if facility depths will be limited by groundwater elevations. This information is to be confirmed during detailed design.

4. Existing Conditions

Existing catchment areas have been determined based on City of London 1 m contours, site plans (where available), City of London storm sewer GIS shape files, Western University Campus Site Utilities and Servicing Plan (2013) and site verification. A site inspection was conducted on April 2nd, 2015. Western University buildings and parking lots within the study area are summarized on **Figure 1.** The study area is contained within the Central Thames Sub-watershed. The east limit of the study area is affected by the Upper Thames River Conservation Authority (UTRCA) regulatory limit (refer to **Figure 1**).

4.1 Existing Minor System

The existing minor system drainage for the study area consists of municipal and Western University private infrastructure. Refer to **Figure 6** for details. Orange (Kininvie Drive Ave and Sleightholme Ave via Sarnia Road) and green (Drainage to Outlet D via Sarnia Road) drainage mosaic outline are currently draining to Mud Creek. Detailed design will evaluate the possibility of draining this area to outlet B in accordance with the City's desire to reduce flows within the existing Mud Creek sewer system.

4.2 Local Minor System Infrastructure

Local minor system drainage is generally conveyed via curbing and gutters and storm sewers along the study area corridor. In some locations the storm sewer diameters decrease in the downstream direction, which regardless of slope is not a recommended practice. The minor system drainage is as follows:

Western Road

- Grosvenor Lodge to Perth Hall: Existing 900 mm diameter storm sewers along Western Road, from Perth Hall Residence to north of Platt's Lane, are conveyed to an existing 1050 mm diameter trunk

sewer. Flows are directed to a storm sewer outfall opposite 1083 Western Road, adjacent to the Western University soccer fields. Flows are conveyed beneath the soccer fields to a storm sewer outfall at the Thames River.

- Sarnia Road/Philip Aziz Avenue to Perth Hall: Existing 250 mm to 375 mm diameter storm sewers along Western Road convey flows to an existing 375 mm diameter storm sewer on Philip Aziz Avenue at Western Road.

- Brescia Lane/Lambton Drive to Sarnia Road/Philip Aziz Avenue: Limited storm infrastructure is present along this section of Western Road. Curb and gutters are limited to the vicinity of Lambton Drive/Brescia Lane and Sarnia Road/Philip Aziz Avenue intersections. The lack of curb and gutters allows road drainage to spill onto private lands along the corridor.

  The east side of Western Road is serviced by private Western University storm sewer connections. Minor flows from the Springett Parking Lot, Brescia University College, and the Richard Ivey Building are conveyed through private storm sewer connections across the Western Road right of way (ROW) into the Western University private storm sewer system. Quality control is provided by permanent private systems (PPS) for the recently completed Richard Ivey Building and Brescia University College expansion through grassed swales, filter strips, and dry detention basins.

  - There are no existing storm sewers servicing the west side of Western Road along this section. A double catch basin at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue captures conveyed flows and discharges to the existing 375 mm diameter storm sewer. The existing 200 mm diameter storm sewer along the west side of Western Road conveys flows from Elborn College entrances to the existing 375 mm diameter storm sewer at Sarnia Road/Philip Aziz Avenue. A private drain connection for Elborn College is provided. Flows are directed to a 300 mm storm sewer on Philip Aziz Avenue at Western Road.

- Burnlea Walk to Brescia Lane/Lambton Drive: Existing 450 mm diameter storm sewers along Western Road convey flows to existing 525 mm to 675 mm diameter storm sewers on Western Road. Flows are directed to a storm sewer outfall at Medway Creek.

  - Private storm sewers service the Western University pedestrian underpass crossing and adjacent ramps.

Sarnia Road

- Ontario Hall to Western Road: Existing 675 mm diameter storm sewers along Sarnia Road convey flows to an existing 450 mm diameter storm sewer on Sarnia Road at Western Road. Flows are directed to an existing 375 mm diameter sewer on Philip Aziz Avenue at Western Road.

- Sleightholme Avenue to Ontario Hall: Existing 100 mm to 600 mm diameter sewers along Sarnia Road convey flows to an existing 600 mm diameter trunk sewer on Coombs Avenue. The southern portion of Brescia University College contributes flows to the 450 mm diameter storm sewer on Sarnia Road.

Philip Aziz Avenue

- Western Road to Huron Drive: Existing 300 mm and 375 mm diameter storm sewers service separate upstream catchments. The existing 300 mm diameter storm sewer services Western Road from Brescia Lane/Lambton Drive to Sarnia Road/Philip Aziz Avenue and Elborn College.

The existing 375 mm diameter storm sewer services Sarnia Road from Ontario Hall and Western Road from Perth Hall to Sarnia Road/Philip Aziz Avenue. The 300 mm and 375 mm storm sewers converge approximately 100 m east of Western Road. Flows are conveyed by a 300 mm storm sewer to a storm outfall at the Thames River.

Based on a review of the storm sewer network and field verification of site conditions, it is recognized that portions of the ROW minor drainage system are performing below current design standards. The following conditions exist:

- Under sized storm sewers on Philip Aziz Avenue and Sarnia Road;
- Storm sewers with diameters decreasing in the downstream direction;
- Lack of storm sewers, curb and gutter, and overflow of road drainage of Western Road onto private lands from Brescia Lane/Lambton Drive to Sarnia Road/Philip Aziz Avenue;
- Significant ponding at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue; and
- No formal stormwater management systems for quality control currently in place for the Western Road corridor.

4.3 Existing Minor System Outlets

Generally, the trunk minor system drainage is conveyed via ditches, curb and gutters, and storm sewers to the following outlets:

- Outlet A: a1050 mm diameter storm outfall opposite 1083 Western Road;
- Outlet B: a 300 mm diameter storm outfall to Thames River (North Branch);
- Outlet C: a 675 mm diameter storm outfall to Medway Creek; and,
- Outlet D: a1350 mm diameter storm outfall to an unnamed watercourse.

It is anticipated that minor system drainage improvements associated with the current proposed road improvements may require a connection into Outlet A, Outlet B and Outlet D. No changes to catchment conditions are anticipated for Outlets C. AECOM reviewed the storm sewer capacity for Outlet A, Outlet B and Outlet D by utilizing the City of London design standards (March 2022) which require that storm sewers are designed to convey, at a minimum, up to the 5-year storm event using City of London standards per Section 5. The “Minor System” incorporates storm sewer pipes, catch basins, roadway gutters and swales, and private storm drain connections for all land uses. Refer to **Appendix A** for calculations. Residual capacity is available in Outlet A; however, Outlet B is significantly undersized for existing design flows. Some pipe capacity load will be re-directed to Outlet B instead of Outlet D for storm sewers within Brescia Lane, Kininvie Drive and, Sleightholme Ave.

4.4 Existing Major Overland Flow System

Within the study area, major flow routes differ slightly from the general path of the storm sewer system, refer to **Figure 7**. The difference in the flow routes of the major and minor systems can be attributed to the topography within the study area and the existing vertical alignment of Western Road and Sarnia Road/Philip Aziz Avenue.

4.5 Local Major System Drainage

Western Road, 140 m north of Brescia Lane/Lambton Drive: The existing road profile contains a high point. Major flows to the north of the high point are conveyed along Western Road to Medway Creek. It is not anticipated that there will be any significant changes to drainage in this area and it has been excluded from

the current study area. Major flows to the south are conveyed along Western Road to Sarnia Road/Philip Aziz Avenue. The existing road profile and curb returns at Lambton Drive/Brescia Lane allow flows to be diverted down Lambton Drive/Brescia Lane.

Springett Lot, Brescia University College and Richard Ivey Building: Major flows from these University properties spill onto the Western Road corridor and are conveyed to the intersection of Western Road and Sarnia Road/Philip Aziz Avenue. Limited quantity control is provided on Brescia lands and the Richard Ivey Building lot through recently constructed grassed swales, and dry detention basins. Initial assessment indicates that available storage volume will be exceeded in the 5-year storm event.

Sarnia Road, 100 m east of Brescia Lane: The existing road profile contains a high point. Major flows to the east are conveyed to the intersection of Western Road and Sarnia Road/Philip Aziz Avenue. Major flows to the west are conveyed down Coombs Avenue. It is not anticipated that there will be any significant changes to drainage patterns to the west and it has been excluded from the current study area.

Intersection of Western Road and Platt's Lane: The existing road profile contains a high point. Major flows to the south of Platt's Lane are subject to improvements conducted as part of the current Class EA and preliminary design work for the Western Road/Wharncliffe Road North Widening from Platt's Lane to Oxford Street. It has therefore been excluded from the current study area. The corridor section north of Platt's Lane to Sarnia Road/Philip Aziz is relatively flat with slight depressions. Major flows accumulate in a slight depression south of the Althouse Faculty of Education entrance until they spill east onto private lands. Flows are informally directed to the Thames River via the Western University soccer fields.

Intersection of Western Road and Sarnia Road/Philip Aziz Avenue: The existing road profile contains a low point south of the intersection of Sarnia Road/Philip Aziz Avenue. Flows from upstream catchments accumulate until they spill down Philip Aziz Avenue. The lack of appropriately sized storm sewers and continuous overland flow path causes frequent ponding at the intersection of Western Road and Sarnia Road/Philip Aziz Avenue.

Philip Aziz Avenue: Major flows from the intersection of Western Road and Sarnia Road/Philip Aziz Avenue spill down Philip Aziz Avenue towards the Thames River. A flow spilt occurs at the Huron Lot entrance. Flows to the Huron lot accumulate within parking lot depressions and are conveyed to the Thames River by private infrastructure. Residual flows along Philip Aziz Avenue accumulate at the intersection of Philip Aziz and Huron Drive until they spill east to the Thames River.

Figure 7 illustrates the low areas susceptible to ponding during significant rainfall events. In addition to the minor systems concerns mentioned in Section **4.2**, AECOM identifies the following concerns for the existing major system:

- Discharge of major flows from the Richard Ivey Building and Brescia University College stormwater management infrastructure onto Western Road.
- Low topographic relief along Western Road from Platt's Lane to Sarnia Road/Philip Aziz Avenue;
- Significant ponding in the vicinity of the Western Road and Sarnia Road/Philip Aziz Avenue intersection. No continuous major overland flow path.
- Directing flows from Philip Aziz Avenue onto private property at the Huron Lot entrance.

4.6 Major System Outlets

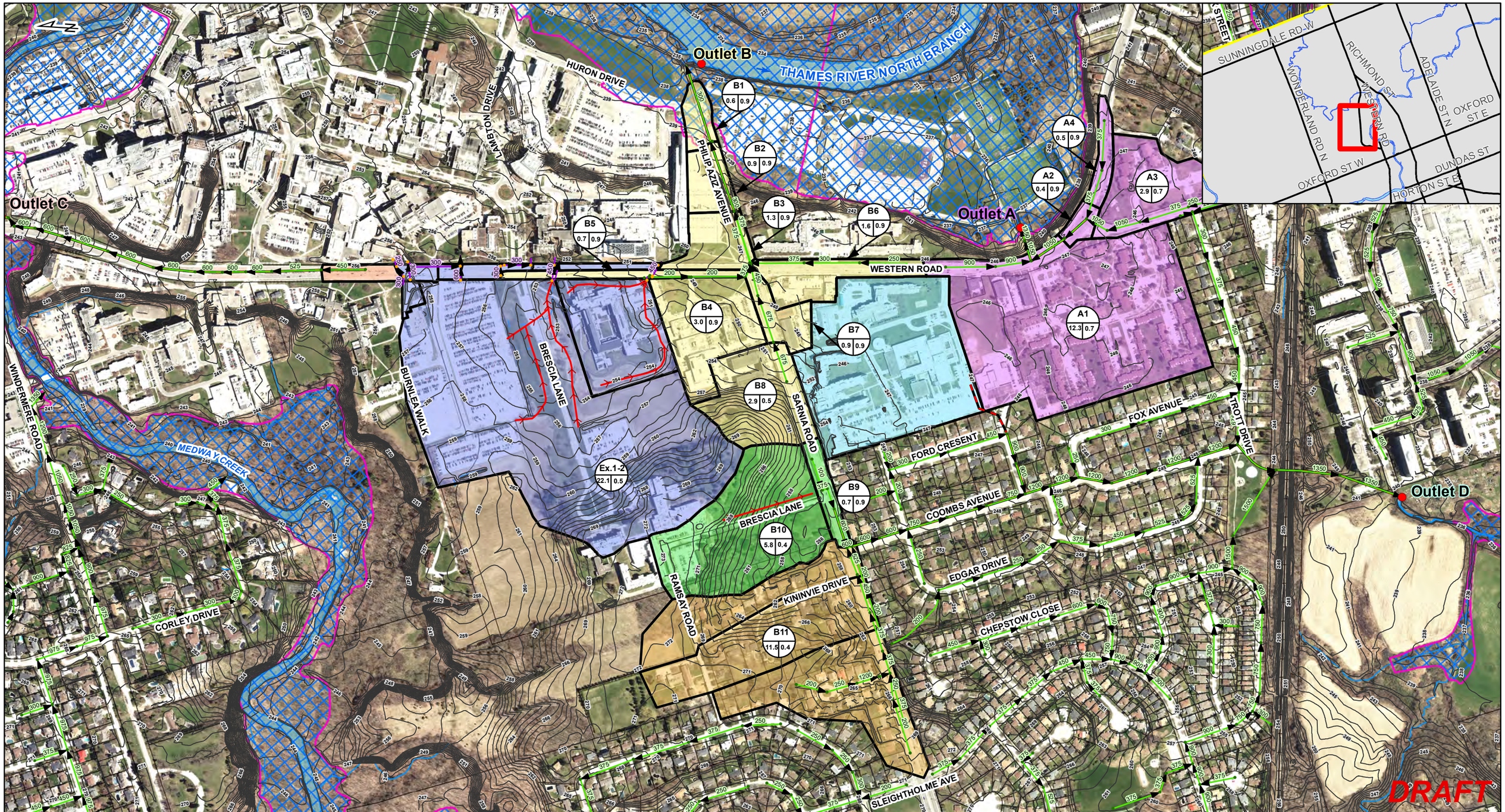
Generally, the major system drainage is conveyed via roadways to the intersection of Western Road and Sarnia Road/Philip Aziz Avenue. Major flows accumulate south of the intersection, until they spill east along Philip Aziz Avenue to the Thames River. **Figure 7** illustrates overland flow routes with blue arrows.

4.7 Ponding Analysis

A DEM derived model was extracted to generate a fill surface to show ponding within the study limit. **Figure 8** illustrates ponding locations. There are four locations where ponding exists during major events if CBs were to be designed for only the 5-year event:

1. Western Road, southeast of the Sarnia Road / Philip Aziz Ave intersection: There is a potential for stormwater ponding and localized flooding in the immediate vicinity of Essex Hall. Partial re-grading of Western Road is recommended in this area to permit overland flow towards Philip Aziz Ave and ultimately towards the Thames River. The area of ponding is approximately 1720 m^2 with a perimeter of 493 m. A detailed review of drainage, runoff and re-grading will be undertaken during detailed design.
2. East of Philip Aziz Ave near Outlet B. Re-grading Philip Aziz in a way so that water would spill directly to Thames River without ponding on the road may be possible. The area of ponding is approximately 1240 m^2 with a perimeter of 514 m.
3. South of Philip Aziz on Western Road. The ponding does not appear to cause any spill or flooding on neighboring properties; water appears to only pond on the road. Opportunities to re-grade Western Road would eliminate this ponding. There is a current stormwater pipe and outlet leading down to the lower field level. There could be an opportunity to improve the drainage of this pipe and its inlet. There is a sufficient ROW property that can be used to improve the drainage during detailed design. The area of ponding is approximately 730 m^2 with a perimeter of 408 m.
4. Sarnia Road, South of Brescia Ln intersection: There is a potential for stormwater ponding and localized flooding in the immediate vicinity of Brescia Ln and Sarnia Road intersection. Partial re-grading of Sarnia Road is recommended in this area to permit overland flow towards Coombs Ave and ultimately towards MUD Creek. The area of ponding is approximately 5520 m^2 with a perimeter of 865 m. A detailed review of drainage, runoff and re-grading will be undertaken during detailed design.

There are four locations within the study limits of the road's right of way that have no clearly defined overland flow (major system) outlet and may therefore be expected to collect runoff within the roadway lanes during large storm events. Aerial images of the sag locations and spill directions are provided on **Figure 8**, **Figure 9**, **Figure 10**, **Figure 11**, and **Figure 12**. The two primary concerns involved with road sag locations are: the depth of flooding on the roadway, and the location where the overflow spills towards. Deep ponding on the road is a safety concern and allowing overflow to spill towards private property carries with it the risk of potential legal liability. Detailed ponding depth, cross-sections and drainage area calculations will be preformed during detailed design in an effort to minimize impacts to the private properties.



Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- Existing Storm Sewer
- Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Regulated Areas
- Sub Catchment
- Drainage to Outlet A
- Drainage to Outlet B
- Drainage to Outlet C
- Drainage to Outlet D via Sarnia Road
- Drainage to Outlet D via Fort Cresent
- Drainage to Thames River via Private Storm Sewers
- Kinnvie Drive Ave Via Sarnia Road

Catchment ID: A1

Catchment Area (ha): 12.3

Run-off Coefficient: 0.7

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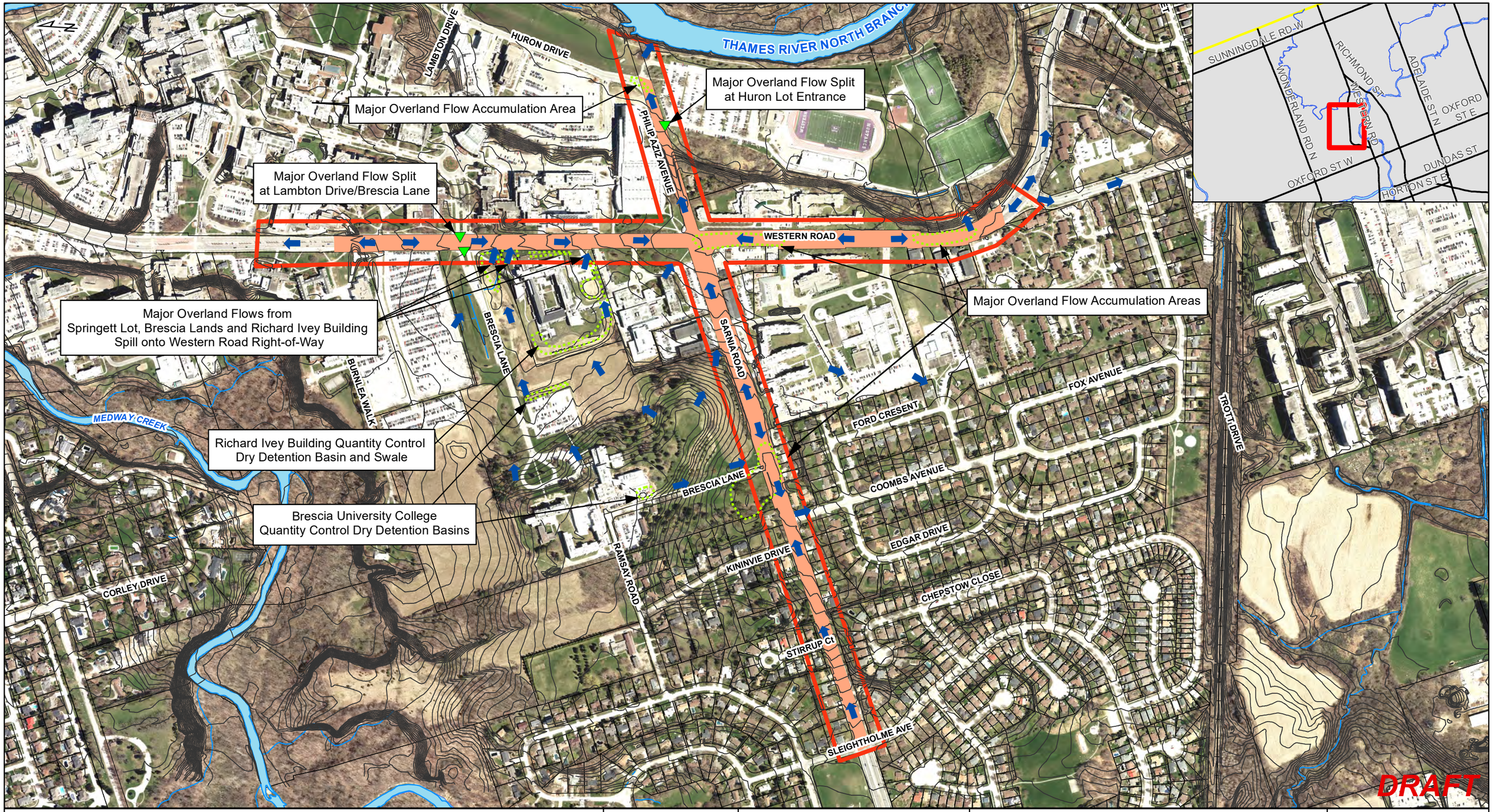
Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Existing Minor System Drainage

Project No.	60661402
Sheet No.	Figure 6
Scale:	1:6,500
Date:	2023-02-27



Notes and Legend:

- Flow Split
- Ponding Area
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Western Road Corridor Subject to Improvement
- Study Area

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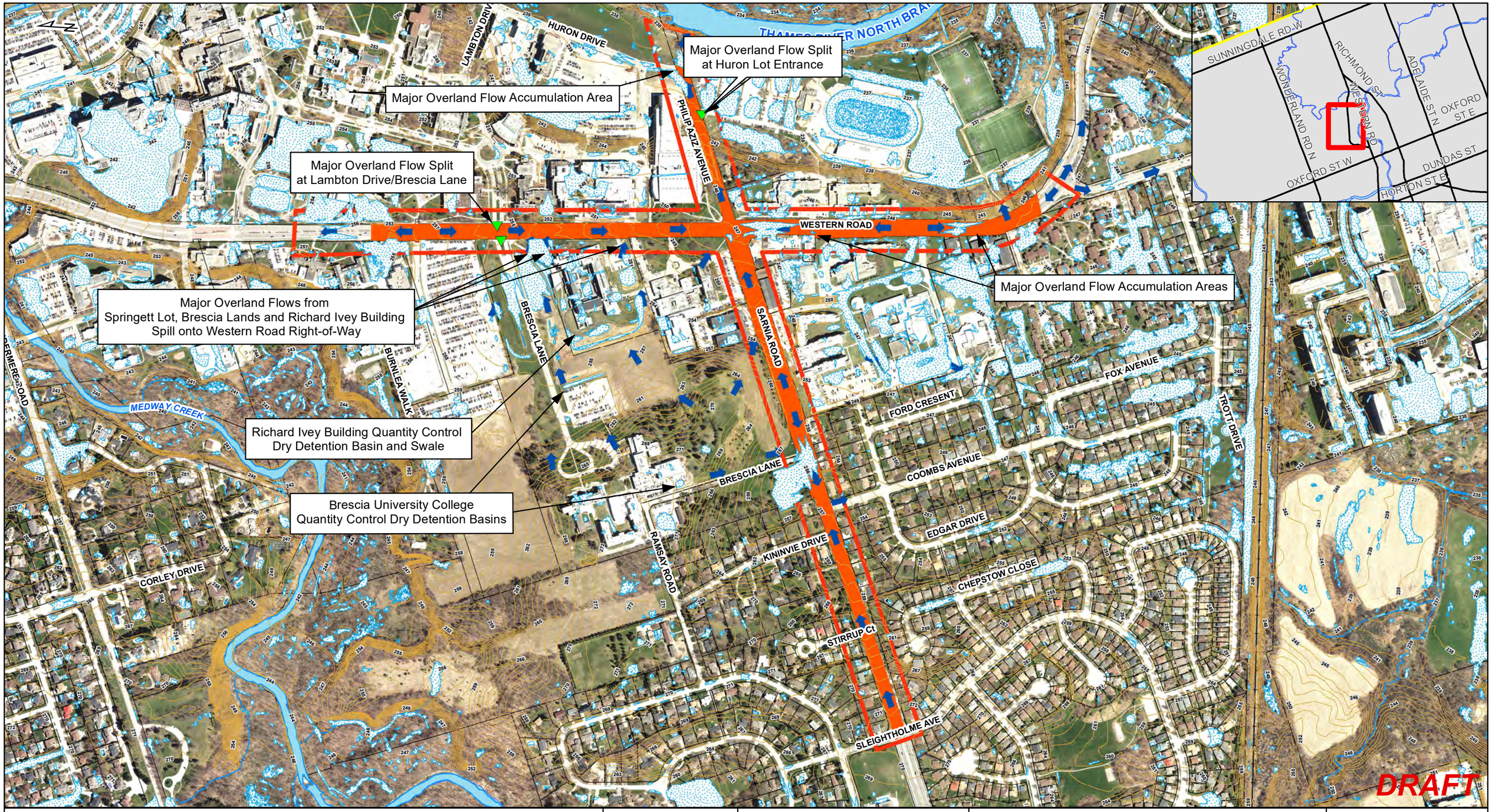
Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Existing Major System Drainage

Project No.	60661402
Sheet No.	Figure 7
Scale:	1:6,500
Date:	2023-02-27



Notes and Legend:

- Flow Split
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Ponding Areas
- Western Road Corridor Subject to Improvement
- Study Area

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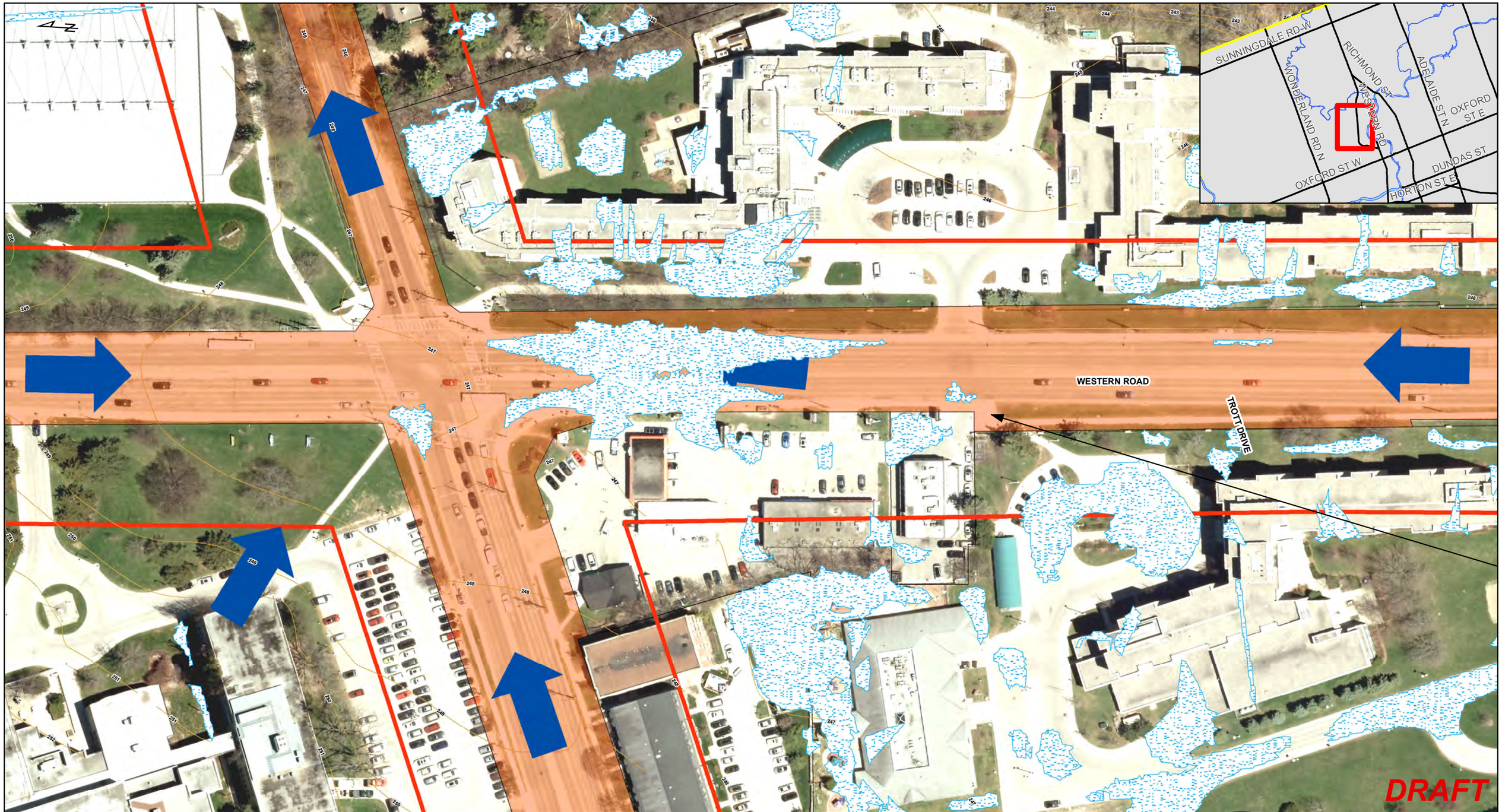
AECOM

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Major System Drainage - Ponding

Project No.	60661402
Sheet No.	Figure 8
Scale:	1:6,500
Date:	2023-02-24



Notes and Legend:

- Flow Split
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Ponding Areas
- Western Road Corridor Subject to Improvement
- Study Area

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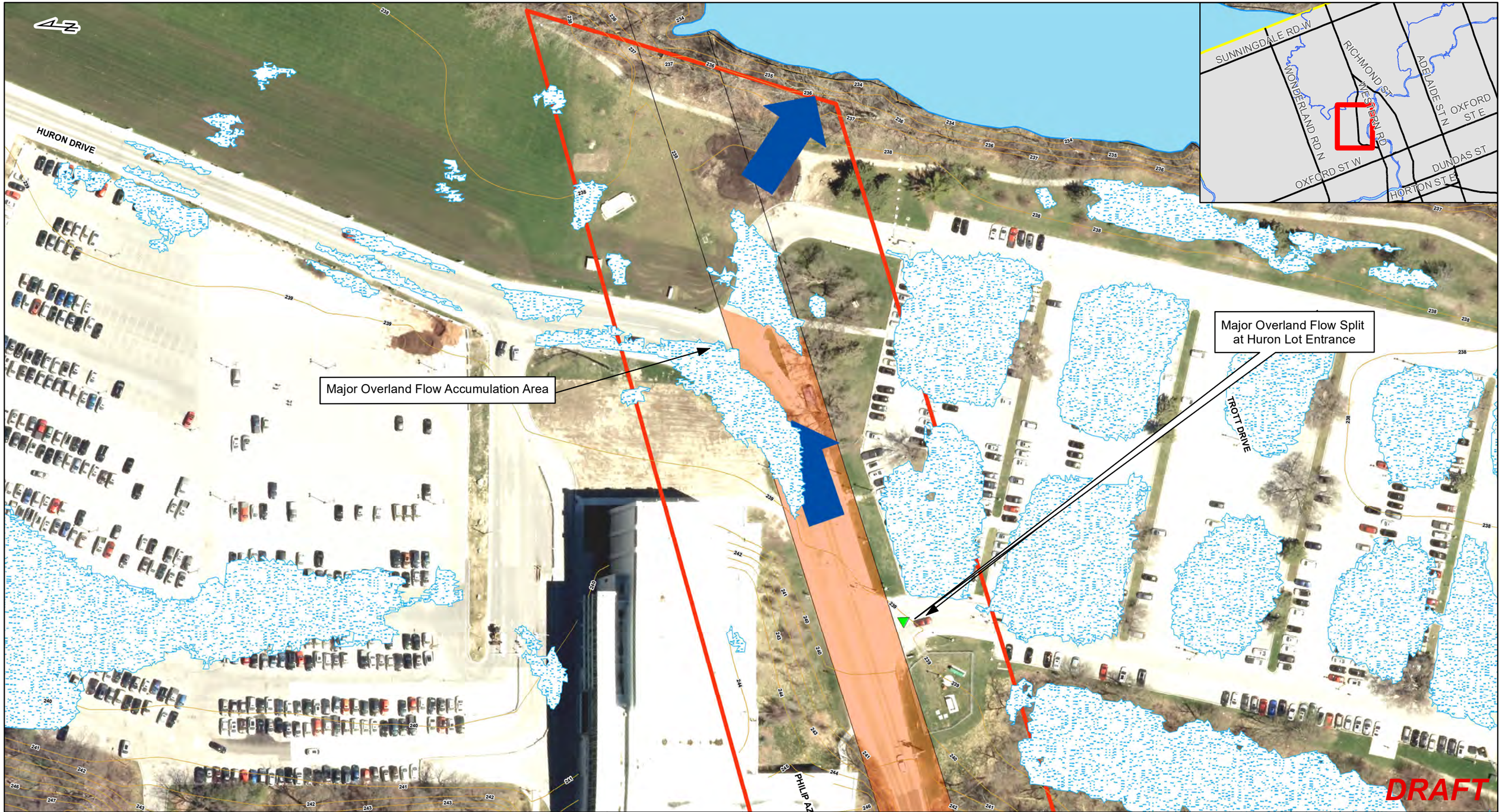
AECOM

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Major System Drainage - Ponding 1

Project No.	60661402
Sheet No.	Figure 9
Scale:	1:1,000
Date:	2023-01-09



Notes and Legend:

- Flow Split
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Ponding Areas
- Western Road Corridor Subject to Improvement
- Study Area

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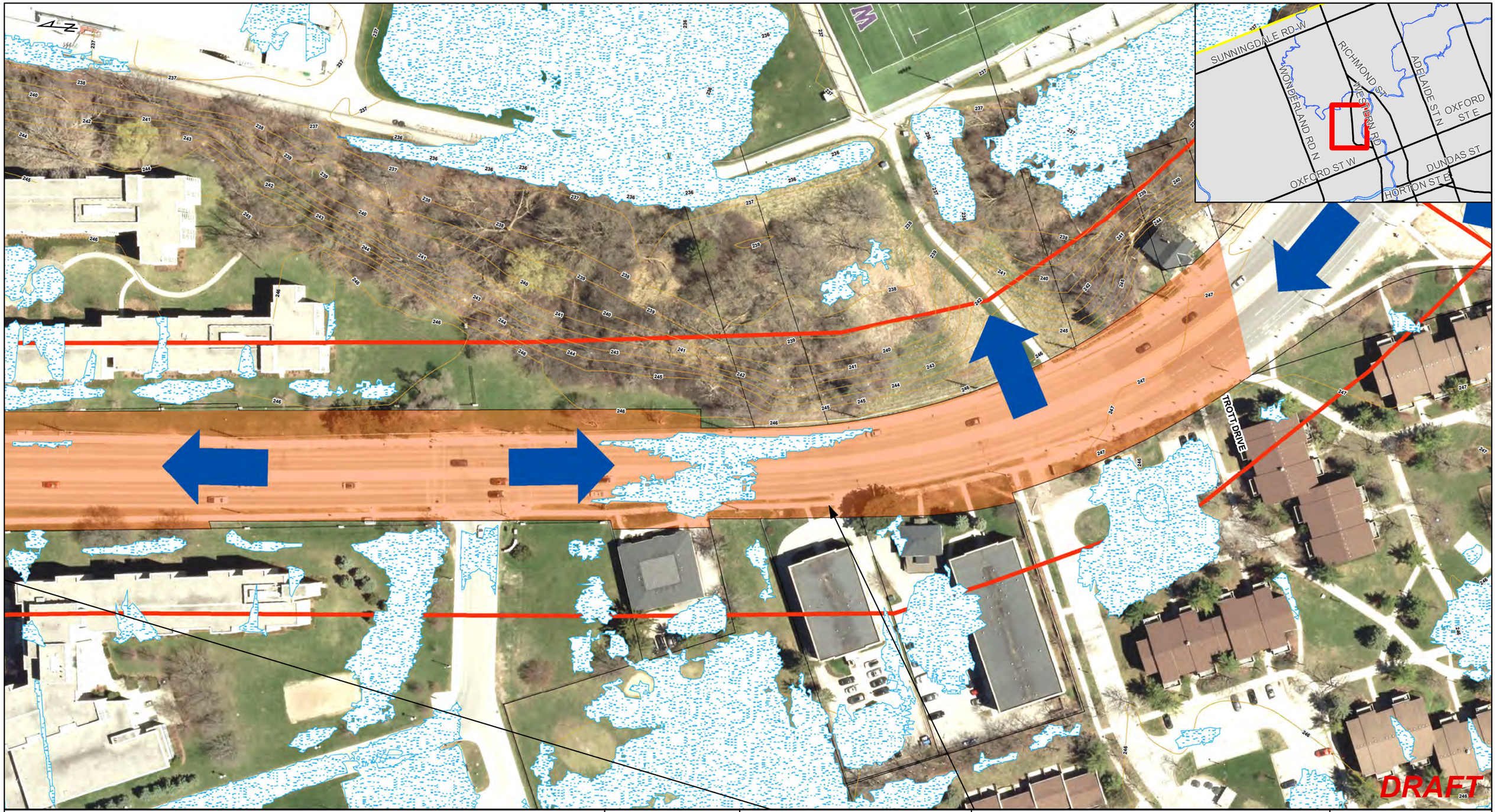
Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Major System Drainage - Ponding 2

Project No.	60661402
Sheet No.	Figure 10
Scale:	1:1,000
Date:	2023-01-09



Notes and Legend:

- Flow Split
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Ponding Areas
- Western Road Corridor Subject to Improvement
- Study Area

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Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Major System Drainage - Ponding 3

Project No.	60661402
Sheet No.	Figure 11
Scale:	1:1,000
Date:	2023-01-09

Notes and Legend:

- Flow Split
- Major Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Ponding Areas
- Western Road Corridor Subject to Improvement
- Study Area

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Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Major System Drainage - Ponding 4

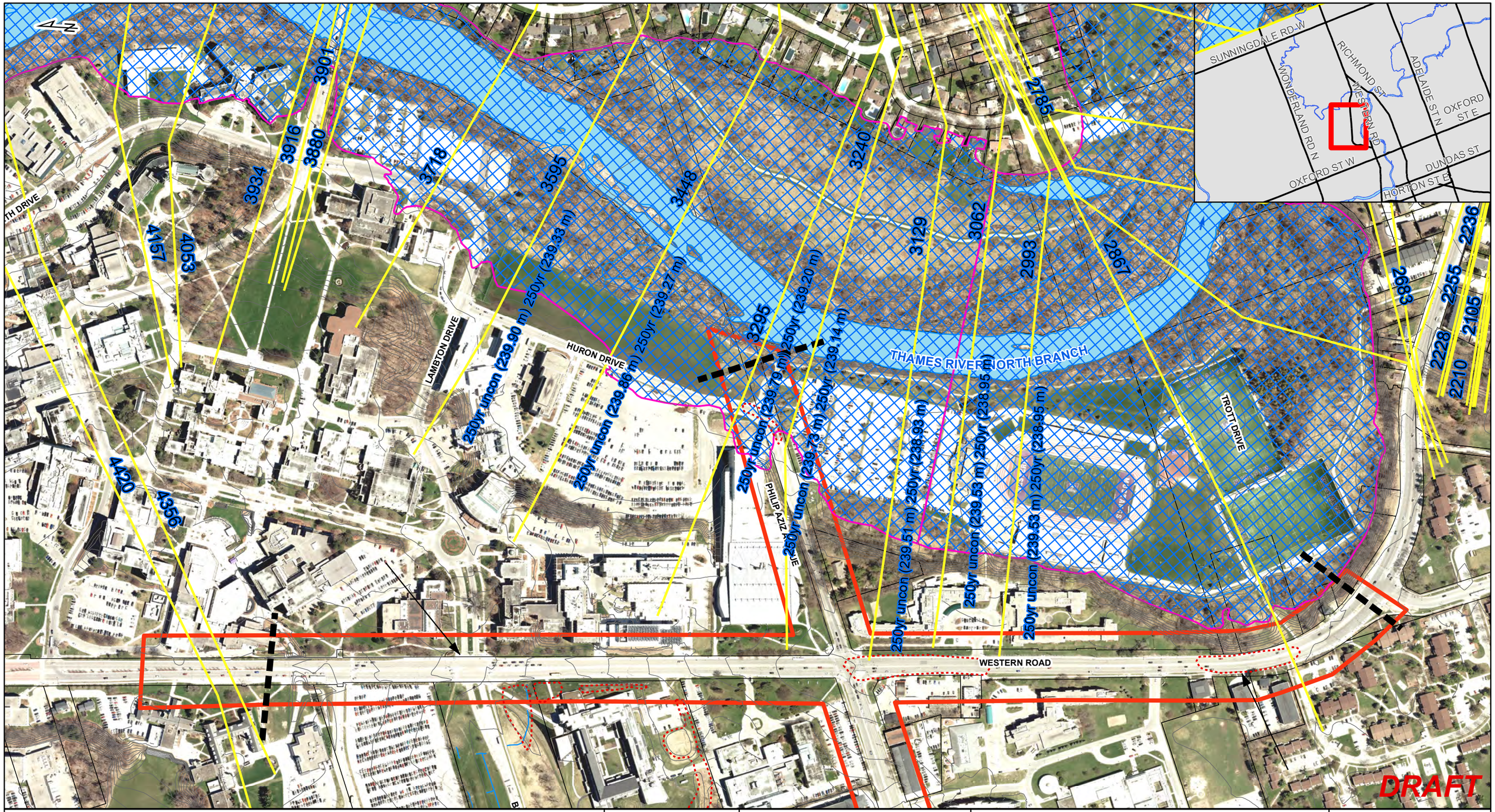
Project No.	60661402
Sheet No.	Figure 12
Scale:	1:1,000
Date:	2023-02-24

5. Regulatory Event

The study area is contained within the Central Thames Sub-watershed. Portions of the study area are affected by the Upper Thames River Conservation Authority (UTRCA) regulatory extents, refer to **Figure 1**. Regulatory flood lines exist along the corridor at the intersection of Philip Aziz Avenue and Huron Drive.

5.1 Thames River HEC-RAS Model

A HEC-RAS Model was reviewed as part of this study. Cross sections were inserted, and regional flood levels are shown on **Figure 13**. The regional uncontrolled water level within the vicinity of “Outlet B – cross section 3295” is 239.79 m and controlled is 239.14 m.



Notes and Legend:

- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Study Area
- Study Limits
- Conservation Authority Regulated Areas
- HEC-RAS Cross-Sections

London CANADA

AECOM

Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Thames River HEC-RAS Regional Flood Levels

Project No.	60661402
Sheet No.	Figure 13
Scale:	1:4,000
Date:	2022-01-27

6. LID Design Criteria and Recommendations

6.1 General

The Western Road and Sarnia Road/Philip Aziz Improvements project has the opportunity to utilize an innovative LID-based stormwater management system which manages runoff close to the source of its generation and treats stormwater runoff as a resource to be harnessed as opposed to a waste product to be discarded. LID-based SWM approaches emphasize the management of stormwater at its source, followed by ongoing treatment along its path of travel (source and conveyance controls). This “treatment train” approach to stormwater management mimics natural hydrologic processes by slowing down, filtering, and attenuating stormwater, by making beneficial use of it on the landscape, and also by retaining a portion of it for infiltration into native soils. The following section provides additional details regarding the available opportunities and recommendations for the system components which may comprise the LID system.

6.2 Design Criteria

The proposed SWM design criteria for the Western Road and Sarnia Road/Philip Aziz Improvements are based on the following documents:

1. Stormwater Management Planning and Design Manual (MOE, 2003);
2. City of London’s 2022 Stormwater Management Design Specification and Requirements Manual (City of London, March 2022);
3. Low Impact Development Stormwater Management Planning and Design Guide (STEP, 2020) and,
4. Design Specification and Requirements Manual (City of London, March 2022)
5. The City’s 2019 Stormwater Management Design Specification and Requirements Manual, Section 6.2.1.3(c)i-ii, provides guidance for road reconstruction projects:
6. Best efforts should be made to retrofit water quality controls for Rapid Transit Boulevard, Main Street, Urban Thoroughfare, or Civic Boulevard roads during reconstruction projects; and,
7. Water quality control shall be provided for any additional impervious surface area (e.g., road widening projects). ii. Water quality controls should be retrofitted on neighbourhood streets where feasible and practical.

The city also requires engineered stormwater management systems to satisfy water quality requirements for peak flows and volumes up to the 25 mm storm event. The city criteria states that, by implementing infiltration or filtration measures for a volume representing the 25 mm storm event, the TSS reduction targets will be considered satisfied.

6.3 Screening and Evaluation of Suitable LID Options

As noted within relevant LID retrofit guides (e.g., CVC’s Grey to Green Road Retrofit Guide), multiple LID implementation options exist which may be suitable for application along arterial roadways. Supporting guidance and information is also available from the City of London’s 2022 Stormwater Management Design Specification and Requirements Manual and the Sustainable Technologies Evaluation Program (STEP) 2018 LID Planning and Design Guide. Screening the suite of viable LID road retrofit options is an important step in the identification and selection of the best LID option(s) for a given SWM servicing project, and this is accomplished by means of a systematic screening process. The following section summarizes the screening approach employed for the Western Road and Sarnia Road/Philip Aziz Improvements. Prior to the screening process, City staff were consulted in January 2022 to confirm their

operational capabilities and further refine the list of potentially suitable servicing options. To streamline efforts, the screening and evaluation process has been broken into two main components:

1. Feasibility Screening Assessment: A rapid screening approach used to assess the broad suitability of various LID alternatives using a general level of detail. Suitable options identified through this process are carried forward for a more detailed engineering assessment; and,
2. Detailed Evaluation: The process utilized to evaluate the LID options carried forward from the Feasibility Assessment. Feasibility screening is completed using a robust suite of criteria intended to capture the broad range of physiographic, functional, maintenance and related considerations

6.4 Potentially Suitable LID Options

Based on the information available within the City of London's 2022 SWM Manual, CVC's Grey to Green Road Retrofit Guide, STEP's 2018 LID Planning and Design Guide and related resources, several suitable LIDs retrofit options may be considered. The following LID options were assessed to determine which servicing options would potentially be most suitable for application throughout the Western Road and Sarnia Road/Philip Aziz Improvements, based on the currently available information:

1. Bioswales: Bioswales could be placed in select areas within the project limits where the city owns lands adjacent to the road corridor. Bioswales would provide filtration and attenuation of stormwater runoff, and a subsurface retention area could be incorporated within the design to provide groundwater recharge benefits as well;
2. Soil Filtration Systems (including Structurally Supported Soils): Similar to a bioretention unit, reinforced soil planters fulfill attenuation, filtration, and partial retention functions. Additionally, these units are well-suited for application in compact areas with tight spatial constraints, and can be surfaced with sidewalk panels or other impervious finishes without leading to compacted soils;
3. Infiltration Gallery System: it would be connected to catch basins along the storm sewer network which would reduce local runoff volumes during minor storm events. Under larger storm events, a secondary catch basin lead, installed at a higher elevation than the Infiltration Gallery obvert, would direct flow to the storm sewer.
4. Permeable Pavements / Permeable Interlocking Concrete Pavers (PICP): PICPs can be used to infiltrate stormwater runoff from sidewalks, bike lanes and multi-use trail areas. This system can be configured to incorporate a subsurface granular storage reservoir in order to attenuate and retain additional stormwater runoff;
5. Etobicoke Exfiltration Systems (EES): A subsurface perforated pipe located underneath the travelled surface of the roadway and the existing sewer lines, in order to collect and infiltrate flows collected by upstream catch basins; and,
6. Subsurface Chamber or Crate Systems: Chamber or crate-style systems would receive runoff and attenuate stormwater flows. Such systems are readily adaptable and could be modified to provide partial retention and attenuation of stormwater.

6.5 Other Stormwater Servicing Options

Increased impervious areas within the project site are required to be treated to provide equal or better levels of quality compared to existing conditions. In areas where LID feature installation is not feasible due to groundwater elevations, limited right-of-way area, or utility conflicts, alternative systems are recommended to provide quality control of runoff from the road.

Oil and Grit Separator (OGS) units may be installed as a part of the proposed storm sewer replacements and upgrades and will provide water quality control while occupying a limited footprint area. Additionally, Goss Traps and/or LittaTraps may be installed in catch basins collecting runoff from the road, to provide localized pre-treatment and reduce the maintenance requirements for the OGS units. Catch basin pre-

treatment options are recommended in high vehicular traffic areas due to the increased debris and litter that may be washed into the catch basins.

Increased impervious area within the project site will also increase the amount of runoff from the project area, and quantity control measures are to reduce peak flows to existing levels. This may be provided using storage provided by oversized sewer pipes, or belowground infiltration options such as EES units or infiltration galleries. As the storm sewers are only designed to collect the 5-year flow, control of peak flows for events larger than the 5-year storm is not feasible for belowground systems reliant on storm sewer collection.

6.6 Feasibility Screening Assessment

Table 3 provides a summary of criteria used to assess the feasibility of the various LID options during the screening process.

Table 3. Feasibility Assessment Criteria

Criteria	Description
Outlet Location	Ability of the LID system to discharge to a suitable outlet or overflow (storm sewer or watercourse) based on capacity, elevations, and additional infrastructure requirements.
Overflows	Ability of inlet elevations of stormwater to the LID feature to remain congruent with the location of overflow appurtenances; ensure adequate freeboard is maintained and that LID features do not surcharge onto roadway or otherwise impact drainage system functionality.
Topographic/Elevation Constraints	Ability of the proposed LID servicing option to be integrated within the existing/proposed grades without the need for significant alteration. This would include all surface and sub-surface infrastructure.
Influent Location(s)	The ability of LID features to accept stormwater at or below grade via curb inlet or daylighted CB lead according to ultimate road design. Also includes the ability of a given LID system to receive runoff from multiple point-source inlets.
Stormwater Quality	Ability of LID features to function in the face of anticipated sediment/water quality pollutant loadings; risk of clogging and ease of long-term maintenance.
Groundwater	LID feature's ability to maintain 1 m desired separation distance between the base of the practice and the seasonally high groundwater elevation.
Utility Conflicts	Proposed LID system must not conflict with existing or proposed utilities; SWM approach must be able to be integrated within the proposed road design.
Road Structure	Ability of the proposed LID system to be integrated within the proposed road design without compromising the road subbase due to prolonged saturation within bearing soils or within the travelled ROW. Long-term design life of the SWM feature must also not be compromised.
Safety and Sightlines	Ability of proposed LID system to be integrated within the proposed road design without compromising vehicle sightlines or pedestrian safety. LID system must meet loading requirements if placed within 1 m of any travelled area.
Drainage Functionality	LID system must satisfy SWM objectives (filtration, attenuation, and retention to the extent possible) without sacrificing or placing at risk the conveyance capacity or functionality of the remaining drainage system. Conveyance of drainage from external areas, risk of road surface ponding and possible surcharging are all impacts to be considered.
Vegetation Viability	Ability of surface vegetated practices to thrive with little to no maintenance, including long-term irrigation. Vegetation and planting beds (if present) must also be resistant to invasion by invasive species and weeds.
Maintenance Requirements	Proposed LID measures must be resilient in the face of day-to-day operation and require minimal regular maintenance while reliably providing a high level of service to the road corridor. Proposed measures must also be maintainable using equipment and processes employed by the city.

Criteria	Description
Cost Effectiveness	Relative cost of the various LID options which satisfy all other criteria and constraints. Cost impacts include – but are not limited to – unacceptably high construction costs due to excessive infrastructure, excavation, or a high degree of disturbance extending beyond the limits of the project area.

Application of the criteria summarized in **Table 4** were used to generate a preliminary evaluation for the LID options identified previously, and this information was then carried forward in the opportunities assessment. LID options were evaluated as either generally "feasible" or "not feasible" based on a meta-assessment of the criteria noted. **Table 7** summarizes the overall results of the feasibility screening process. The results of the assessment summarized in **Table 4** are preliminary, based on the information currently available. As the design within the various segments of the Western Road and Sarnia Road/Philip Aziz progresses, additional information may result in refinements to the ultimate SWM servicing approach which is ultimately selected.

Figure 14 through **Figure 18** provide images of the potential LID systems identified in **Table 7**.

Table 4. Feasibility Screening Options for Western Road and Sarnia Road/Philip Aziz Site

Criteria/Options	Bioswale	Soil System	Infiltration Gallery System	Permeable Pavement	Etobicoke Exfiltration System	Chamber or Crate System
Outlet Location	Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Overflows	Feasible	Feasible	Feasible	Not Feasible	Feasible	Feasible
Topography / Elevation	Not Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Influent Locations	Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Stormwater Quality	Feasible	Feasible	Feasible	Not Feasible	Feasible[1]	Feasible
Groundwater[2]	Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Utility Conflicts	Not Feasible	Feasible	Feasible	Feasible	Feasible	Not Feasible
Road Structure	Not Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Safety and Sightlines	Feasible	Feasible	Feasible	Feasible	Feasible	Feasible
Drainage Function	Feasible	Feasible	Feasible	Not Feasible	only Feasible if storm sewers are modified to have grades less than 1% instead of 1-2%	Feasible
Vegetation Viability	Feasible	Feasible	N/A	N/A	N/A	N/A
Maintenance Requirements	Not Feasible	Not Feasible	Feasible	Not Feasible	Feasible	Not Feasible
ROW Space Availability	Not Feasible	Not Feasible	Feasible under sidewalks	Not Feasible	Feasible	Not Feasible

Criteria/Options	Bioswale	Soil System	Infiltration Gallery System	Permeable Pavement	Etobicoke Exfiltration System	Chamber or Crate System
Cost Effectiveness	Not Feasible	Not Feasible	Feasible	Feasible	Not Feasible	Not Feasible
Overall Assessment	**Not Feasible**	**Not Feasible**	**Feasible**	**Not Feasible**	**Feasible**	**Not Feasible**

[1] Etobicoke Exfiltration Systems are recommended to be located downstream of OGS units in small storm catchment areas to improve infiltrated water quality and reduce the overall maintenance burden.

[2] The groundwater conditions and elevations in the area of Western Road and Sarnia Roads are not yet known, but data from Philip Aziz are used as an assumption for these areas; for the purposes of this assessment, it has been assumed that all of the options would be considered feasible for this criterion.

Due to the low permeability of the native soils in this area, permeable pavements are not recommended, as the amount of rainfall collected and infiltrated will be limited. In addition, due to the high traffic volumes and limitations of any pre-treatment options available for permeable pavements, installation of this system to collect roadway runoff is not advised given the elevated sediment loadings which are expected within the corridor. The limited retention potential, water quality risk to groundwater, and maintenance considerations involved with sediment loading mean that implementation of permeable pavement in this location is not recommended.

Due to the high number of utilities crossing the sidewalks and the maintenance complications involved with shallow and narrow storage beneath sidewalk areas receiving raw road runoff, crate/chamber systems are not deemed to be feasible within the Project Area.

Supported soil systems may be costly to install on a large scale and, due to the limited locations where sufficient space is available for such cells to be installed within the corridor, this option is generally considered infeasible within the Western Road and Sarnia Road/Philip Aziz site. Additionally, the maintenance considerations involving pruning, weeding, and flushing of the cells, likely involving closing of lanes, and are hence considered problematic to implement.

Bioswales are limited to areas where there is sufficient space available within the ROW, and to areas where maintenance access to the systems would be feasible. Due to the limited ROW space along the corridor and the expected volume of traffic along the road, no areas meeting this requirement have been identified within the project area.

Etobicoke Exfiltration Systems (EESs) provide volume detention and infiltration without requiring open surface area within the ROW, which is an ideal quality for the constrained ROW availability along the Western Road and Sarnia Road/Philip Aziz site. Due to high traffic volumes within the Project Area, the EES should be implemented only in select locations, ideally at upstream legs of storm sewer networks, and downstream of OGS units where infiltrated water quality will be highest and sediment loading will be relatively low, reducing the maintenance required for the LIDs. As the OGS and EES units will be paired, inspection of the systems may be carried out at the same time, reducing the number of trips to the sites and traffic controls needed. Installation of pre-treatment measures at catch basin inlets upstream of the systems will further reduce the maintenance requirements of the subsurface systems. While the Stormwater Management Planning and Design Manual (MOECP, 2003) does not specify a limit to the catchment area for an EES, OGS units are limited in the amount of flow they can feasibly treat, and standard units should generally treat catchment areas of less than 5 ha. Usage of an EES without appropriate pre-treatment, especially on an arterial roadway, is not recommended. Based on storm sewer grades ranging grater than 1-2%, the EESs systems are not recommended because it won't be able to detain water within the system. However, if the storm sewers are proposed to have slopes less than 1%, this would be feasible. Currently the Etobicoke Exfiltration Systems are not deemed to be feasible.

Infiltration system is intended to enhance runoff quality and - while satisfying City of London design guidelines. Infiltration galleries, connected to catch basins along Western Road, Sarnia Road, and Philip Aziz Ave, are an appropriate option to reduce local runoff volumes during minor storm events. Under larger storm events, a secondary catch basin lead, installed at a higher elevation than the infiltration gallery obvert, would direct flow to the storm sewer. Additionally, catch basin pre-treatment devices (i.e., Goss trap, CB Shield or similar) are proposed in order to satisfy water quality pre-treatment objectives and reduce the loading of suspended solids to both the storm sewer and any proposed LID system. Given there are insufficient space available within the ROW, the system would be placed under sidewalks. LID systems such as infiltration galleries and catch basin pre-treatment devices are deemed feasible within the Project Area.

Figure 14. Bioswale Segment

Figure 15. Supported Soil System

Figure 16. PICP

Figure 17. Etobicoke Exfiltration System

Figure 18. Chamber System

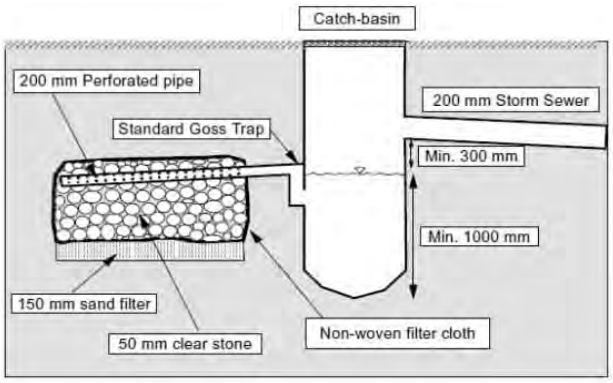


Figure 19. Infiltration Gallery Connected to Standard Catch Basin

7. Proposed Conditions

7.1 Storm Sewer Assessment

According to the Design Specifications and Requirements Manual (City of London, March 2022), storm sewers should provide sufficient capacity to convey the 5-year flow without surcharging. An assessment of the proposed storm sewers within the study area was completed using the Rational Method. Detailed calculation results and catchment area drawings are provided in **Appendix A**.

The recommended sewer sizes and sewer segment catchment areas are shown in **Figure 21**. There are three pipes sizes shown on the drainage map. Option 2 includes drainage from the Ivey and Brescia Lane areas while Option 1 does not include drainage from the Ivey and Brescia Lane. Upsizing is typically increased by 250 mm (ex. 1200mm to 1450mm). This will be refined into one option when merging drainage from Sleightholme Ave, Stirrup Ct, Kininvie Dr and Brescia Ln that was originally directed to outlet D. Its important to note that adding drainage area from the Mud Creek catchment (additional 18 ha area) will increase the proposed pipe size by an additional 250 mm (from 1450 mm to 1700 mm). This will be confirmed in the detailed design stage. An additional Option 3 has been added to show this option which includes direction of flows from Sleightholme Ave, Stirrup Ct, Kininvie Dr and Brescia Ln to the new Outlet B.

Further refinement will be implemented to the storm sewer network as the City noted that the future Sarnia Road storm sewer should carry flows from Sleightholme Ave to the Philip Aziz storm outlet, including the area north of Sarnia Road. The Mud Creek storm system is currently understood to be overloaded, so the additional flows from the existing Sarnia Road area (and associated drainage areas to the north) need to be removed and re-directed to this new storm outlet B. AECOM will reflect this change on the EA drawings as a proposed sewer with the final layout being confirmed through detailed design. Refer to **Figure 6** for details. Orange (Kininvie Drive Ave Via Sarnia Road) and green (Drainage to Outlet D via Sarnia Road) drainage mosaic outlines are currently draining to Mud Creek; detailed design will include the possibility of draining to outlet B (total drainage area of 18 ha). The storm water management report will be updated to reflect the detailed design and to address any changes coming from the geotechnical and hydrogeological information.

City staff requested that consideration be given to establish the top end of the Coombs Ave storm sewer to be located immediately south of Sarnia Road, and that it should not carry any minor storm flows from Sarnia Road. AECOM will propose a new MH on Coombs Ave, at the property line between MN 511 and MN 270 to maintain the existing storm private drain connections (PDC). During detailed design this is to be reviewed to confirm that the existing PDC can be maintained, and MH 2W86 eliminated, thereby making MH 2W87 the top end of this storm sewer section.

The City has noted that there are duplicate storm sewers on Sarnia Road that need to be reviewed to determine if they can be consolidated into one storm sewer. AECOM noted that one concrete storm pipe was built in 1958 and the other was built in 1979. It is believed that the 1957 storm sewer runs provided gravity connections for floor drains/weeping tiles and possibly downspouts for a number of properties on the north and south side of Sarnia Road, and that these properties were on septic systems at the time. The 1973 installation of sanitary sewers should have redirected the sanitary flows to the new municipal sewers and decommissioned the individual septic systems. At the time, the weeping tiles and/or floor drains may have been disconnected from the storm sewer and been reconnected to the sanitary sewer (no longer acceptable). In 1979 a new storm sewer was constructed. The 1957 storm sewers outlets to the newer storm sewers but left the 1957 sewers in place likely due to the unknown nature of internal house connections. It is noted that the correction of this problem requires cooperation from all property owners. The investigation, public consultation, analysis, and recommendations for replacement of the dual storm sewer system and associated private drain connections within this corridor will be addressed during preliminary design. Every opportunity to redirect storm flows away from the Mud Creek system will be considered.

7.2 Outlet B Storm Sewer Outlet Sizing

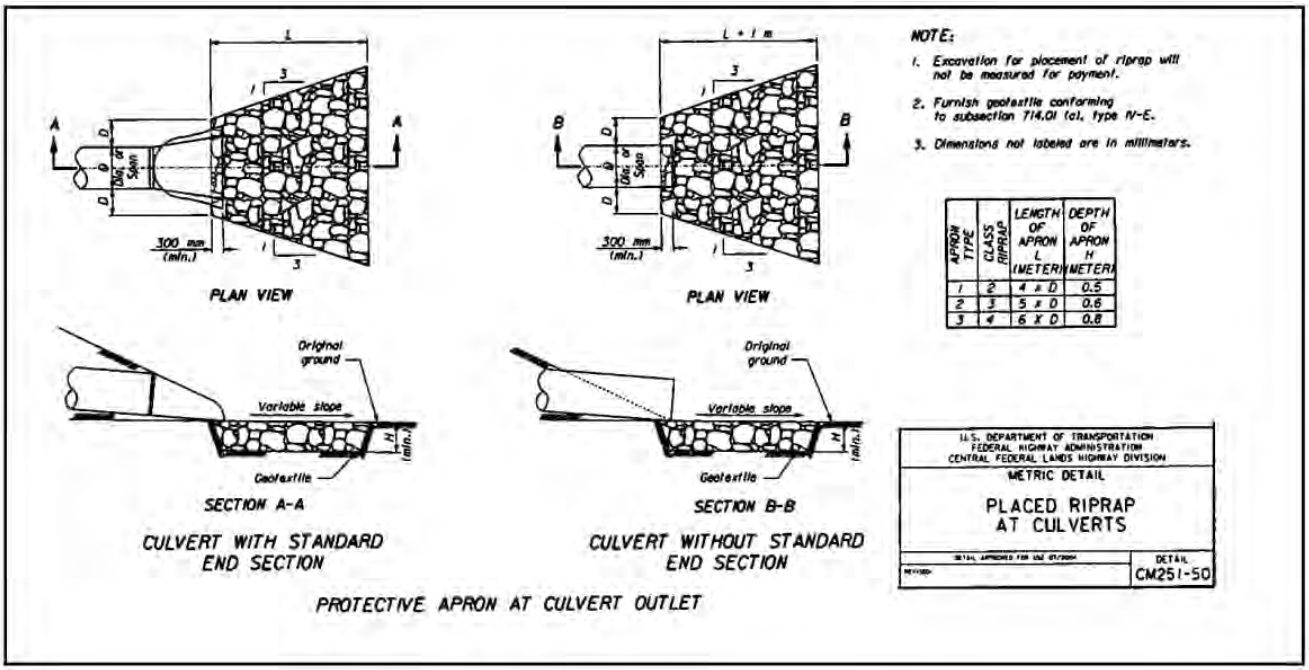
Outlet B is within the UTRCA regulated area and therefore the proposed erosive protection should be to the satisfaction of UTRCA as well as DFO regulations. Riprap apron sizing design for a proposed storm sewer outlet B at end of Philip Aziz Ave. The existing pipe's slope is 1.8%, as is the existing outlet channel (~14%). The storm sewer system was inspected in September 2019. The inspection summary, catchment area information, and design calculations are provided in **Appendix A**.

It is recommended to relocate outlet B with suitable erosion protection as shown in **Figure 22**. New maintenance access, a headwall, riprap and rock protection would be placed at the outlet. The outlet is to be protected with riprap and angular rock. Riprap is to be added to the slope down toward the normal water level of Thames River to reinstate the slope from the outlet down. If riprap is placed on native soils, the placed stone is to be underlain by a nonwoven, Class II, FOS 75-150 µm geotextile. The new sewer pipe is to be installed on a 150 mm thick layer of granular 'A' bedding. Granular 'A' can also be utilized to provide pipe cover.

AECOM proceeded to assess the downstream channel outlet velocities in order to provide the necessary riprap apron design specifications for dissipation of water energy. In accordance with WC-3 (This standard identifies the requirements for the protection of bridge and culvert foundations against scour, and includes the minimum depths of footings.), armouring is required to provide protection for a pipe outlet against potential scour. Sections 3.1 & 3.3 state that if scour potential has been identified as a problem, armouring shall be designed for a velocity which is 1.5 times the average velocity of the design flow (for standard roads). The scour protection required for the storm sewer is to be designed for the 5-yr flow velocity - 2.5 m/s (1.5x this velocity yields a value of 3.8 m/s) for a corresponding discharge of 2.46 m^3/s. This will be further refined, and more details added during detailed design.

7.2.1 Riprap Apron Design

The riprap apron design is the most used approach for outlet protection, primarily for culverts/sewer outlets up to 1500 mm (60 in) in diameter. An example schematic of an apron has been drawn from the Federal Lands Division of the Federal Highway Administration (FHWA) and is shown in **Figure 20**. A flat riprap apron can be used to prevent erosion at the transition from a pipe or box culvert outlet to a natural channel. Protection is provided primarily by having sufficient length and flare to dissipate energy by expanding the flow. They are constructed of riprap or grouted riprap at a zero grade for a distance that is often related to the outlet pipe diameter. These aprons do not dissipate significant energy except through increased roughness over a short distance. However, they do serve to spread the flow, thereby helping to transition flows to the dimensions of the natural drainage way or to sheet flow where no natural drainage way exists. However, if such dissipative measures are too short or otherwise ineffective, they simply move the location of potential erosion downstream. The key design elements of the riprap apron are the riprap size as well as the length, width, and depth of the apron.



APRON TYPE	CLASS RIPRAP	LENGTH OF APRON L (METER)	DEPTH OF APRON H (METER)
1	2	4 x D	0.5
2	3	5 x D	0.6
3	4	6 x D	0.8

Figure 20. Placed Riprap at Culverts (Central Federal Lands Highway Division)

Several relationships have been proposed for riprap sizing for sewer outlet aprons. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g., diameter), outlet Froude number, and tailwater condition. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts, imperial units are employed since the equations are drawn from US sources:

$$D_{50} = 0.2D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{\frac{4}{3}}\left(\frac{D}{TW}\right)$$

Where:
D_{50} = riprap size, m (ft)
Q = design discharge, m^3/s (ft^3/s)
D = culvert diameter (circular), m (ft)
TW = tailwater depth, m (ft)
g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for the above equation should be limited to between 0.4D and 1.0D. If tailwater depth is unknown, 0.4D is to be used. In addition, the above equation assumes that the rock specific gravity is 2.65. If the actual specific gravity of the stone differs significantly from this value, the D_{50} should be adjusted in a manner that is inversely proportional to the specific gravity.

The average D_{50} was determined between this method and MTO Scour Protection (Figure 7 of the guide) to be 375 mm, and this will be compared to the table below for the available riprap classes to obtain apron length and depth. As per design standards from the FHWA (2003) shown in **Table 7,** the class of riprap to be specified is that which has a D_{50} greater than or equal to the required minimum size.

Table 5. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

The apron dimensions must also be specified. **Table 7** provides guidance on the apron length and depth. Apron length is given as a function of the culvert rise and the riprap size. Apron depth ranges from $3.5D_{50}$ for the smallest riprap size to a limit of $2.0D_{50}$ for the larger riprap sizes. The final length and width may be determined using the 1:3 flare shown in **Figure 20** and should conform to the dimensions of the downstream channel. A filter blanket should also be provided as described in HEC 11 (Brown and Clyde, 1989). The downstream channel is a trapezoidal channel with a bottom width of 0.5 m and side slopes of approximately 0.2:1. Detailed calculations and a general channel configuration are included in the **Appendix B**. The flow expands in the channel and reduces the tailwater condition of the culvert. The measured downstream channel slope is approximately 14%. Careful consideration will be given to the outlet elevation and sizing as it relates to River flooding and conveyance of minor flows during the detailed design phase.

Over their service life, riprap aprons experience a wide variety of flow and tailwater conditions. To ensure continued satisfactory operation, maintenance personnel should inspect riprap aprons after major flood events. If repeated severe damage occurs, subject locations may be a candidate for extending the apron or for application of another type of energy dissipator. Sizing details is outlined in **Table 6**.

Table 6. Outlet B by Philip Aziz Site Sizing Details

	Proposed Sewer Option 1	Proposed Sewer Option 2	Proposed Sewer Option 3
TW Depth (m)	0.18 (0.4D)	0.23 (0.4D)	0.30 (0.4D)
Discharge (5-yr) (m^3/s)	2.90	4.79	7.65
D_{50} (Fletcher and Grace, 1972) (mm)	250	250	250
$D_{50\ max}$ (Fletcher and Grace, 1972) (mm)	550	750	1050
D_{50} (MTO) (mm)	550	750	1050
$D_{50\ max}$ (MTO) (mm)	825	1125	1575
Apron length (m)	10.0	11.6	13.6
Apron depth (m)	1.1	1.5	2.1

Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- Existing Storm Sewer
- Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Proposed Catchment
- Options Pipe Dia. O1 (O2) [O3] Prop STM SEWER

Existing Catchment Outlets

- Drainage to Outlet A
- Drainage to Outlet B
- Drainage to Outlet C
- Drainage to Outlet D via Sarnia Road
- Drainage to Outlet D via Fort Cresent
- Drainage to Thames River via Private Storm Sewers
- Kinnvie Drive Ave Via Sarnia Road

Catchment ID: A1

Catchment Area (ha): 12.3

Run-off Coefficient: 0.7

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Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Proposed Drainage

Project No.	60661402
Sheet No.	Figure 21
Scale:	1:6,500
Date:	2023-03-02

Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- 450 Existing Storm Sewer to be removed
- 450 Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- 247 Contours
- Lot Lines
- Proposed Catchment
- O1 (O2) Prop STM SEWER

Existing Catchment Outlets

- Drainage to Outlet A
- Drainage to Outlet B
- Drainage to Outlet C
- Drainage to Outlet D via Sarnia Road
- Drainage to Outlet D via Fort Cresent
- Drainage to Thames River via Private Storm Sewers
- Kinnvie Drive Ave Via Sarnia Road

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Drainage and Stormwater Management

Proposed New Outlet B

Project No.	60661402
Sheet No.	Figure 22
Scale:	1:600
Date:	2023-01-12

7.3 Proposed LID System

The proposed Project involves widening of the roadway to install or repurpose existing lanes into rapid transit lanes, and to include the installation of a bicycle lane. Due to the ROW being located within a pre-existing urbanized area, the net increase in imperviousness over the Project area is comparatively limited. However, to improve water quality and conveyance, LID measures have been assessed for suitability of implementation within the project area. One system is proposed for further consideration, based on the feasibility assessment in **Section 6.6**:

7.3.1 Option 1 - Etobicoke Exfiltration Systems (EES):

Etobicoke Exfiltration Systems (EES) is recommended to be installed below the proposed storm sewers downstream of feasible OGS unit locations.

Due to the limited ROW space within the project area, bioswales are not feasible along the corridor. OGS units will be primarily used to provide water quality control for the increased impervious area. OGS units are not designed to treat very large flow rates and are ideally installed to service catchment areas less than 5 ha in size. For this reason, the OGS units are recommended to be installed in maintenance holes at upstream locations along each storm sewer segment within the project area. The catchment areas collected by each OGS unit will include at least as much impervious area as proposed to be added along the total length of each storm sewer segment, therefore providing a ‘Normal’ level of treatment (70% TSS removal) for the increased impervious area within the project area.

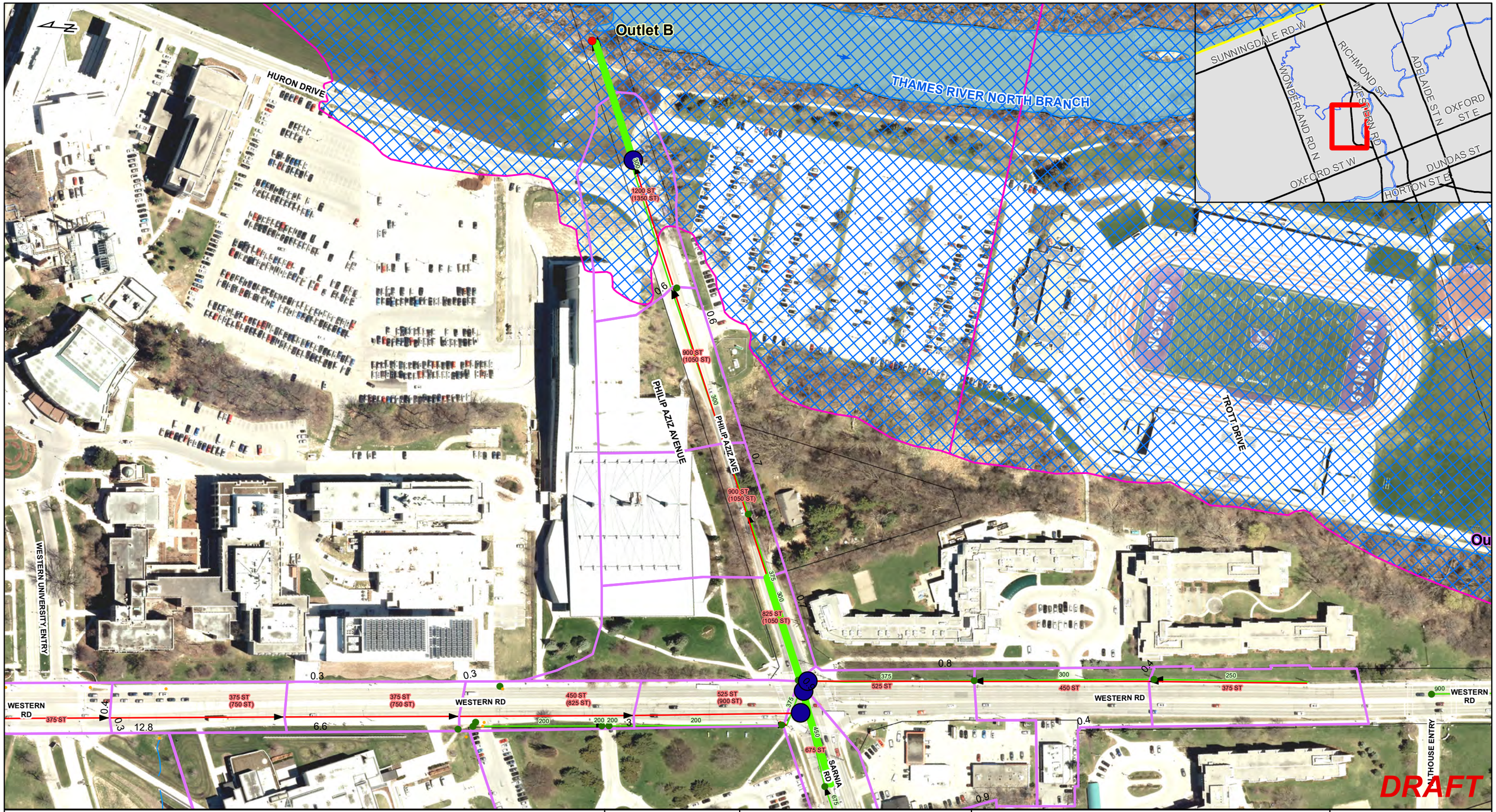
Partial water quantity control and water balance improvements for the areas treated by OGS units are recommended to be provided by EES, located downstream of the proposed OGS units to limit sediment loading to such LID features. As EES units are not ideal for areas of heavy traffic (proposed for Philip Aziz Ave), it is recommended the EES be installed in areas where the percent increase in peak flow due to the increased imperviousness exceeds 5%. Increases of less than 5% are within the margin of error of most hydrologic calculations, and the downstream pipes are sized according to standard pipe sizes, which typically provide a small amount of residual capacity above design flows. Therefore, installing EES units only at areas where attenuation is required will allow for more cost-effective management of flows and reduced maintenance requirements over the long-term. The recommended EES units are also sized to capture and infiltrate the 25 mm runoff volume from the increased impervious area for the storm sewer segment, as recommended for water balance measures by the Cit of London Design Specifications and Requirements Manual (2021). The required storage volume to control the 5-year peak flow is often less than the volume required to capture the 25 mm runoff volume, so these features would therefore provide peak flow control as well. Storms beyond the 5-year event were not considered as the storm sewers are not designed to collect storms of a magnitude which is greater than this. Additional information is provided in **Appendix A**.

The approximate area of increased imperviousness along each of the storm sewer segments within the project area are provided in **Table 7**, along with the recommended locations and type of LID systems required to provide quality and quantity control for the increased ROW imperviousness.

The potential locations for the LID options within the project area are noted on **Figure 23**. These potential locations for LID implementation are schematic only. Additional information regarding the sizing of these measures is provided in **Appendix A**. The location and detailed design of LID features are anticipated to be updated following the detailed evaluation of geotechnical, hydrogeological, utility, and related information once it becomes available.

Table 7. Recommended LID Management Systems

Project Street	Sewer DS Outlet MH	Increased Impervious Area (ha)	% Increase in Peak Flow	LID System	Treated Impervious Area	LID Length	LID Width
			(%)		(ha)	(m)	(m)
SARNIA ROAD	MH16	0.05	6%	EFO10 OGS	3.88	34	1.6
WESTERN ROAD	MH7	0.11	8%	EFO6 OGS	1.47	17	2.6
WESTERN ROAD	MH6	0.06	4%	EFO6 OGS	1.60	60	1.4
PHILLIP AZIZ DRIVE	MH2	0.35	9%	EFO8 OGS	2.57	71	2.7
PHILLIP AZIZ DRIVE / WESTERN ROAD / SARNIA ROAD (Roadway only)	MH2	-	-	EFO10	3.29	-	-
PHILLIP AZIZ DRIVE / WESTERN ROAD / SARNIA ROAD to Outlet B Option 1	MH2			2x EFO12	12.49	-	-



Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- Existing Storm Sewer
- Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Proposed Catchment
- Prop STM SEWER
- Conservation Authority Regulated Areas
- Proposed OGS Locations
- Proposed EES Locations

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Drainage and Stormwater Management

Proposed LIDs - Option 1

Project No.	60661402
Sheet No.	Figure 23
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Date:	2022-02-07

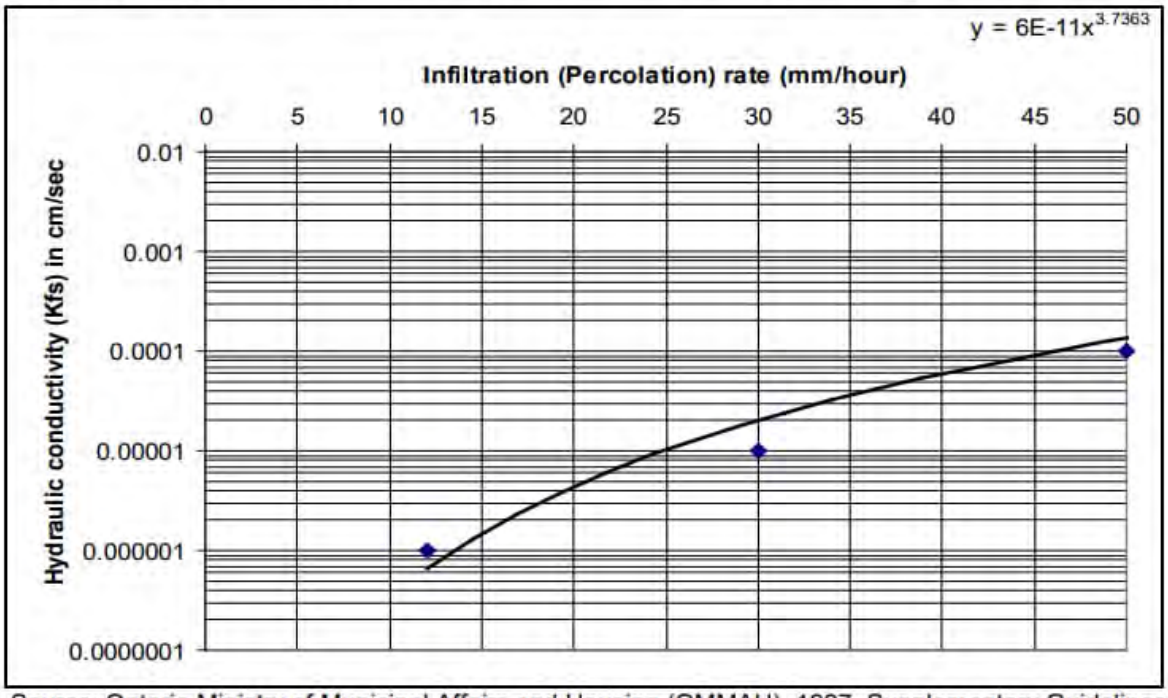
7.3.2 Option 2 - Infiltration Galleries Under Sidewalks:

Infiltration Galleries are proposed to be installed under the proposed sidewalks along with LittaTraps at existing and proposed CB locations.

To satisfy the design objectives described in **Section 6.2** on a 'best efforts' basis, infiltration galleries within the right of way (ROW) are proposed, in addition to catch basin pre-treatment devices, in accordance with the 'treatment train' approach. The inclusion of the treatment and infiltration system is intended to enhance runoff quality and provide runoff retention/volume reductions on a 'best-efforts' basis while satisfying City of London design guidelines. The system will function by having catch basins equipped with inlet pre-treatment devices such as LittaTrap inlet filters and precast Goss traps in the catch basins, complete with 900 mm extended depth sumps to improve the filtering of debris and coarse sediments while also reducing the possibility of having floatable enter the infiltration galleries. Runoff volumes exceeding the retention capacity of the infiltration system will bypass to the storm sewer through a pre-cast Goss trap (or approved equivalent) to reduce the discharge of debris and floatable to the storm sewer network. Runoff exceeding the inlet capacity of the storm sewer system will become overland flow within the municipal ROW. A 150 mm PVC cleanout port for the infiltration galleries should be provided and situated within the grassed boulevard and be equipped with a galvanized cap and sweeping 90° elbow to improve ease of maintenance of these features. The infiltration galleries are also to be offset a minimum of 4 m from any existing building foundations and the sidewalls of all galleries are to be wrapped in an impermeable liner in order to preclude horizontal exfiltration.

The maximum retention depth provided by the gallery is dictated by the ultimate drawdown, typically obtainable over the course of a 48 to 72-hour period, as per 2018 LID Planning and Design Guide (STEP, 2018). Golder Associates provided technical guidance in the determination of native soil infiltration rates, and the results of their field investigations are summarized in their geotechnical report (September 2021). Following field investigations and the completion of one laboratory grain size distribution analysis from BH2, BH7, BH1 and BH1A on Philip Aziz Ave (Golder Report 10-1132-0113), which is considered to be generally representative of the soils found at the site, the soils were characterized predominantly clayey silt at depths greater than 3.5 m and sand/gravel for depths between 1.4 and 3.5 m and sandy silt at depths of 0.2 to 1.4 m which is classified as a moderate to moderately-low permeability, with a hydraulic conductivity of approximately 1.5×10^{-5} cm/s. The hydraulic conductivity corresponds to an infiltration rate of approximately 25 mm/hr, per Credit Valley Conservation Authority Low Impact Development Stormwater Management Planning and Design Guide, Figure C1 (2010) as seen in **Figure 24**. Applying a conservative factor of safety of 2.5 yields a design infiltration rate (DIR) of 10 mm/hr, which permits a 0.7 m deep trench to drawdown in 72 hours. A drawdown time of 72 hours was selected as opposed to a time of 48 hours due to the soil infiltration conditions.

Figure C1: Approximate relationship between infiltration rate and hydraulic conductivity



Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Figure 24. Approximate Relationship Between Infiltration Rate and Hydraulic Conductivity

The LID system was designed with due consideration for both existing and proposed infrastructure constraints, existing mature trees, and their associated driplines, as well as consideration of native soil infiltration rates, as described. The proposed infiltration systems are to be located behind each identified catch basin and will treat the corresponding catchment area based on a design runoff coefficient of C=0.90 for the proposed ROW only. There are 15 individual catchment areas within the proposed improvement area, with 13 of these areas specified to include infiltration galleries. Catchments that will not utilize infiltration galleries are catchments P15 and P5, and this is due to being external drainage areas which are not associated with the road improvement portion. The dimensions of each gallery have been sized based on the unit's ability to retain approximately 6 to 9 mm of daily rainfall depth, corresponding to approximately 55 to 65% of the total average annual rainfall depth. The remaining water quality treatment target may be provided by LittaTrap CB inserts (or approved equivalent) to achieve an aggregated 70% TSS removal for the total average annual design rainfall. Retaining this daily rainfall depth will meet both City of London and MECP quality guidelines as the system generally meets Level 2 "Normal" (70% annual TSS removal) levels of treatment where the infiltration galleries are present. A 200 mm perforated subdrain (double-walled 320 kPa) will distribute runoff throughout each gallery. To ensure there is adequate dispersion and exfiltration throughout the gallery, it is proposed to drill additional 12.7 mm-diameter holes (0.5-inch) in the 3, 5, 7, and 9 o'clock position every 200 mm throughout each pipe's length (16 holes per metre). The 13 infiltration galleries provide a combined 239 m^3 of retention volume based on an aggregate porosity of 40% (assumed to be filled with triple-washed 19 mm clear stone). Refer to **Appendix A** for detailed calculations. The potential locations for the LID option 2A and 2B within the project area are noted on **Figure 26** and **Figure 27**. Option 2B outlines one designated location under Philip Aziz pavement for an area of 17.8 x 48 m, however maintenance and utility conflicts weren't considered.

A Rational Method calculation was completed for each catchment area to quantify the peak runoff rates and total volumes for the 25 mm event and evaluate the overall effectiveness of the system. Due to utility conflicts and trees present within the ROW, some of the prorated gallery retention depths deviate slightly

from the 6 to 9 mm of daily runoff retention depth; however, based on the weighted average for the Project area, the galleries satisfy the City of Toronto Wet Weather Flow Management Guidelines (WWFMG; Figure 1a) in aggregate, as approximately 10 mm of retention depth yields approximately 70% retention of the total average annual rainfall volume for the catchments where the infiltration galleries are present, and overall provides 6 - 9 mm of daily runoff retention depth or 55 to 65% of the total average annual rainfall volume for the entire improvement area. Daily runoff volumes exceeding the approximate 6 to 9 mm retention capacity of the infiltration galleries will bypass to the storm sewer network via the existing trunk storm sewer. Refer to **Table 8** below for anticipated performance details associated with the proposed design, and **Figure 25** for the cumulative annual rainfall depth estimate derived from Figure 1a of the WWFG. Refer to **Appendix A** for detailed SWM calculations.

Table 8: Discharge and System Effectiveness

Street Name	Area	Runoff Coefficient	Time of Concentration	Peak Discharge	Runoff Volume (4-hours)	Depth of Runoff	Daily Runoff Depth Retained	% Of Total Average Annual Rainfall Depth
(ID)	**(ha)**	**(C)**	**(minutes)**	**(m^3/s)**	**(m^3)**	**(mm)**	**(mm)**	**(%)**
SARNIA ROAD	0.370	0.90	10.4	0.05	83	23	6	55
WESTERN ROAD	0.300	0.90	10.4	0.04	68	23	7	56
WESTERN ROAD	0.248	0.90	10.4	0.03	56	23	7	60
WESTERN ROAD	0.235	0.90	10.4	0.03	53	23	7	60
WESTERN ROAD	0.346	0.90	10.4	0.05	78	23	6	56
WESTERN ROAD	0.248	0.90	10.4	0.03	56	23	7	60
WESTERN ROAD	0.248	0.90	10.4	0.03	56	23	7	60
WESTERN ROAD	0.245	0.90	10.4	0.03	55	23	7	60
WESTERN ROAD	0.218	0.90	10.4	0.03	49	23	8	61
PHILLIP AZIZ DRIVE	0.237	0.90	10.4	0.03	54	23	7	60
PHILLIP AZIZ DRIVE	0.161	0.90	10.4	0.02	36	23	9	65
PHILLIP AZIZ DRIVE	0.187	0.90	10.4	0.03	42	23	8	64
PHILLIP AZIZ DRIVE	0.249	0.90	10.4	0.03	56	23	7	60
Totals	**3.29**	**0.90**	**10.4**	0.45	**742**	**23**	**7**	**60**

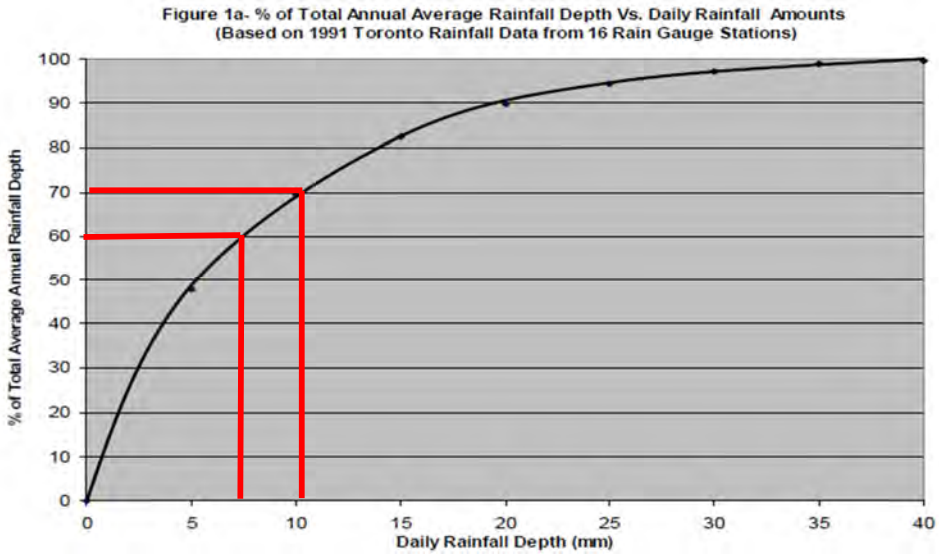
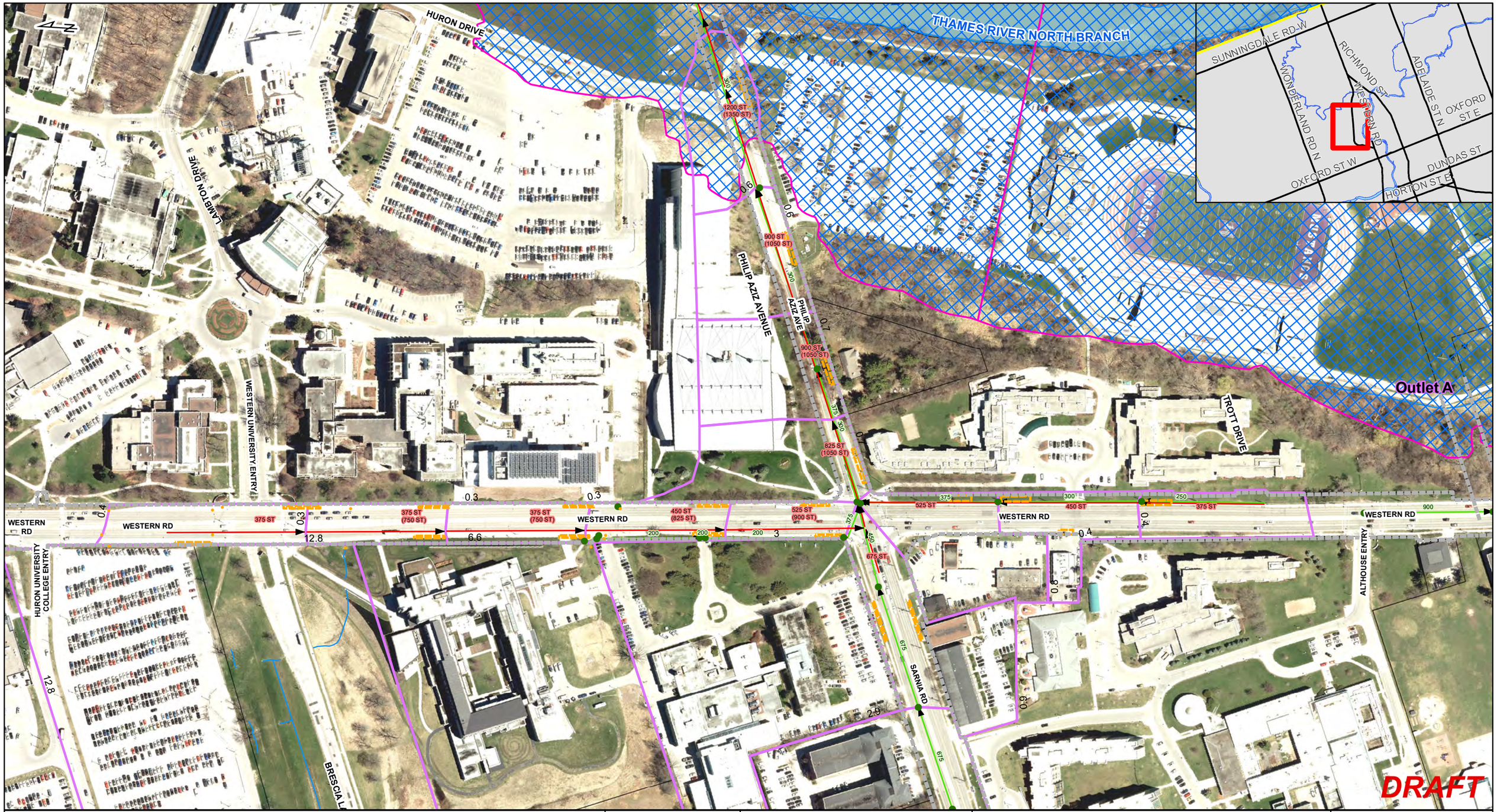


Figure 25. Approximate Average Annual Rainfall Depth Retained.



Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- Existing Storm Sewer
- Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- Contours
- Lot Lines
- Proposed Catchment
- Prop STM SEWER
- Conservation Authority Regulated Areas
- Infiltration Gallery Locations with LittaTrap at every CB
- Right of Way (ROW)

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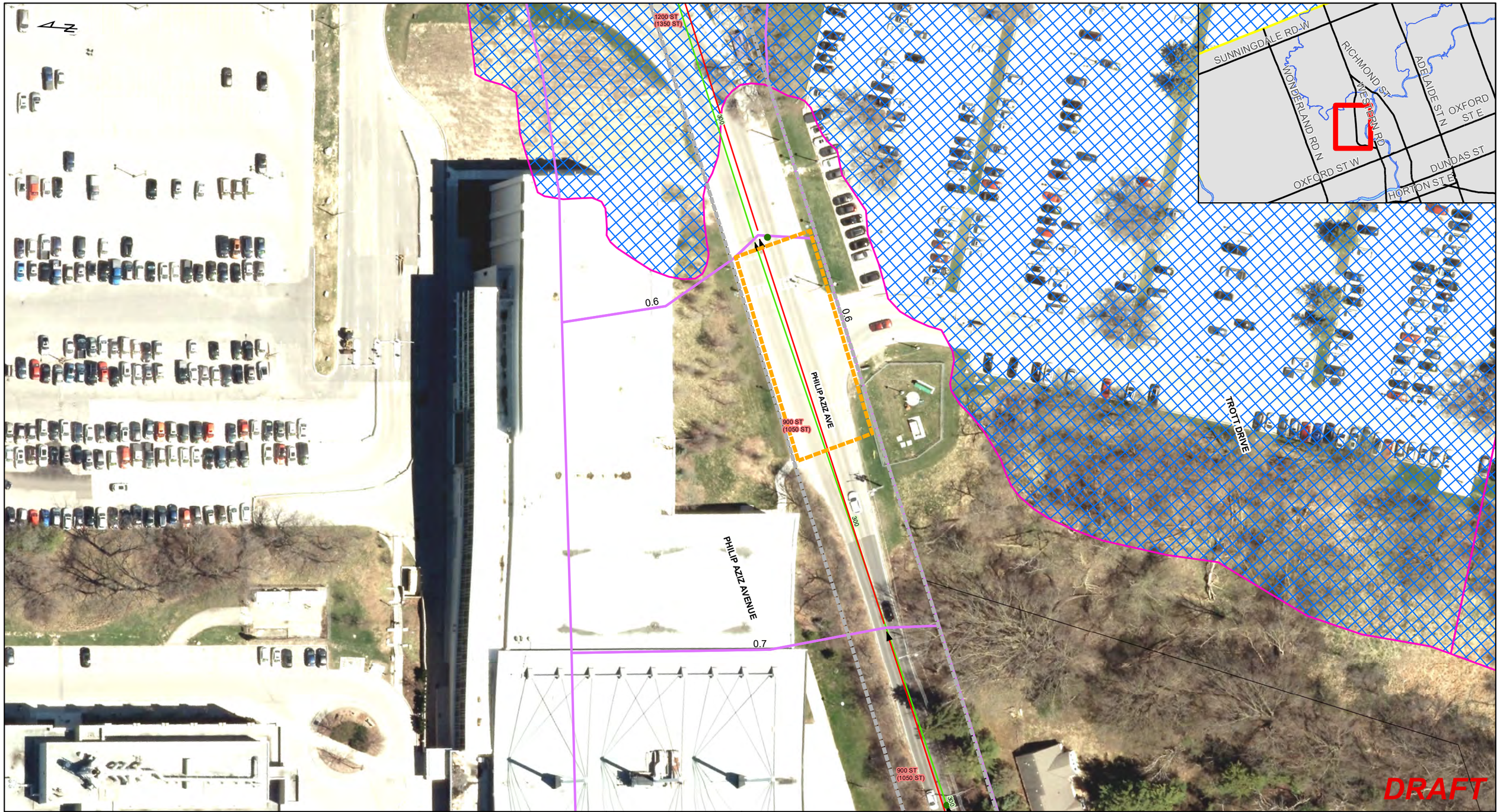
Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Proposed LIDs - Option 2A

Project No.	60661402
Sheet No.	Figure 26
Scale:	1:2,500
Date:	2022-02-08



Notes and Legend:

- Existing Storm Sewer Outlet
- Existing Storm Sewer Manhole
- Existing Private Storm Sewer Manhole
- Existing Outlet Sewer
- 450 Existing Storm Sewer
- 450 Existing Private Storm Sewer
- Minor Flow Path
- Stream/River/Ditch
- Railway Line
- 247 Contours
- Lot Lines
- Proposed Catchment
- O1 (O2) Prop STM SEWER
- Conservation Authority Regulated Areas
- Infiltration Gallery Location with LittaTrap at every CB
- Right of Way (ROW)

London CANADA

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Western Road and Sarnia Road/Philip Aziz Avenue Improvements

Drainage and Stormwater Management

Proposed LIDs - Option 2B

Project No.	60661402
Sheet No.	Figure 27
Scale:	1:800
Date:	2022-02-08

7.4 Proposed Design Features

The key components for the LID features recommended for the project site include the following:

- Inlet catch basin pre-treatment (all inlets discharging to an OGS unit, as feasible);
- Treatment provided by an OGS unit (for areas where no LIDs are feasible);
- Etobicoke Exfiltration Systems to be located downstream of OGS units where feasible; and
- Infiltration Galleries and pre-treatment.

The following sections provide additional detail related to the function of the individual LID practices proposed for consideration within the project area. While the proposed development should have minor impacts on total imperviousness and peak flows, adding LID systems will improve water quality and mitigate the amount of runoff leaving the site.

7.4.1 Pre-Treatment Measures

In areas upstream of EES units, or where LID treatment options are not feasible, an Oil and Grit Separator (OGS) unit is recommended to be installed to treat the increased impervious area within the project site. OGS units provide water quality control by trapping and collecting sediment, debris, and oil from the influent flows and discharging the cleaned water. A schematic of an OGS unit is provided in **Figure 28**. AECOM will investigate the use of Stormceptor MAX during the detailed design stage as the drainage areas will significantly increase for option 2 and 3. The Stormceptor MAX is a custom unit designed specifically for treating large catchment areas. Given that this would be a custom unit, Forterra would require some additional information in order to estimate the budget cost (inlet pipe size, grade elevation of the unit, and inlet invert) which will be completed during the detailed design stage. For option 1, OGS Stormceptor EFO (ISO 14034/ETV verified) was selected for sizing for 70% TSS removal of the MOE FINE PSD. This would require the use of two EFO12 ($231,182) units in parallel in addition to cost of EFO6, EFO 8 and EFO 10. The mentioned budget costs include purchase, delivery to site, and the 2.5 or 5 year Quality Assurance Program unique to Stormceptor. Refer to **Appendix A** for OGS sizing information.

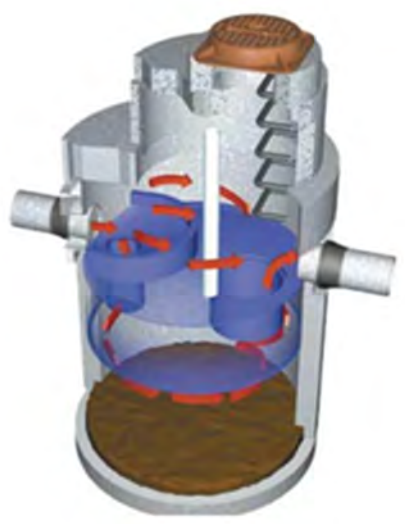

Figure 28. OGS Unit

To assist with the removal of coarse sediments and debris and to maximize the longevity of the selected treatment system, robust pre-treatment is recommended at proposed stormwater inlet collection locations (CBs, CICBs, etc.) which discharge to any detention, retention, or exfiltration systems. Each inlet to the

OGS units and exfiltration systems within the subject corridor is recommended to be fitted with a LittaTrap inlet filter, as shown in **Figure 29**, or a Goss Trap, shown in **Figure 30**. This will reduce loading to - and maintenance requirements for - the OGS units.

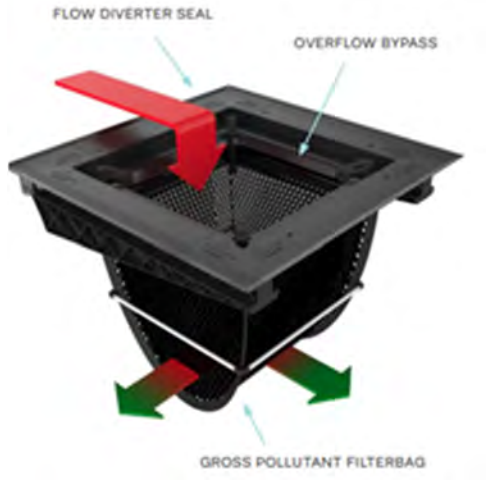

Figure 29. LittaTrap Inlet Filter

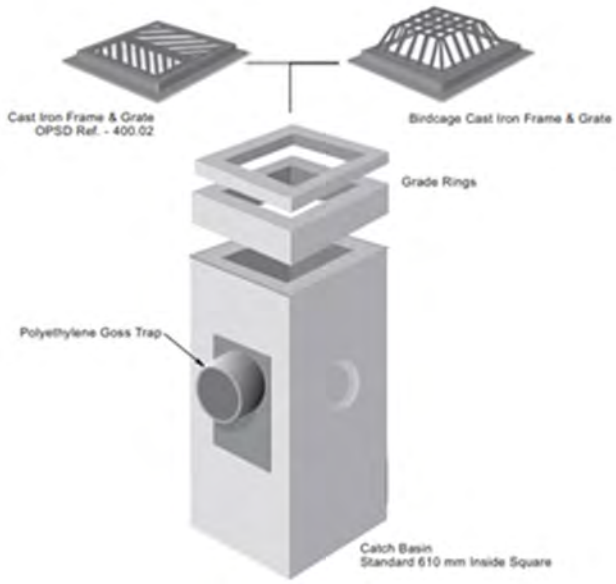

Figure 30. Goss Trap Inlet Filter

7.4.2 LID Perforated Pipe (Etobicoke Exfiltration System/Third Pipe System)

In areas where lane expansions increase the amount of impervious area and result in more than a 5% increase in peak flows, it is recommended that Etobicoke Exfiltration Systems (EESs) be installed below the roadway to improve water balance requirements and reduce runoff volumes. After the ROW runoff has been pre-treated within the catch basins, runoff will then enter an OGS unit for additional runoff treatment, then to a maintenance manhole and then it will enter the Etobicoke system for attenuation for partial retention storage as seen in **Figure 31**. The system consists of perforated PVC pipes installed below the proposed sewer lines, with both the perforated pipes and the sewer line encased in a granular trench.

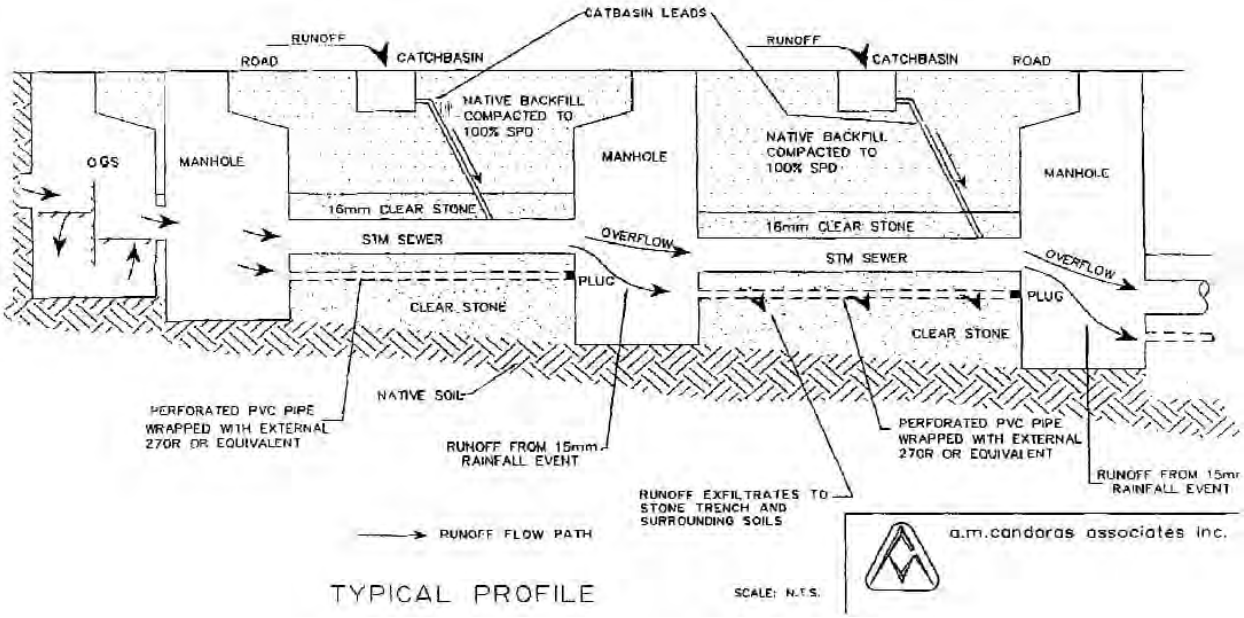

Figure 31. Etobicoke Exfiltration System Typical Profile

The perforated pipes are connected to both the upstream and downstream maintenance holes below the storm sewers. At the downstream maintenance hole, mechanical plugs are installed within the exfiltration pipes, causing the system to function strictly as a storage system instead of a partial storage and conveyance system. During a storm event, storm runoff from the upstream maintenance hole enters the perforated pipe and then exfiltrates firstly to the stone trench and subsequently to the surrounding soil. To prevent the perforated pipes and stone trench from clogging, as well as to sediment intrusion or loss of granular materials, the side walls of the stone trench are to be lined with a filter fabric.

For large storm events, the runoff may exceed the exfiltration volume and the storage capacity of the perforated pipes and stone trench, resulting in an overflow to the storm sewer at the upstream maintenance hole. Since the exfiltration system is situated below the storm sewer (usually below the frost line in Canada), it will not be frozen in winter and early spring and it will continue to work during snowmelts throughout winter and early spring, providing effective functionality year-round.

EESs are typically recommended for low traffic roads. Since the project area includes arterial roads, pre-treatment of the runoff is required to protect the Highly Vulnerable Aquifer located within the project area. Inlet CB pre-treatment is strongly recommended in addition to OGS pre-treatment for all areas draining to an EES. A conceptual layout of an Etobicoke exfiltration system is provided in **Figure 32**.

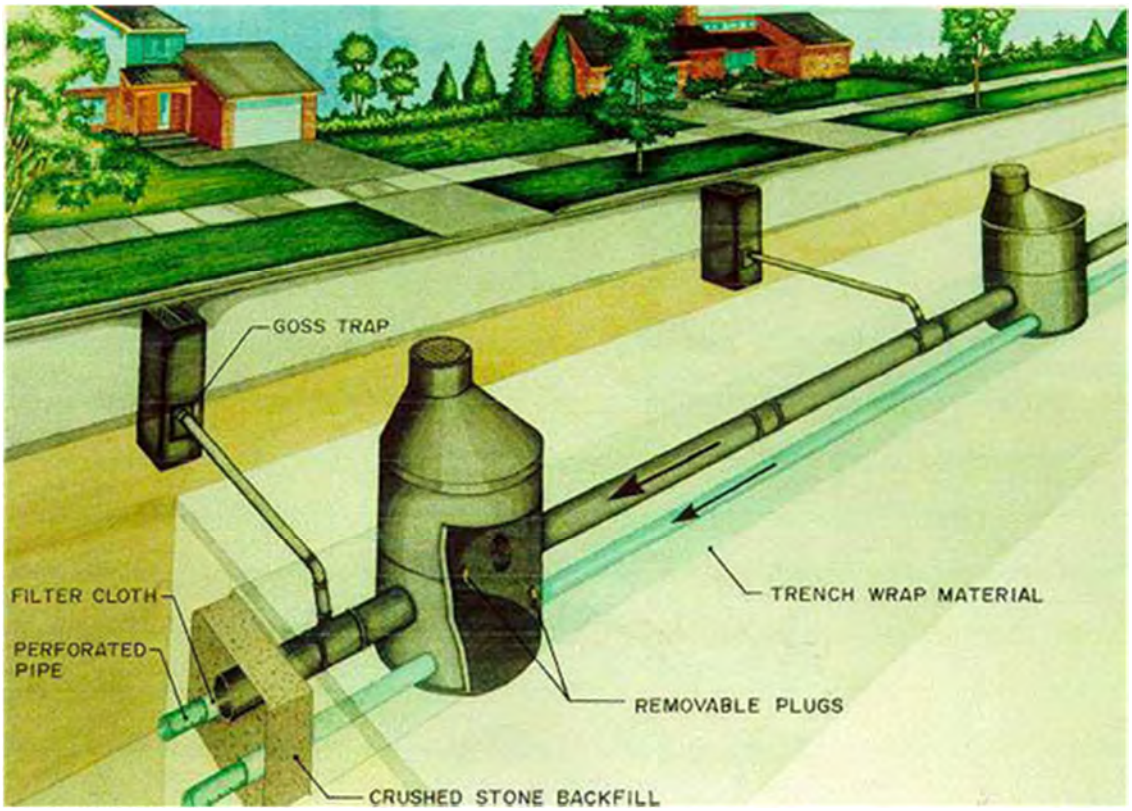

Figure 32. Etobicoke Exfiltration System Schematic

7.4.3 Infiltration Galleries

As previously mentioned, while the layout of the site limits the application of certain LID options (e.g., supported soil systems, surface bioretention, etc.), opportunities to reduce local storm flow impacts exist and will be included within the overall design. Infiltration galleries, connected to catch basins along Western Road, Sarnia Road, and Philip Aziz Ave, are an appropriate option to reduce local runoff volumes during minor storm events. Under larger storm events, a secondary catch basin lead, installed at a higher elevation than the infiltration gallery obvert, would direct flow to the storm sewer. Additionally, catch basin pre-treatment devices (i.e., Goss trap, CB Shield or similar) are proposed in order to satisfy water quality pre-treatment objectives and reduce the loading of suspended solids to both the storm sewer and any proposed LID system. A typical infiltration gallery connected to a standard catch basin is shown on **Figure 33** below for reference.

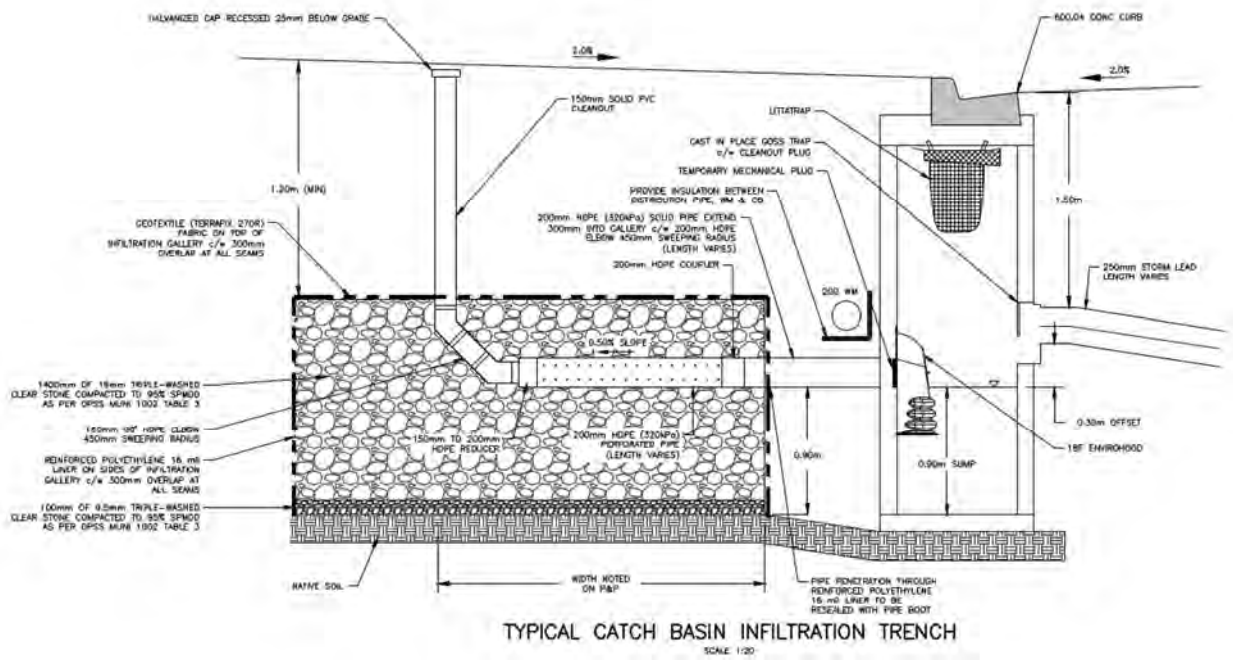

Figure 33. Typical Infiltration Gallery Connected to Standard Catch Basin

Its important to note that, upon confirming the groundwater elevations during the detailed design stage, if both EES and infiltration galleries are found infeasible there would be an additional option of offline storage to be considered with OGSs similar to what was done on Saria Rd west of Wonderland Rd.

8. Erosion and Sediment Management

8.1 Erosion and Sediment Control Plan

An effective construction phase erosion and sediment control (ESC) plan is critical to ensure the functionality and long-term operational success of any LID-based SWM features which may be implemented within the corridor.

The installation of the Etobicoke Exfiltration Systems should include sediment fencing and filter cloth lining to prevent the entry of sediment within the systems during construction. Mechanical plugs should be utilized to keep exfiltration features offline until such time that all contributing drainage areas are fully stabilized, and necessary water quality pre-treatment devices are fully operational.

The sediment and erosion control measures to be implemented as part of the construction and servicing of the site could include a combination the following:

- heavy duty silt fencing;
- light duty silt fencing;
- rock check dams;
- straw bale filters;
- filter fabric under catch basin frames and grates; and
- mud mats.

8.2 Operations and Maintenance

Routine maintenance and inspection are essential to the long-term operation and effectiveness of bioswales, EES units, infiltration galleries and other LID measures. Proper maintenance will increase the useful service life of the facility and aesthetic value to the community.

- OGS units are proprietary and will provide their own maintenance guidelines and schedule. The general maintenance recommendations for OGS units are as follows:
  - Inspect post construction, prior to being put into service;
  - Inspect every 6 months for the first year to determine the oil and sediment accumulation rate. In subsequent years, inspections are based on first-year observations or local requirements;
  - Inspect immediately after an oil, fuel, or chemical spill. A licensed waste management company should remove oil and sediment and dispose responsibly and;
- Use a vacuum truck to remove collected sediment and oil when unit is reaching capacity.
- The Etobicoke Exfiltration Systems should be monitored simultaneously with the paired OGS units, to check for sedimentation and ensure drawdown within the systems. Cleaning and maintenance of the systems may be accomplished using a vacuum truck or similar.
- A 150 mm PVC cleanout port for the infiltration galleries has also been provided and is to be situated within the grassed boulevard and be equipped with a galvanized cap and sweeping 90° elbow which will improve ease of maintenance of the LID features

9. Conclusions and Recommendations

9.1 LID Servicing Options

The recommended LID servicing options for the project site include strategically placed Etobicoke Exfiltration systems and infiltration galleries on the backside of select catch basins.

- The key components/elements for the LID features proposed for the project site include the following:
- Inlet catch basin pre-treatment (all inlets discharging to an OGS unit);
- Treatment provided by an OGS unit (for areas where no LIDs are feasible) and,
- Etobicoke Exfiltration Systems to be located downstream of OGS units where feasible

9.2 Design Recommendations

In summary, the following are the proposed design recommendations:

1. Provide inlet pre-treatment measures in proposed catch basin locations to reduce direct grit loading into the OGS systems, thereby reducing maintenance frequency, and helping to achieve necessary normal-level water quality treatment requirements for additional impervious areas within the project site;
2. Implement EES in select locations downstream of OGS units where the contributing drainage area is suitable for such systems, where utility and geotechnical conditions facilitate their use and where traffic loading is minimized.
3. Provide Infiltration Galleries with pre-treatment if the EES system is not feasible. This will be confirmed upon confirming the groundwater elevations during the detailed design stage.

The draft stormwater management design is subject to change during the detailed design as soil hydraulic conductivity, infiltration and groundwater information are not currently known for Western Road and Sarnia Road. This information is to be confirmed during detailed design and will be collected/provided by a third-party geotechnical engineering firm. Soil infiltration rate of 10 mm/h is assumed. Detailed design will further evaluate the possibility of draining Kininvie Drive Ave and Sleightholme Ave via Sarnia Road area to outlet B in accordance with the City's desire to reduce flows within the existing Mud Creek sewer system. Detailed ponding depth, cross-sections and drainage area calculations will be preformed during detailed design in an effort to minimize impacts to the private properties. The location and detailed design of LID features are anticipated to be updated following the detailed evaluation of geotechnical, hydrogeological, utility, and related information once it becomes available.

10. References

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Appendix A Stormwater Management and Drainage

A.1 IDF

A.2 Existing Storm Sewer Calculations

A.3 Proposed Storm Sewer Calculations

A.4 Rational Method

A.5 EES LID Calculations

A.6 Infiltration Galleries Calculations

A.7 Grit Loading Calculations

A.8 OGS Sizing Information

A.9 Outlet B Rip-Rap Sizing

City of London Intensity, Duration, Frequency Values

AECOM

City of London IDF (2022)			
Event	Parameter		
	A	B	C
25 mm	538.85	6.331	0.809
2-Year	754.36	6.011	0.810
5-Year	1183.74	7.641	0.838
10-Year	1574.38	9.025	0.860
25-Year	2019.37	9.824	0.875
50-Year	2270.67	9.984	0.876
100-Year	2619.36	10.500	0.884
250-Year	3048.22	10.030	0.888

The criterion used in the design of storm sewers is generally to be based on the 1 in 5-year City of London Rainfall Intensity curve.

City of London IDF (2022)											
Event	Rainfall Intensity (mm/hr)										
	5-Minutes	10-Minutes	15-Minutes	30-Minutes	1-Hour	2-Hour	3-Hour	4-Hour	6-Hour	12-Hour	24-Hour
25 mm	75.61	56.25	45.32	29.46	18.10	10.75	7.85	6.26	4.54	2.61	1.50
2-Year	108.07	79.80	64.03	41.39	25.33	15.01	10.95	8.73	6.33	3.63	2.08
5-Year	141.24	106.82	86.67	56.60	34.64	20.34	14.73	11.67	8.38	4.73	2.66
10-Year	162.47	124.99	102.27	67.38	41.26	24.10	17.35	13.69	9.76	5.43	3.01
25-Year	190.82	147.97	121.54	80.37	49.17	28.58	20.50	16.12	11.43	6.31	3.46
50-Year	211.98	164.72	135.46	89.72	54.95	31.94	22.91	18.01	12.78	7.05	3.86
100-Year	232.24	181.39	149.56	99.36	60.87	35.32	25.28	19.84	14.04	7.70	4.20
250-Year	274.73	212.89	174.67	115.11	70.05	40.44	28.87	22.63	15.98	8.74	4.75

City of London IDF (2022)											
Event	Rainfall Depth (mm)										
	5-Minutes	10-Minutes	15-Minutes	30-Minutes	1-Hour	2-Hour	3-Hour	4-Hour	6-Hour	12-Hour	24-Hour
25 mm	6.30	9.38	11.33	14.73	18.10	21.50	23.55	25.05	27.25	31.33	35.89
2-Year	9.01	13.30	16.01	20.69	25.33	30.01	32.84	34.91	37.96	43.59	49.89
5-Year	11.77	17.80	21.67	28.30	34.64	40.69	44.19	46.70	50.30	56.77	63.80
10-Year	13.54	20.83	25.57	33.69	41.26	48.19	52.05	54.75	58.56	65.21	72.24
25-Year	15.90	24.66	30.38	40.18	49.17	57.16	61.49	64.47	68.61	75.70	83.04
50-Year	17.67	27.45	33.86	44.86	54.95	63.89	68.73	72.05	76.66	84.54	92.69
100-Year	19.35	30.23	37.39	49.68	60.87	70.64	75.84	79.38	84.24	92.46	100.84
250-Year	22.89	35.48	43.67	57.56	70.05	80.87	86.61	90.51	95.85	104.85	114.01

Notes:

1. Based on City of London Design Specifications and Requirements Manual (Mar 2022).

RUNOFF COEFFICIENT 'C'

PARKS & PLAYGROUNDS - 0.20
RESIDENTIAL- SINGLE & DU - 0.50
- ROWHOUSING - 0.65
- APARTMENTS - 0.65 to 0.70
COMMERCIAL & INDUSTRIA - 0.7 to 0.9
DENSELY BUILT, PAVED - 0.90

FLOW, Q = 2.78 CiA
WHERE, Q = PEAK FLOW IN LITRES PER SECOND (L/s)
C = RUNOFF COEFFICIENT (See Above)
i = RAINFALL INTENSITY (mm/hr), RETURN PERIOD = 5 years
A = AREA IN HECTARES (ha)

STORM SEWER DESIGN SHEET
(BASED ON CITY OF LONDON 5-YR STORM)

PROJECT Western Road, Sarnia Road and Philip Aziz Avenue EA
PROJECT NO. 60661402
DRAINAGE AREA
DESIGNED BY YO
CHECKED BY
DATE 02-08-22

WESTERN ROAD AND SARNIA ROAD/PHILIP AZIZ AVENUE
EXISTING CONDITIONS

SEWER LOCATION				AREA		A X C					RAINFALL INTENSITY			Q								PROFILE			
AREA NO.	STREET	FROM MH	TO MH	AREA ha.	TOT. AREA ha.	RUNOFF COEFF. (above)	INCR AxC	TOTAL SECT. AxC A X C	TOTAL LAT. A X C	CUM. SEWER (2.78 x) A x C	TIME ENT. SECT. min.	TIME ENT. ACCUM. min.	INTENSITY 'i' mm/hr	l/s	"n"	NOM. PIPE D mm	STORM SLOPE %	CAPACITY Q l/s	VELOCITY m./s. (min. 1.0 m/s)	LENGTH m	FLOW TIME minutes	SEWER FALL m	DROP IN MANHOLE m	INVERT ELEVATION U.S. m	INVERT ELEVATION D.S. m
A4	PLATTS LANE	4F0019	4F0020	0.54	0.54	0.90	0.49		0.49	1.36		12.34	95.74	130											
A3	WESTERN ROAD	4F0019	4F0020	2.86	3.40	0.70	2.00		2.00	5.56		15.18	86.26	480	0.013	1050	0.44	1810	2.09	54.3	0.43	0.238		240.774	240.536
A2	WESTERN ROAD	4F0020	4F0022	0.35	3.75	0.90	0.32	0.49	2.81	7.81	0.43	15.61	84.97	664	0.013	1050	0.32	1535	1.77	73.5	0.69	0.232		240.414	240.182
A1	WESTERN ROAD	4F022	4F0023	12.32	16.07	0.70	8.62		11.43	31.78		19.00	75.62	2403	0.013	1050	1.05	2793	3.23	39.0	0.20	0.408		239.792	239.384
A-all	TO OUTLET	4F0023	OUTLET A	0.00	16.07				11.43	31.78	0.20	19.20	75.15	2388	0.013	1350	0.37	3247	2.27	25.6	0.19	0.095		235.674	235.579
B8	SARNIA ROAD	AF0002	AF0003	2.94	2.94	0.54	1.59			4.41		16.25	82.85	366	0.013	675	2.88	1427	3.99	166.0	0.69	4.781		250.507	245.322
B7	SARNIA ROAD	AF0003	AF0010	0.94	3.88	0.90	0.85	1.59		6.77	0.69	16.94	80.89	547	0.013	450	2.81	**478**	3.01	61.9	0.34	1.739	0.016	245.306	243.566
B6	WESTERN ROAD	AF0009	AF0010	1.61	1.61	0.90	1.45			4.03		13.90	90.36	364	0.013	375	0.26	**93**	0.84	99.2	1.96	0.258		243.316	242.895
B3	PHILLIP AZIZ DRIVE	AF0010	AF0011	1.27	6.76	0.90	1.14	2.43	1.45	13.97		15.73	84.40	1179	0.013	375	0.79	**163**	1.47	99.5	1.13	0.787		242.850	242.063
B5	WESTERN ROAD	AF0005	AF0006	0.68	0.68	0.90	0.61			1.70		15.30	85.72	146											
B4	ELBORN COLLEGE	--	AF0006	2.99	2.99	0.90	2.69			7.48		10.30	105.33	788											
--	PHILLIP AZIZ DRIVE	AF0006	AF40	0.00	3.67			2.69	0.61	9.18		10.30	105.33	967	0.013	375	1.50	**224**	2.03	26.8	0.22	0.402		245.100	244.698
--	PHILLIP AZIZ DRIVE	AF40	AF0011	0.00	3.67			2.69	0.61	9.18	0.22	10.52	104.25	957	0.013	300	4.60	**216**	3.06	100.0	0.54	4.600	0.248	244.450	242.063
B2	PHILLIP AZIZ DRIVE	AF0011	AF0012	0.94	11.37	0.90	0.85	5.03	3.30	25.51	1.13	16.85	81.14	2069	0.013	300	3.00	**175**	2.47	134.7	0.91	4.041		242.020	237.838
B1	PHILLIP AZIZ DRIVE	AF0012	OUTLET B	0.58	11.95	0.90	0.52	9.17		26.96	0.91	17.76	78.70	2121	0.013	300	1.75	**133**	1.89	145.7	1.29	2.550	0.015	237.823	**253.367**

Notes:
B8 RUNOFF COEF. = [0.9*(1.42 ha) + 0.2*(1.51ha)]/2.93ha = 0.54

TC Calculations:
A4 TC = 10.3 minutes (as per CoL Design Manual Figure 5.3)+ 184 m / 1.5 m/s = 12.34 minutes
A3 TC = 12.5 minutes (as per CoL Design Manual Figure 5.3)+ 242 m / 1.5 m/s = 15.18 minutes
A1 TC = 19.0 minutes (as per CoL Design Manual Section 5.8.2 a)

B6 TC = 10.3min (as per CoL Design Manual Figure 5.3)+ 320m/1.5m/s = 13.9min
B5 TC = 10.3min (as per CoL Design Manual Figure 5.3)+ 450m/1.5m/s = 15.3min
B3 TC_{ADJ} = [(16.94*549)+(13.90*364)]/(549+364) = 15.73min

RUNOFF COEFFICIENT 'C'

PARKS & PLAYGROUNDS	- 0.20
RESIDENTIAL- SINGLE & DUPLEX	- 0.50
- ROWHOUSING	- 0.65
- APARTMENTS	- 0.65 to 0.70
COMMERCIAL & INDUSTRIAL	-0.70-0.90
DENSELY BUILT, PAVED	- 0.90

FLOW, Q = 2.78 CiA

WHERE Q = PEAK FLOW IN LITRES PER SECOND (L/s)

C = RUNOFF COEFFICIENT (See Above)

i = RAINFALL INTENSITY (mm/hr), RETURN PERIOD = 5 years

A = AREA IN HECTARES (ha)

STORM SEWER DESIGN SHEET

(BASED ON CITY OF LONDON 5-YR STORM)

PROJECT	Western Road, Sarnia Road and Philip Aziz Avenue EA
PROJECT NO.	60661402
DRAINAGE AREA	
DESIGNED BY	AN
CHECKED BY	
DATE	02-28-23

WESTERN ROAD AND SARNIA ROAD/PHILIP AZIZ AVENUE
PROPOSED CONDITIONS (OPTION 1)

SEWER LOCATION				AREA		A X C					RAINFALL INTENSITY			Q								PROFILE				
AREA NO.	STREET	FROM MH	TO MH	AREA ha.	TOT. AREA ha.	RUNOFF COEFF. (above)	INCR AxC	TOTAL SECT. AxC A X C	TOTAL LAT. A X C	CUM. SEWER (2.78 x) A x C	TIME ENT. SECT. min.	TIME ENT. ACCUM. min.	INTENSITY 'i' mm/hr	l/s	"n"	NOM. PIPE D mm	STORM SLOPE %	CAPACITY Q l/s	VELOCITY m./s. (min. 1.0 m/s)	LENGTH m	FLOW TIME minutes	SEWER FALL m	HEADLOSS m	DROP IN MANHOLE m	INVERT ELEVATION U.S. m	INVERT ELEVATION D.S. m
P15	SARNIA ROAD	MH18	MH17	2.94	2.94	0.70	2.06			5.72		13.38	92.22	528	0.013	675	3.15	1492	4.17	76.1	0.30	2.397			250.507	248.108
P14	SARNIA ROAD	MH17	MH16	0.94	3.88	0.90	0.85	2.06		8.07	0.30	13.69	91.11	736	0.013	675	3.10	1480	4.14	89.9	0.36	2.787	0.037	0.100	248.108	245.322
	SARNIA ROAD	MH16	MH7	--	3.88						0.36	14.05	89.84	736	0.013	675	3.00	1456	4.07	34.0	0.14	1.020	0.067	0.100	245.222	244.202
P13	WESTERN ROAD	MH15	MH14	0.39	0.39	0.90	0.35			0.98		11.36	100.36	98	0.013	375	0.50	129	1.17	90.1	1.28	0.451			245.125	244.675
P12	WESTERN ROAD	MH14	MH13	0.42	0.81	0.90	0.38	0.35		2.03	1.28	12.65	95.02	193	0.013	450	0.50	210	1.32	99.0	1.25	0.495	0.154	0.200	244.475	243.980
P11	WESTERN ROAD	MH13	MH6	0.79	1.60	0.90	0.71	0.73		4.00	1.25	13.89	90.38	362	0.013	525	0.80	401	1.85	97.0	0.87	0.776	0.293	0.300	243.680	242.904
P10	WESTERN ROAD	MH12	MH11	0.41	0.41	0.90	0.37			1.03		11.94	97.87	100	0.013	375	1.90	252	2.28	98.0	0.72	1.862			254.700	252.838
P9	WESTERN ROAD	MH11	MH10	0.28	0.69	0.90	0.25	0.37		1.73	0.72	12.66	94.97	164	0.013	375	2.10	265	2.40	98.0	0.68	2.058	0.433	0.450	252.388	250.330
P8	WESTERN ROAD	MH10	MH9	0.28	0.97	0.90	0.25	0.62		2.43	0.68	13.34	92.38	224	0.013	375	2.20	271	2.46	98.0	0.66	2.156	0.346	0.400	249.930	247.774
P7	WESTERN ROAD	MH9	MH8	0.27	1.24	0.90	0.24	0.87		3.10	0.66	14.00	90.00	279	0.013	450	1.60	376	2.37	98.0	0.69	1.568	0.251	0.300	247.474	245.906
P6	WESTERN ROAD	MH8	MH7	0.23	**1.47**	0.90	0.21	1.12		3.68	0.69	14.69	87.66	322	0.013	525	1.10	471	2.17	98.0	0.75	1.078	0.155	0.200	245.706	244.628
P5	WESTERN ROAD/ELBORN COLLEGE	MH7	MH6	2.97	8.32	0.90	2.67		4.23	19.18		14.25	89.16	1710	0.013	900	1.20	2069	3.25	16.8	0.09	0.201		2.0 D. S.	242.700	242.499
P4	PHILLIP AZIZ DRIVE	MH6	MH5	0.69	10.61	0.90	0.62		9.80	28.98	0.09	14.33	88.87	2576	0.013	900	2.30	2865	4.50	59.9	0.22	1.378	0.082	0.100	242.399	241.021
P3	PHILLIP AZIZ DRIVE	MH5	MH4	0.70	11.31	0.90	0.63	10.43		30.73	0.22	14.55	88.12	2708	0.013	900	2.30	2865	4.50	78.2	0.29	1.799	0.307	0.350	240.671	238.872
P2	PHILLIP AZIZ DRIVE	MH4	MH3	0.60	11.91	0.90	0.54	11.06		32.23	0.29	14.84	87.17	2810	0.013	900	2.30	2865	4.50	91.5	0.34	2.105	0.249	0.300	238.572	236.467
P1	PHILLIP AZIZ DRIVE	MH3	MH2	0.58	12.49	0.90	0.52	11.60		33.69	0.34	15.18	86.09	2900	0.013	1200	0.60	3151	2.79	71.0	0.42	0.426	0.086	0.100	236.367	235.941
	PHILLIP AZIZ DRIVE	MH2	MH1	--	12.49									2900	0.013	1200	0.60	3151	2.79	71.0	0.42	0.426	0.032	0.100	235.841	235.415

Notes:

P15 RUNOFF COEF. = [0.9*(1.42 ha) + 0.2*(1.51ha)]/2.93ha = 0.54 --> city comment Feb 2023 to revise to 0.7

TC Calculations:	Validation				
P15 TC = 12.6min (as per CoL Design Manual Figure 5.3)+ 75m/1.5m/s = 1	12.6	+	0.8	=	13.4
P13 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 90m/1.5m/s = 1	10.4	+	1.0	=	11.4
P10 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 142m/1.5m/s =	10.4	+	1.6	=	11.9

P5 TC_{ADJ} = [(14.81*321)+(14.05*736)]/(321+736) = 14.26 min

RUNOFF COEFFICIENT 'C'

PARKS & PLAYGROUNDS	- 0.20
RESIDENTIAL- SINGLE & DUPLEX	- 0.50
- ROWHOUSING	- 0.65
- APARTMENTS	- 0.65 to 0.70
COMMERCIAL & INDUSTRIAL	-0.70-0.90
DENSELY BUILT, PAVED	- 0.90

FLOW, Q = 2.78 CiA

WHERE Q = PEAK FLOW IN LITRES PER SECOND (L/s)

C = RUNOFF COEFFICIENT (See Above)

i = RAINFALL INTENSITY (mm/hr), RETURN PERIOD = 5 years

A = AREA IN HECTARES (ha)

5-yr AES Parameters A = 1183.74, B= 7.641, C = 0.838

STORM SEWER DESIGN SHEET

(BASED ON CITY OF LONDON 5-YR STORM)

PROJECT	Western Road, Sarnia Road and Philip Aziz Avenue EA
PROJECT NO.	60661402
DRAINAGE AREA	
DESIGNED BY	AN
CHECKED BY	
DATE	02-28-23

WESTERN ROAD AND SARNIA ROAD/PHILIP AZIZ AVENUE
PROPOSED CONDITIONS (OPTION 2 - IVEY AND BRESCIA SERVICING INCLUDED)

SEWER LOCATION				AREA		A X C					RAINFALL INTENSITY			Q								PROFILE				
AREA NO.	STREET	FROM MH	TO MH	AREA ha.	TOT. AREA ha.	RUNOFF COEFF. (above)	INCR AxC	TOTAL SECT. AxC A X C	TOTAL LAT. A X C	CUM. SEWER (2.78 x) A x C	TIME ENT. SECT. min.	TIME ENT. ACCUM. min.	INTENSITY 'i' mm/hr	l/s	"n"	NOM. PIPE D mm	STORM SLOPE %	CAPACITY Q l/s	VELOCITY m./s. (min. 1.0 m/s)	LENGTH m	FLOW TIME minutes	SEWER FALL m	HEADLOSS m	DROP IN MANHOLE m	INVERT ELEVATION U.S. m	INVERT ELEVATION D.S. m
P15	SARNIA ROAD	MH18	MH17	2.94	2.94	0.70	2.06			5.72		13.38	92.22	528	0.013	675	3.15	1492	4.17	76.1	0.30	2.397			250.507	248.108
P14	SARNIA ROAD	MH17	MH16	0.94	3.88	0.90	0.85	2.06		8.07	0.30	13.69	91.11	736	0.013	675	3.10	1480	4.14	89.9	0.36	2.787	0.037	0.100	248.108	245.322
	SARNIA ROAD	MH16	MH7	--	3.88						0.36	14.05	89.84	736	0.013	675	3.00	1456	2.81	34.0	0.20	1.020	0.032	0.100	245.222	244.202
P13	WESTERN ROAD	MH15	MH14	0.39	0.39	0.90	0.35			0.98		11.36	100.36	98	0.013	375	0.50	129	1.17	90.1	1.28	0.451			245.125	244.675
P12	WESTERN ROAD	MH14	MH13	0.42	0.81	0.90	0.38	0.35		2.03	1.28	12.65	95.02	193	0.013	450	0.50	210	1.32	99.0	1.25	0.495	0.154	0.200	244.475	243.980
P11	WESTERN ROAD	MH13	MH6	0.79	1.60	0.90	0.71	0.73		4.00	1.25	13.89	90.38	362	0.013	525	0.80	401	1.85	97.0	0.87	0.776	0.293	0.300	243.680	242.904
P10	WESTERN ROAD	MH12	MH11	0.41	0.41	0.90	0.37			1.03		11.94	97.87	100	0.013	375	1.90	252	2.28	98.0	0.72	1.862			254.700	252.838
EXT1	SPRINGETTE PARKING LOT/BRESCIA LANDS	--	MH11	15.00	15.00	0.70	10.50			29.19		17.78	78.64	2296												
P9	WESTERN ROAD	MH11	MH10	0.28	15.69	0.90	0.25	0.37	10.50	30.92		17.78	78.64	2431	0.013	900	2.10	2737	4.30	98.0	0.38	2.058	0.308	0.500	252.338	250.280
P8	WESTERN ROAD	MH10	MH9	0.28	15.97	0.90	0.25	11.12		31.62	0.38	18.16	77.67	2456	0.013	900	2.20	2802	4.40	98.0	0.37	2.156	0.123	0.300	249.980	247.824
EXT2	IVEY BUILDING/BRESCIA LANDS	--	MH9	7.09	7.09									135												
P7	WESTERN ROAD	MH9	MH8	0.27	23.33	0.90	0.24	11.37		32.29	0.37	18.53	76.75	2613	0.013	1050	1.60	3604	4.16	98.0	0.39	1.568	0.305	0.400	247.424	245.856
P6	WESTERN ROAD	MH8	MH7	0.23	23.56	0.90	0.21	11.62		32.87	0.39	18.93	75.80	2626	0.013	1050	1.10	2988	3.45	98.0	0.47	1.078	0.062	0.300	245.556	244.478
P5	WESTERN ROAD/ELBORN COLLEGE	MH7	MH6	2.97	30.41	0.90	2.67		14.73	48.37	0.47	18.93	75.80	3801	0.013	1200	1.20	4456	3.94	16.8	0.07	0.201		2.0 D.S.	242.470	242.269
P4	PHILLIP AZIZ DRIVE	MH6	MH5	0.69	32.70	0.90	0.62		20.30	58.17	0.07	19.00	75.63	4534	0.013	1200	2.30	6169	5.45	59.9	0.18	1.378	0.121	0.150	242.119	240.741
P3	PHILLIP AZIZ DRIVE	MH5	MH4	0.70	33.40	0.90	0.63	20.93		59.92	0.18	19.18	75.19	4641	0.013	1200	2.30	6169	5.45	78.2	0.24	1.799	0.277	0.300	240.441	238.642
P2	PHILLIP AZIZ DRIVE	MH4	MH3	0.60	34.00	0.90	0.54	21.56		61.42	0.24	19.42	74.64	4720	0.013	1200	2.30	6169	5.45	91.5	0.28	2.105	0.235	0.250	238.392	236.287
P1	PHILLIP AZIZ DRIVE	MH3	MH2	0.58	34.58	0.90	0.52	22.10		62.88	0.28	19.70	74.00	4788	0.013	1450	0.60	5219	3.16	71.0	0.37	0.426	0.073	0.100	236.187	235.761
	PHILLIP AZIZ DRIVE	MH2	MH1	--	34.58									4788	0.013	1450	0.60	5219	3.16	71.0	0.37	0.426	0.041	0.100	235.661	235.235

Notes:

EXT2 - IVEY BUILDING/BRESCIA LANDS - as per the Richard Ivey School of Business 1255 Western Road Stormwater Management Design Brief (Development Engineering 2009)

Runoff Ceof Calculations:

P15 RUNOFF COEF. = [0.9*(1.42 ha) + 0.2*(1.51ha)]/2.93ha = 0.54 --> city comment Feb 2023 to revise to 0.7

EXT1 RUNOFF COEF. = [0.9*(7.2 ha) + 0.2*(7.7 ha)]/15 ha = 0.54 --> city comment Feb 2023 to revise to 0.7

TC Calculations:	Validation				
P15 TC = 12.6min (as per CoL Design Manual Figure 5.3)+ 75m/1.5m/s = 13.4 min	12.6	+	0.8	=	13.4
P13 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 90m/1.5m/s = 11.4 min	10.4	+	1.0	=	11.4
P10 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 142m/1.5m/s = 11.9 min	10.4	+	1.6	=	11.9
EXT1 TC = 12.6 min (as per CoL Design Manual Figure 5.3)+ 471 m/1.5m/s = 17.8 min	12.6	+	5.2	=	17.8

RUNOFF COEFFICIENT 'C'

PARKS & PLAYGROUNDS	- 0.20
RESIDENTIAL- SINGLE & DUPLEX	- 0.50
- ROWHOUSING	- 0.65
- APARTMENTS	- 0.65 to 0.70
COMMERCIAL & INDUSTRIAL	-0.70-0.90
DENSELY BUILT, PAVED	- 0.90

STORM SEWER DESIGN SHEET

(BASED ON CITY OF LONDON 5-YR STORM)

PROJECT	Western Road, Sarnia Road and Philip Aziz Avenue EA
PROJECT NO.	60661402
DRAINAGE AREA	
DESIGNED BY	AN
CHECKED BY	
DATE	02-28-23

FLOW, Q = 2.78 CiA

WHERE Q = PEAK FLOW IN LITRES PER SECOND (L/s)

C = RUNOFF COEFFICIENT (See Above)

i = RAINFALL INTENSITY (mm/hr), RETURN PERIOD = 5 years

A = AREA IN HECTARES (ha)

WESTERN ROAD AND SARNIA ROAD/PHILIP AZIZ AVENUE

)POSED CONDITIONS (OPTION 3 - Preliminary Calcs considering flows from Brescia Ln, Kinivie Dr, Stirrup Ct, Ivey, Brescia and Sleghtholme Ave)

SEWER LOCATION				AREA		A X C					RAINFALL INTENSITY			Q									PROFILE				
AREA NO.	STREET	FROM MH	TO MH	AREA ha.	TOT. AREA ha.	RUNOFF COEFF. (above)	INCR AxC	TOTAL SECT. AxC A X C	TOTAL LAT. A X C	CUM. SEWER (2.78 x) A x C	TIME ENT. SECT. min.	TIME ENT. ACCUM. min.	INTENSITY 'i' mm/hr	l/s	"n"	NOM. PIPE D mm	STORM SLOPE %	CAPACITY Q l/s	VELOCITY m./s. (min. 1.0 m/s)	LENGTH m	FLOW TIME minutes	SEWER FALL m	HEADLOSS m	DROP IN MANHOLE m	INVERT ELEVATION U.S. m	INVERT ELEVATION D.S. m
P18	SARNIA ROAD	MH20	MH19	11.50	11.50	0.40	4.60			12.79		28.41	58.69	750	0.013	850	0.30	851	1.50	20.0	0.22	0.060		0.300	252.000	251.940
P16&17	SARNIA ROAD	MH19	MH18	6.50	18.00	0.45	2.93	4.60		20.92	0.22	28.63	58.39	1221	0.013	1050	0.23	1310	1.51	500.0	5.51	1.150	0.171	0.300	251.640	250.490
P15	SARNIA ROAD	MH18	MH17	2.94	20.94	0.70	2.06	7.53		26.64	5.51	34.14	51.86	1382	0.013	700	3.15	1644	4.27	76.1	0.30	2.397	0.534	0.550	249.940	247.543
P14	SARNIA ROAD	MH17	MH16	0.94	21.88	0.90	0.85	9.58		28.99	0.30	34.44	51.55	1495	0.013	700	3.10	1631	4.24	89.9	0.35	2.787	0.375	0.400	247.143	244.356
	SARNIA ROAD	MH16	MH7	--	21.88						0.35	34.79	51.19	1495	0.013	700	3.00	1604	4.17	34.0	0.14	1.020	0.071	0.100	244.256	243.236
P13	WESTERN ROAD	MH15	MH14	0.39	0.39	0.90	0.35			0.98		11.36	100.36	98	0.013	375	0.50	129	1.17	90.1	1.28	0.451			245.125	244.675
P12	WESTERN ROAD	MH14	MH13	0.42	0.81	0.90	0.38	0.35		2.03	1.28	12.65	95.02	193	0.013	450	0.50	210	1.32	99.0	1.25	0.495	0.154	0.200	244.475	243.980
P11	WESTERN ROAD	MH13	MH6	0.79	1.60	0.90	0.71	0.73		4.00	1.25	13.89	90.38	362	0.013	525	0.80	401	1.85	97.0	0.87	0.776	0.293	0.300	243.680	242.904
P10	WESTERN ROAD	MH12	MH11	0.41	0.41	0.90	0.37			1.03		11.94	97.87	100	0.013	375	1.90	252	2.28	98.0	0.72	1.862			254.700	252.838
EXT1	SPRINGETTE PARKING LOT/BRESCIA LANDS	--	MH11	15.00	15.00	0.70	10.50			29.19		17.78	78.64	2296												
P9	WESTERN ROAD	MH11	MH10	0.28	15.69	0.90	0.25	0.37	10.50	30.92		17.78	78.64	2431	0.013	900	2.10	2737	4.30	98.0	0.38	2.058	0.308	0.500	252.338	250.280
P8	WESTERN ROAD	MH10	MH9	0.28	15.97	0.90	0.25	11.12		31.62	0.38	18.16	77.67	2456	0.013	900	2.20	2802	4.40	98.0	0.37	2.156	0.123	0.300	249.980	247.824
EXT2	IVEY BUILDING/BRESCIA LANDS	--	MH9	7.09	7.09									135												
P7	WESTERN ROAD	MH9	MH8	0.27	23.33	0.90	0.24	11.37		32.29	0.37	18.53	76.75	2613	0.013	1050	1.60	3604	4.16	98.0	0.39	1.568	0.305	0.400	247.424	245.856
P6	WESTERN ROAD	MH8	MH7	0.23	23.56	0.90	0.21	11.62		32.87	0.39	18.93	75.80	2626	0.013	1050	1.10	2988	3.45	98.0	0.47	1.078	0.062	0.300	245.556	244.478
P5	WESTERN ROAD/ELBORN COLLEGE	MH7	MH6	2.97	48.41	0.90	2.67		22.25	69.29	0.47	18.93	75.80	5387	0.013	1350	1.20	6100	4.26	16.8	0.07	0.201		2.0 D.S.	242.470	242.269
P4	PHILLIP AZIZ DRIVE	MH6	MH5	0.69	50.70	0.90	0.62		35.35	100.01	0.07	18.99	75.64	7700	0.013	1350	2.30	8446	5.90	59.9	0.17	1.378	0.141	0.150	242.119	240.741
P3	PHILLIP AZIZ DRIVE	MH5	MH4	0.70	51.40	0.90	0.63	35.98		101.76	0.17	19.16	75.24	7792	0.013	1350	2.30	8446	5.90	78.2	0.22	1.799	0.236	0.300	240.441	238.642
P2	PHILLIP AZIZ DRIVE	MH4	MH3	0.60	52.00	0.90	0.54	36.61		103.26	0.22	19.38	74.72	7851	0.013	1350	2.30	8446	5.90	91.5	0.26	2.105	0.203	0.250	238.392	236.287
P1	PHILLIP AZIZ DRIVE	MH3	MH2	0.58	52.58	0.90	0.52	37.15		104.71	0.26	19.64	74.13	7897	0.013	1700	0.60	7977	3.51	71.0	0.34	0.426	0.067	0.100	236.187	235.761
	PHILLIP AZIZ DRIVE	MH2	MH1	--	52.58									7897	0.013	1700	0.60	7977	3.51	71.0	0.34	0.426	0.050	0.100	235.661	235.235

Notes:

TC Calculations:

	Validation				
P15 TC = 12.6min (as per CoL Design Manual Figure 5.3)+ 75m/1.5m/s = 13.4 min	12.6	+	0.8	=	13.4
P18 TC = 16.25min (as per CoL Design Manual Figure 5.3)+ 500m/1.5m/s = 17.08 min	22.9	+	5.6	=	28.4
P13 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 90m/1.5m/s = 11.4 min	10.4	+	1.0	=	11.4
P10 TC = 10.4min (as per CoL Design Manual Figure 5.3)+ 142m/1.5m/s = 11.9 min	10.4	+	1.6	=	11.9
EXT1 TC = 12.6 min (as per CoL Design Manual Figure 5.3)+ 471 m/1.5m/s = 17.8 min	12.6	+	5.2	=	17.8

Rational Method- Flows and Comparison

Assumptions of this method:

- the peak rate of runoff, Q_i is determined by using an average rainfall intensity, i, over the entire watershed with a time duration equal to the watershed time of concentration, tc;
- the peak rate of runoff is assumed to have a return period equal to that of the intensity-duration-frequency curve;
- the rainfall intensity, i, remains constant for the computed time of concentration, tc, and is uniform across the drainage area;
- the runoff coefficient, C, does not vary over the duration of the storm.

Return Period (Year)	A	B	C
25 mm	538.85	6.331	0.809
2-Year	1290.00	8.500	0.860
5-Year	1183.74	7.641	0.838
10-Year	1574.38	9.025	0.860
25-Year	2019.37	9.824	0.875
50-Year	2270.67	9.984	0.876
100-Year	2619.36	10.500	0.884
250-Year	3048.22	10.030	0.888

$I = A/(T+B)^c$

Existing Conditions

Catchment ID	Location	Area	Tc	Intensity - TRCA Wet Weather Flow IDF Curve (24 hr)							Runoff Coefficient C	Flow Estimate - Q = CiA								
				i_2 (mm/hr)	i_5 (mm/hr)	i_{10} (mm/hr)	i_{25} (mm/hr)	i_{50} (mm/hr)	i_{100} (mm/hr)	i_{1250} (mm/hr)		Q_2 (m^3/s)	Q_5 (m^3/s)	Q_{10} (m^3/s)	Q_{25} (m^3/s)	Q_{50} (m^3/s)	Q_{100} (m^3/s)	Q_{250} (m^3/s)	$i_{25\ mm}$ (mm/hr)	$Q_{25\ mm}$ (m^3/s)
(ID)	(Street)	(ha)	(min)																	
P15	SARNIA ROAD	2.94	16	81.6	82.7	97.8	116.3	129.6	143.2	167.1	0.54	0.36	0.36	0.43	0.51	0.57	0.63	0.74	43.2	0.19
P14	SARNIA ROAD	0.94	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.24	0.25	0.29	0.34	0.38	0.42	0.49	55.2	0.13
P13	WESTERN ROAD	0.39	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.10	0.10	0.12	0.14	0.16	0.17	0.20	55.2	0.05
P12	WESTERN ROAD	0.42	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.11	0.11	0.13	0.15	0.17	0.19	0.22	55.2	0.06
P11	WESTERN ROAD	0.79	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.20	0.21	0.24	0.29	0.32	0.35	0.41	55.2	0.11
P10	WESTERN ROAD	0.41	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.11	0.11	0.13	0.15	0.17	0.18	0.21	55.2	0.06
P9	WESTERN ROAD	0.28	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.07	0.07	0.09	0.10	0.11	0.12	0.15	55.2	0.04
P8	WESTERN ROAD	0.28	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.07	0.07	0.09	0.10	0.11	0.12	0.15	55.2	0.04
P7	WESTERN ROAD	0.27	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.07	0.07	0.08	0.10	0.11	0.12	0.14	55.2	0.04
P6	WESTERN ROAD	0.23	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.06	0.06	0.07	0.08	0.09	0.10	0.12	55.2	0.03
P4	PHILLIP AZIZ DRIVE	0.69	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.18	0.18	0.21	0.25	0.28	0.31	0.36	55.2	0.10
P3	PHILLIP AZIZ DRIVE	0.70	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.18	0.18	0.22	0.25	0.28	0.31	0.37	55.2	0.10
P2	PHILLIP AZIZ DRIVE	0.60	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.15	0.16	0.18	0.22	0.24	0.27	0.31	55.2	0.08
P1	PHILLIP AZIZ DRIVE	0.58	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.90	0.15	0.15	0.18	0.21	0.24	0.26	0.30	55.2	0.08

Proposed Conditions

Catchment ID	Location	Area	Tc	Intensity - TRCA Wet Weather Flow IDF Curve (24 hr)							Runoff Coefficient C	Flow Estimate - Q = CiA								
				i_2 (mm/hr)	i_5 (mm/hr)	i_{10} (mm/hr)	i_{25} (mm/hr)	i_{50} (mm/hr)	i_{100} (mm/hr)	i_{1250} (mm/hr)		Q_2 (m^3/s)	Q_5 (m^3/s)	Q_{10} (m^3/s)	Q_{25} (m^3/s)	Q_{50} (m^3/s)	Q_{100} (m^3/s)	Q_{250} (m^3/s)	$i_{25\ mm}$ (mm/hr)	$Q_{25\ mm}$ (m^3/s)
P15	SARNIA ROAD	2.94	16	81.6	82.7	97.8	116.3	129.6	143.2	167.1	0.54	0.36	0.36	0.43	0.51	0.57	0.63	0.74	43.2	0.19
P14	SARNIA ROAD	0.94	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.96	0.26	0.26	0.31	0.36	0.41	0.45	0.52	55.2	0.14
P13	WESTERN ROAD	0.39	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.96	0.11	0.11	0.13	0.15	0.17	0.19	0.22	55.2	0.06
P12	WESTERN ROAD	0.42	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.95	0.11	0.12	0.14	0.16	0.18	0.20	0.23	55.2	0.06
P11	WESTERN ROAD	0.79	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.92	0.21	0.21	0.25	0.30	0.33	0.36	0.42	55.2	0.11
P10	WESTERN ROAD	0.41	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.97	0.11	0.12	0.14	0.16	0.18	0.20	0.23	55.2	0.06
P9	WESTERN ROAD	0.28	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.97	0.08	0.08	0.09	0.11	0.12	0.13	0.16	55.2	0.04
P8	WESTERN ROAD	0.28	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.97	0.08	0.08	0.09	0.11	0.12	0.13	0.16	55.2	0.04
P7	WESTERN ROAD	0.27	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.97	0.08	0.08	0.09	0.11	0.12	0.13	0.15	55.2	0.04
P6	WESTERN ROAD	0.23	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.98	0.06	0.07	0.08	0.09	0.10	0.11	0.13	55.2	0.03
P4	PHILLIP AZIZ DRIVE	0.69	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	1.00	0.20	0.20	0.24	0.28	0.31	0.34	0.40	55.2	0.11
P3	PHILLIP AZIZ DRIVE	0.70	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	1.00	0.20	0.20	0.24	0.28	0.32	0.35	0.41	55.2	0.11
P2	PHILLIP AZIZ DRIVE	0.60	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	1.00	0.17	0.17	0.20	0.24	0.27	0.30	0.35	55.2	0.09
P1	PHILLIP AZIZ DRIVE	0.58	10	103.1	105.0	122.9	145.6	162.1	178.6	209.5	0.92	0.15	0.16	0.18	0.22	0.24	0.27	0.31	55.2	0.08

Catchment ID	Location	Area (ha)	Increased Impervious Area (ha)	% Change in 5-year flow	Ultimate Outlet Location	Proposed Treated Impervious Area (ha)	Total Increased Impervious Area (ha)	Total Treated Impervious Area (ha)
P15	SARNIA ROAD	2.94	0.000	0%	Outlet B	0.00		
P14	SARNIA ROAD	0.94	0.055	6%	Outlet B	0.37		
P13	WESTERN ROAD	0.39	0.024	7%	Outlet B	0.30		
P12	WESTERN ROAD	0.42	0.020	5%	Outlet B	0.25		
P11	WESTERN ROAD	0.79	0.019	3%	Outlet B	0.24		
P10	WESTERN ROAD	0.41	0.029	8%	Outlet B	0.35		
P9	WESTERN ROAD	0.28	0.020	8%	Outlet B	0.25	0.58	9.52
P8	WESTERN ROAD	0.28	0.020	8%	Outlet B	0.25		
P7	WESTERN ROAD	0.27	0.020	8%	Outlet B	0.25		
P6	WESTERN ROAD	0.23	0.017	8%	Outlet B	0.22		
P4	PHILLIP AZIZ DRIVE	0.69	0.177	11%	Outlet B	0.24		
P3	PHILLIP AZIZ DRIVE	0.70	0.100	11%	Outlet B	0.16		
P2	PHILLIP AZIZ DRIVE	0.60	0.065	11%	Outlet B	0.19		
P1	PHILLIP AZIZ DRIVE	0.58	0.012	2%	Outlet B	0.25		

Catchment ID	Location	OGS Location		Increase in Imprevious Area	Treated Catchment Area	Treated Impervious Area	OGS Size	% Change in 5-year flow	Change in 5-year flow volume	25 mm Impervious Area Runoff	EES Pipe Diameter	EES Pipe Amount	EES Width	EES Depth	EES Length	EES Volume	Percent Impervious	Cross-Sectional Area of the envelope	Cross-Sectional Area of the Perforated Pipe	Area of storage	Downstream Storm Sewer Pipe Size
		Manhole Name	Chainage	(ha)	(ha)	(ha)		(%)	V5 (m3)	V25mm (m3)	(mm)		(mm)	(mm)	(m)	(m^3)	(%)	(m^2)	(m^2)	(m^2)	(mm)
P14	SARNIA ROAD	MH16	-	0.05	3.88	3.72	EFO10	6%	10	14	300	2	1575	600	34	16	1.0	0.9	0.1	0.3	675
P7 P8 P9	WESTERN ROAD	MH7	-	0.11	1.47	1.43	EFO6	8%	19	26	750	2	2625	1050	17	27	1.0	2.8	0.9	0.7	825
11 P12 P1	WESTERN ROAD	MH6	-	0.06	1.60	1.51	EFO6	4%	11	16	150	2	1425	450	60	17	0.9	0.6	0.0	0.2	825
1 P2 P3 P	PHILLIP AZIZ DRIVE	MH2	-	0.35	2.57	2.52	EFO8	9%	38	89	600	2	2700	900	71	93	1.0	2.4	0.6	0.7	1200

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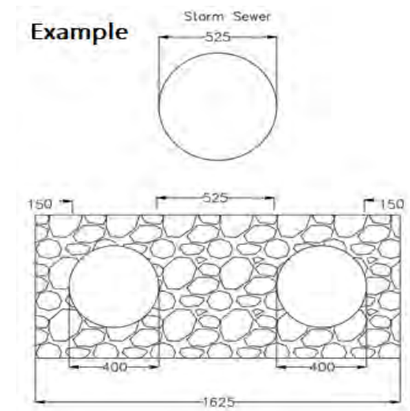
EES Sizing Details

LOCATION			Catchment		Footprint											Storage/Detention Storage Layer							
Upstream CB Mileage	Street	DS OUTLET MH	AREA	Percent IMP	Trench Catchment Coverage	Number of Pipes	Unit Width	Length	Trench Area	Longitudinal Gutter Slope So	Drop in Pipe	Total US buffer (3:1)	Total US buffer (3:1)	Ratio of LID Area to Catchment Area	Ratio of IMP Area to LID Area	Pipe Storage Diameter	Pipe Storage	Gravel Storage Total Depth [2]	Gravel Storage Storage	Total Storage		Design Infiltration Rate of Native Material [1]	Media Drawdown Time
			ha.	(%)	(%)	(n)	m	m	m^2	m/m	m					mm	m^3	mm	m^3	mm/m^2	m^3	(mm/hr)	hrs
-	SARNIA ROAD	MH16	3.88	0.96	0.1%	2	1.6	34	54	0.031	1.1	5	3	0.1%	694	300.00	4.81	600	11	16	16	10	42
-	WESTERN ROAD	MH7	1.47	0.97	0.3%	2	2.6	17	44	0.011	0.2	2	1	0.3%	324	750.00	14.83	1050	13	763	27	10	87
-	WESTERN ROAD	MH6	1.60	0.94	0.5%	2	1.4	60	85	0.008	0.5	3	2	0.5%	177	150.00	2.12	450	15	165	17	10	27
-	PHILLIP AZIZ DRIVE	MH2	2.57	0.98	0.7%	2	2.7	71	192	0.006	0.4	3	2	0.7%	131	600.00	40.15	900	53	653	93	10	72

Notes:

1. from Golder Rev0 Sept, 2021
2. Includes the height provided by the diameter of the pipe



Project Street	Sewer DS Outlet MH	Increased Impervious Area	% Increase in Peak Flow	LID System	Chainage Location	Treated Impervious Area (ha)	LID Length (m)	LID Width (m)
SARNIA ROAD	MH16	0.05	6%	EFO10 OGS	-	3.88	34	1.6
WESTERN ROAD	MH7	0.11	8%	EFO6 OGS	-	1.47	17	2.6
WESTERN ROAD	MH6	0.06	4%	EFO6 OGS	-	1.60	60	1.4
PHILLIP AZIZ DRIVE	MH2	0.35	9%	EFO8 OGS	-	2.57	71	2.7

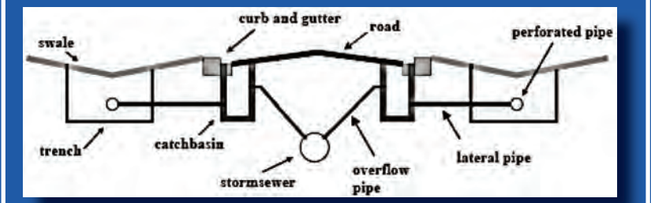
PERFORATED PIPE SYSTEM

CVC/TRCA LOW IMPACT DEVELOPMENT
PLANNING AND DESIGN GUIDE - FACT SHEET

Figure 12

GENERAL DESCRIPTION

Perforated pipe systems can be thought of as long infiltration trenches or linear soak-aways that are designed for both conveyance and infiltration of stormwater runoff. They are composed of perforated pipes installed in gently sloping granular stone beds that are lined with geotextile fabric that allow infiltration of runoff into the gravel bed and underlying native soil while it is being conveyed from source areas or other BMPs to an end-of-pipe facility or receiving waterbody. Perforated pipe systems can be used in place of conventional storm sewer pipes, where topography, water table depth, and runoff quality conditions are suitable. They are suitable for treating runoff from roofs, walkways, parking lots and low to medium traffic roads, with adequate pretreatment. Perforated pipe systems can also be referred to as pervious pipe systems, exfiltration systems, clean water collector systems and percolation drainage systems.



DESIGN GUIDANCE

SOIL CHARACTERISTICS

Perforated pipe systems can be constructed over any soil type, but hydrologic soil group A or B soils are best for achieving water balance objectives. If possible, facilities should be located in portions of the site with the highest native soil infiltration rates. Designers should verify the native soil infiltration rate at the proposed location and depth through measurement of hydraulic conductivity under field saturated conditions.

GEOMETRY AND SITE LAYOUT

Gravel beds in which the perforated pipes are installed are typically rectangular excavations with a bottom width between 600 and 2400 mm. The gravel beds should have gentle slopes between 0.5 to 1%.

PRE-TREATMENT

It is important to prevent sediment and debris from entering infiltration facilities because they could contribute to clogging and failure of the system. The following pre-treatment devices are options:

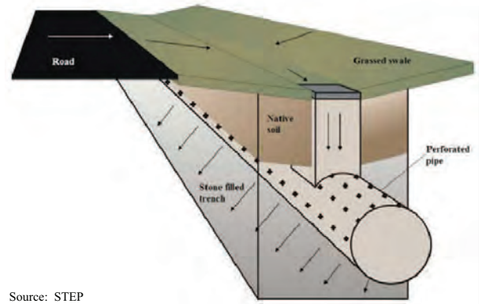
- *In-ground devices:* Devices placed between a conveyance pipe and the facility (e.g., oil and grit separators, sedimentation chambers, goss traps), that can be designed to remove both large and fine particulate from runoff. A number of proprietary filter designs are also available.
- *Vegetated filter strips or grass swales:* Road and parking lot runoff can be pretreated with vegetated filter strips or grass swales prior to entering the infiltration practice.

CONVEYANCE AND OVERFLOW

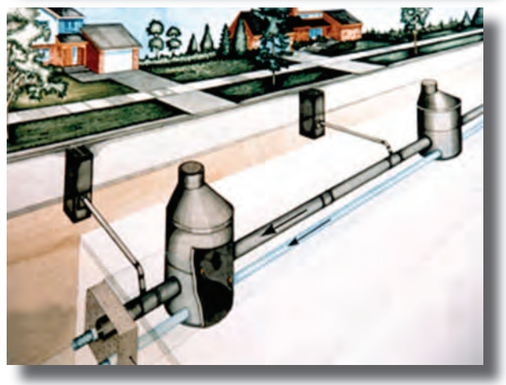
Collection and conveyance of runoff into the perforated pipe system can be accomplished through conventional catchbasins and non-perforated pipes leading from foundation drains and roof downspouts. Perforated pipes should be smooth walled to reduce the potential for clogging and facilitate clean out. The gravel filled trench should be 75 to 150 mm deep above the perforated pipe. On-line concrete, clay or plastic trench baffles or other barriers can be installed across the granular filled trench to reduce flow along the system, thereby increasing the potential for infiltration. Overflows from the granular filled trench should either back up into manholes that are also connected to conventional storm sewers or be conveyed to a storm sewer or receiving waterbody by overland flow.

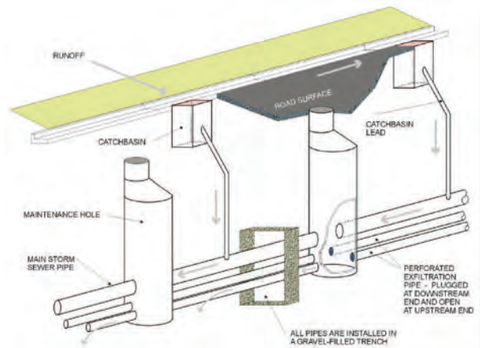
FILTER MEDIA

- *Gravel filled trench:* Should be filled with uniformly-graded, washed, 50 mm clear stone that provides 40% void space.
- *Geotextile:* A non-woven needle punched, or woven monofilament geotextile fabric should be installed around the stone reservoir of perforated pipe systems with a minimum overlap at the top of 300 mm.



Source: STEP





COMMON CONCERNS

Risk of Groundwater Contamination
Most pollutants in urban runoff are well retained by infiltration practices and soils and therefore, have a low to moderate potential for groundwater contamination. To minimize risk of groundwater contamination the following management approaches are recommended:

- infiltration practices should not receive runoff from high traffic areas where large amounts of de-icing salts are applied (e.g., busy highways), nor from pollution hot spots;
- prioritize infiltration of runoff from source areas that are comparatively less contaminated such as roofs, low traffic roads and parking areas; and,
- apply sedimentation pretreatment practices (e.g., oil and grit separators) before infiltration of road or parking area runoff.

Standing Water and Mosquitoes
Complete drawdown should occur within 72 hours after a storm event, before mosquitoes have an opportunity to breed.

Foundations and Seepage
Should be setback at least four (4) metres from building foundations to prevent basement flooding and damage during freeze/thaw cycles.

Winter Operation
Perforated pipe systems will continue to function during winter months if the inlet pipe and top of the gravel bed is located below the local maximum frost penetration depth.

Risk of Soil Contamination
Available evidence from monitoring studies indicates that small distributed stormwater infiltration practices do not contaminate underlying soils, even after 10 years of operation.

Maintenance
With proper location and adequate pretreatment, perforated pipe systems can continue to function effectively with very low levels of maintenance activities. Like conventional stormwater conveyance infrastructure (i.e., catchbasins and storm sewers), perforated pipe systems are typically located on public property (e.g., within road rights-of-way). An advantage to incorporating these systems in stormwater management systems is that legal agreements with property owners or managers, to ensure long term operation and maintenance, are not needed.

CONSTRUCTION CONSIDERATIONS

Soil Disturbance and Compaction
Before site work begins, locations of facilities should be clearly marked. Only vehicular traffic used for construction of the infiltration facility should be allowed close to the facility location.

Erosion and Sediment Control
Infiltration practices should never serve as a sediment control device during construction. Construction runoff should be directed away from the proposed facility location. After the site is vegetated, erosion and sediment control structures can be removed.

Source: STEP

Source: Plastream

GENERAL SPECIFICATIONS

Material	Specification	Quantity
Perforated pipe	Pipe should be continuously perforated, smooth interior, with a minimum inside diameter of 200 millimetres.	Perforated pipe should run length-wise through the facility at least 100 mm above the bottom of the gravel filled trench. Non-perforated pipe should be used for conveyance to the facility.
Stone	The trench in which perforated pipes are installed should be filled with washed 50 mm clear stone with a 40% void ratio.	Volume is based on trench dimensions and a void ratio of 40%.
Geotextile	Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics. Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging. Primary considerations are: • Suitable apparent opening size (AOS) for non-woven fabrics, or percent open area (POA) for woven fabrics, to maintain water flow even with sediment and microbial film build-up; • Maximum forces that will be exerted on the fabric (i.e., what tensile, tear and puncture strength ratings are required?); • Load bearing ratio of the underlying native soil (i.e., is geotextile needed to prevent downward migration of aggregate into the native soil?); • Texture (i.e., grain size distribution) of the overlying native soil, filter media soil or aggregate material; and • Permeability of the native soil. For further guidance see CVC/TRCA LID SWM Planning and Design Guide, Table 4.10.4	Around the gravel filled trench (stone reservoir).

ABILITY TO MEET SWM OBJECTIVES

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefit
Perforated Pipe Systems	Yes	Yes	Partial, depends on soil infiltration rate

OPERATION AND MAINTENANCE

Maintenance typically consists of cleaning out leaves, debris and accumulated sediment caught in pretreatment devices annually or as needed. Inspection via manholes should be performed to ensure the facility drains within the maximum acceptable length of time (typically 72 hours) at least annually and following every major storm event (>25 mm). If the time required to fully drain exceeds 72 hours, drain via pumping and clean out the perforated pipe by flushing. If slow drainage persists, the system may need removal and replacement of granular material and/or geotextile liner. Perforated pipe systems should be located below shoulders of roadways, pervious boulevards or grass swales where they can be readily excavated for servicing.

SITE CONSIDERATIONS

Site Topography
Systems cannot be located on natural slopes greater than 15%. The gravel bed should be designed with gentle slopes between 0.5. to 1%.

Drainage Area
Typically designed with an impervious drainage area to treatment facility area ratio of between 5:1 to 10:1.

Soil
Perforated pipe systems can be located over any soil type, but hydrologic soil group A and B soils are best for achieving water balance benefits. Facilities should be located in portions of the site with the highest native soil infiltration rates. Native soil infiltration rate at the proposed facility location and depth should be confirmed through measurement of hydraulic conductivity under field saturated conditions.

Wellhead Protection
Facilities receiving road or parking lot runoff should not be located within two (2) year time-of-travel wellhead protection areas.

Water Table
The bottom of the gravel bed should be separated from the seasonally high water table or top of bedrock elevation by at least one (1) metre to prevent groundwater contamination.

Pollution Hot Spot Runoff
To protect groundwater from possible contamination, source areas where land uses or human activities have the potential to generate highly contaminated runoff (e.g., vehicle fueling, servicing and demolition areas, outdoor storage and handling areas for hazardous materials and some heavy industry sites) should not be treated by perforated pipe systems.

Setback from Buildings
Facilities should be setback a minimum of four (4) metres from building foundations.

Proximity to Underground Utilities
Local utility design guidance should be consulted to define the horizontal and vertical offsets. Generally, requirements for underground utilities passing near the practice will be no different than for utilities in other pervious areas.

TORONTO AND REGION Conservation for The Living City

CVC CREDIT VALLEY CONSERVATION

FOR FURTHER DETAILS SEE SECTION 4.10 OF THE CVC/TRCA LID SWM GUIDE

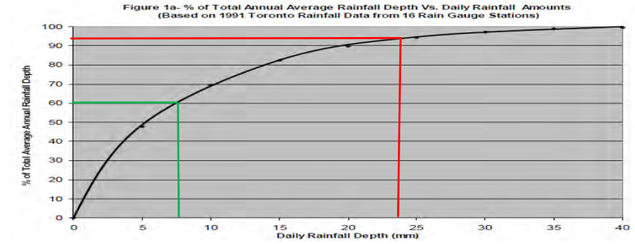
Proposed Conditions

AECOM

Catchment Details																								Infiltration Trench Details							
Location	Catchment ID	Engineering Drawing LID	Actual Area		Existing Treatment Area		Proposed Treatment Area		Increase in Area compared to Existing		Design Runoff Coefficient	Time of Concentration	25 mm 4-Hour Event Peak Runoff		25 mm 4-Hour Event Total Runoff Volume (4-Hours)	Depth of Runoff	% of Total Average Annual Rainfall Depth	Depth of Runoff Treated by LittaTrap	% of Total Average Annual Rainfall Depth Treated by LittaTrap	Depth of Runoff Left to Treat	Depth of Runoff to be treated by Infiltration Trench	% of Total Average Annual Rainfall Depth Left to Treat	25 mm 4-Hour Event Total Runoff Volume to be Treated by Infiltration Trench (4-Hours)	Trench Volume	Aggregate Pore Volume	Daily Runoff Depth Retained	% of Total Average Annual Rainfall Depth	Length One Side	Length Each Side	Width (sidewalk)	Unit Footprint
(Street)	(ID)	(ID)	(m^2)	(ha)	(m^2)	(ha)	(m^2)	(ha)	(m^2)	(ha)	(C)	(minutes)	(m^3/s)	L/s	(m^3)	(mm)	(%)	(mm)	(%)	(mm)	(mm)		(m^3)	(m^3)	(m^3)	(mm)	(%)	(m)	(m)	(m)	(m^2)
SARNIA ROAD	P14	LID1	9,400	0.940	3,151	0.315	3,699	0.370	548	0.055	0.90	10.4	0.05	51	83	22.6	93	10.2	69	12.4	6	55	23	58	23	6	55	58.7	29.3	1.4	82
WESTERN ROAD	P13	LID2	3,900	0.390	2,760	0.276	3,000	0.300	240	0.024	0.90	10.4	0.04	41	68	22.6	93	10.6	71	12.0	7	56	20	50	20	7	56	17.9	8.9	4.0	71
WESTERN ROAD	P12	LID3	4,200	0.420	2,277	0.228	2,475	0.248	198	0.020	0.90	10.4	0.03	34	56	22.6	93	11.3	72	11.3	7	60	18	53	21	9	60	20.1	10.0	3.8	76
WESTERN ROAD	P11	LID4	7,900	0.790	2,162	0.216	2,350	0.235	188	0.019	0.90	10.4	0.03	32	53	22.6	93	11.3	72	11.3	7	60	17	43	17	7	60	15.2	7.6	4.0	61
WESTERN ROAD	P10	LID5	4,100	0.410	3,168	0.317	3,456	0.346	288	0.029	0.90	10.4	0.05	48	78	22.6	93	10.4	70	12.2	6	56	22	55	22	6	56	52.4	26.2	1.5	79
WESTERN ROAD	P9	LID6	2,800	0.280	2,277	0.228	2,475	0.248	198	0.020	0.90	10.4	0.03	34	56	22.6	93	11.3	72	11.3	7	60	18	45	18	7	60	42.9	21.4	1.5	64
WESTERN ROAD	P8	LID7	2,800	0.280	2,277	0.228	2,475	0.248	198	0.020	0.90	10.4	0.03	34	56	22.6	93	11.3	72	11.3	7	60	18	45	18	7	60	42.9	21.4	1.5	64
WESTERN ROAD	P7	LID8	2,700	0.270	2,254	0.225	2,450	0.245	196	0.020	0.90	10.4	0.03	34	55	22.6	93	11.3	72	11.3	7	60	18	45	18	7	60	42.9	21.4	1.5	64
WESTERN ROAD	P6	LID9	2,300	0.230	2,001	0.200	2,175	0.218	174	0.017	0.90	10.4	0.03	30	49	22.6	93	11.5	73	11.1	8	61	17	43	17	8	61	40.5	20.2	1.5	61
PHILLIP AZIZ DRIVE	P4	LID10	6,900	0.690	604	0.060	2,374	0.237	1,770	0.177	0.90	10.4	0.03	33	54	22.6	93	11.3	72	11.3	7	60	17	43	17	7	60	25.3	12.6	2.4	61
PHILLIP AZIZ DRIVE	P3	LID11	7,000	0.700	609	0.061	1,609	0.161	1,000	0.100	0.90	10.4	0.02	22	36	22.6	93	12.2	75	10.4	9	65	14	35	14	9	65	20.8	10.4	2.4	50
PHILLIP AZIZ DRIVE	P2	LID12	6,000	0.600	1,220	0.122	1,871	0.187	651	0.065	0.90	10.4	0.03	26	42	22.6	93	12.0	74	10.6	8	64	16	40	16	9	64	23.8	11.9	2.4	57
PHILLIP AZIZ DRIVE	P1	LID13	5,800	0.580	2,363	0.236	2,487	0.249	124	0.012	0.90	10.4	0.03	34	56	22.6	93	11.3	72	11.3	7	60	18	45	18	7	60	26.8	13.4	2.4	64
Totals			**95,200**	**9.52**	**27,124**	**2.71**	**32,897**	**3.29**	**5,773**	**0.58**	**0.90**	**10.4**	**0.46**	**455**	**742**	**22.6**	**93**	**11.2**	**72**	**11.4**	**7**	**60**	**237**	**598**	**239**	**7**	**59**	**-**		**-**	**855**

Infiltration Trench Details

	1. Aggregate Trench Depth:	0.70	m
	2. Aggregate Porosity:	0.40	(%)
	3. Hydraulic Conductivity:	1.0E-05	cm/s (Golder Rev0 Sept, 2021)
0.260869565	4. Infiltration Rate:	25	mm/hr (Golder Rev0 Sept, 2021)
	5. Factor of Safety:	2.5	(unitless)
	6. Design Infiltration Rate:	10	mm/hr
	7. Drawdown Time:	70	hours (based on Design Infiltration Rate) 72



Notes:

1. Intensity formula: i = a/(t+b)^(c) per City of London Design Specifications and Requirements Manual (2019).
2. Figure 1a from the City of Toronto Wet Weather Flow Guidelines (2006).
3. Time of concentration based on City of London Design Specifications and Requirements Manual (2019).

Proposed Conditions

AECOM

Location	Catchment ID	Engineering Drawing LID	Proposed Treatment Area		Design Runoff Coefficient	Average Annual Runoff Depth	Average Annual Runoff Volume	Annual Grit Mass	Annual Grit Volume	Catch Basin Pre-Treatment Measures				LID Measures	Annual Treatment	
										# of Catch Basin Inlet Pre-Treatment Devices	Removal Efficiency [3]	Total Captured Grit Volume	Cleanout Frequency	Fractional Load Reduction - Retention	Total Fractional Loading	Total Fractional Load of Catchment Area
(Street)	(ID)	(ID)	(m^2)	(ha)	(C)	(mm/year)	(m^3/year)	(kg/year)	(m^3/year)	(#)	(%)	(m^3)	(Months)	(%)	(%)	(-)
SARNIA ROAD	P14	LID1	3,699	0.37	0.90	911	3,369	1,112	0.69	2	45%	0.16	6	55%	70%	2,580
WESTERN ROAD	P13	LID2	3,000	0.30	0.90	911	2,732	902	0.56	2	47%	0.13	7	56%	70%	2,110
WESTERN ROAD	P12	LID3	2,475	0.25	0.90	911	2,254	744	0.46	2	50%	0.12	8	60%	70%	1,733
WESTERN ROAD	P11	LID4	2,350	0.24	0.90	911	2,140	706	0.44	2	50%	0.11	9	60%	70%	1,645
WESTERN ROAD	P10	LID5	3,456	0.35	0.90	911	3,148	1,039	0.65	2	46%	0.15	6	56%	70%	2,419
WESTERN ROAD	P9	LID6	2,475	0.25	0.90	911	2,254	744	0.46	2	50%	0.12	8	60%	70%	1,733
WESTERN ROAD	P8	LID7	2,475	0.25	0.90	911	2,254	744	0.46	2	50%	0.12	8	60%	70%	1,733
WESTERN ROAD	P7	LID8	2,450	0.25	0.90	911	2,231	736	0.46	2	50%	0.12	8	60%	70%	1,715
WESTERN ROAD	P6	LID9	2,175	0.22	0.90	911	1,981	654	0.41	2	51%	0.10	9	61%	70%	1,523
PHILLIP AZIZ DRIVE	P4	LID10	2,374	0.24	0.90	911	2,162	714	0.45	2	50%	0.11	8	60%	70%	1,662
PHILLIP AZIZ DRIVE	P3	LID11	1,609	0.16	0.90	911	1,466	484	0.30	2	54%	0.08	11	65%	70%	1,127
PHILLIP AZIZ DRIVE	P2	LID12	1,871	0.19	0.90	911	1,704	562	0.35	2	53%	0.09	10	64%	70%	1,310
PHILLIP AZIZ DRIVE	P1	LID13	2,487	0.25	0.90	911	2,265	748	0.47	2	50%	0.12	8	60%	70%	1,741
Totals			**32,897**	**3.29**	**0.90**	**911**	**29,962**	**9,888**	**6.18**	**26**	**25%**	**1.52**	**8**	**59%**	**70%**	**23,028**

Average Annual Rainfall Depth: 1,012 mm (City of London Annual Average Precipitation)
Typical Grit Paved Roadways [1]: 330 mg/L
Grit Bulk Density: 1.6 kg/L
Grit Capture Efficiency: 100 %

Notes:

1. Average event mean concentration for TSS based on City of Toronto Wet Weather Flow Management Guidelines Appendix B.1.7(a).
2. Average annual sediment removal rates (%) based on City of Toronto Sediment - Particle Size Distribution.
3. LittaTrap performance is 40% typical TSS removal efficiency. LittaTrap maximum capacity based on 85% of total capacity capacity (85% of 0.046 m^3 for LT6060).

Location	Catchment ID	Treated Drainage Area	OGS Location		OGS Size
(Street)	(ID)	(ha)	Manhole Name	Chainage	
SARNIA ROAD	P14 P15	3.88			EFO10
WESTERN ROAD	P6 P7 P8 P9 P10	1.47			EFO6
WESTERN ROAD	P11 P12 P13	1.60			EFO6
PHILLIP AZIZ DRIVE	P1 P2 P3 P4	2.57			EFO8
Philip Aziz/Western/Sarnia Roadway Only	P1 P2 P3 P4 P6 P7 P8 P9 P10 P11 P12 P13 P14 P15	3.29			EFO10
Outlet B Option 1	all catchments	12.49			2x EFO12
Outlet B Option 2	all catchments	34.58			Detailed Design
Outlet B Option 3	all catchments	52.58			Detailed Design

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

02/07/2022

Province:	Ontario
City:	London
Nearest Rainfall Station:	LONDON CS
Climate Station Id:	6144478
Years of Rainfall Data:	20
Site Name:	SARNIA ROAD
Drainage Area (ha):	3.88
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	134.98
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Western Rd Improvements
Project Number:	60661402
Designer Name:	Aws Nabeel
Designer Company:	AECOM
Designer Email:	aws.nabeel@aecom.com
Designer Phone:	519-731-3456
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	39
EFO6	54
EFO8	65
EFO10	72
EFO12	78

Recommended Stormceptor EFO Model: EFO10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 72

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

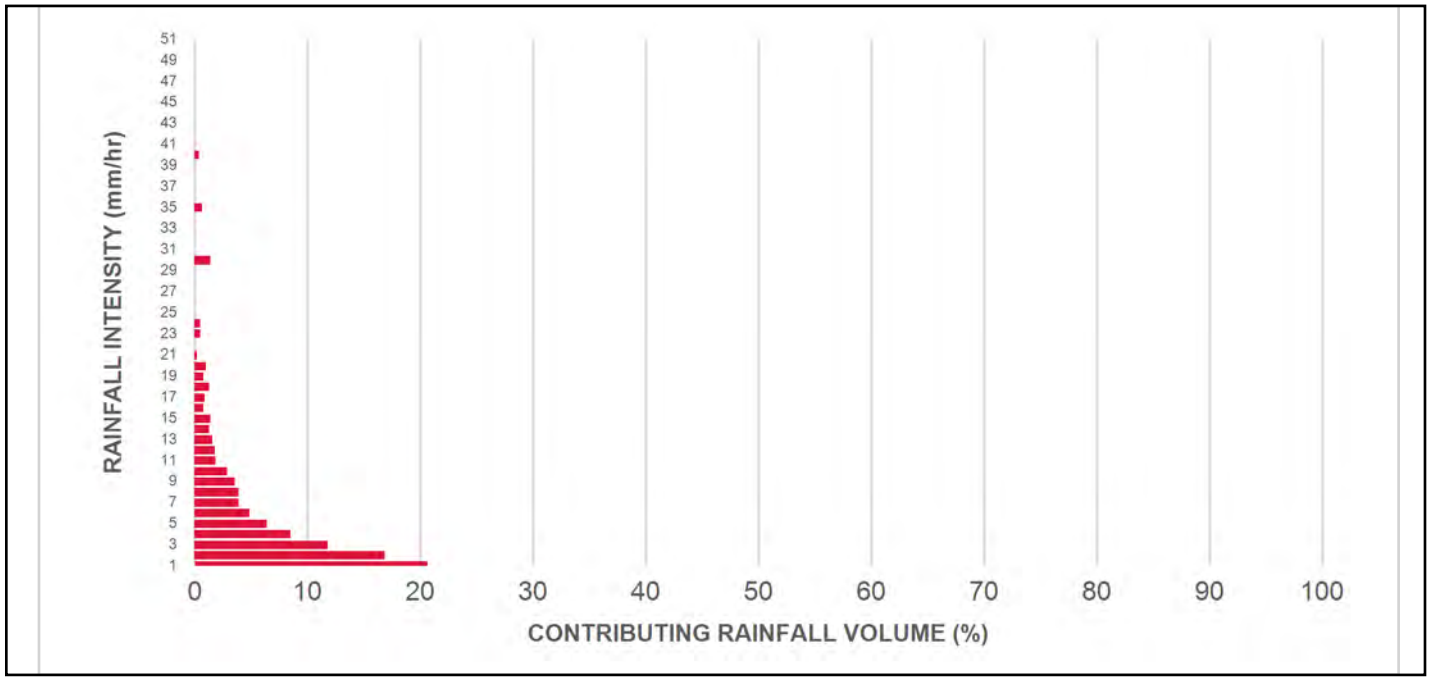
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

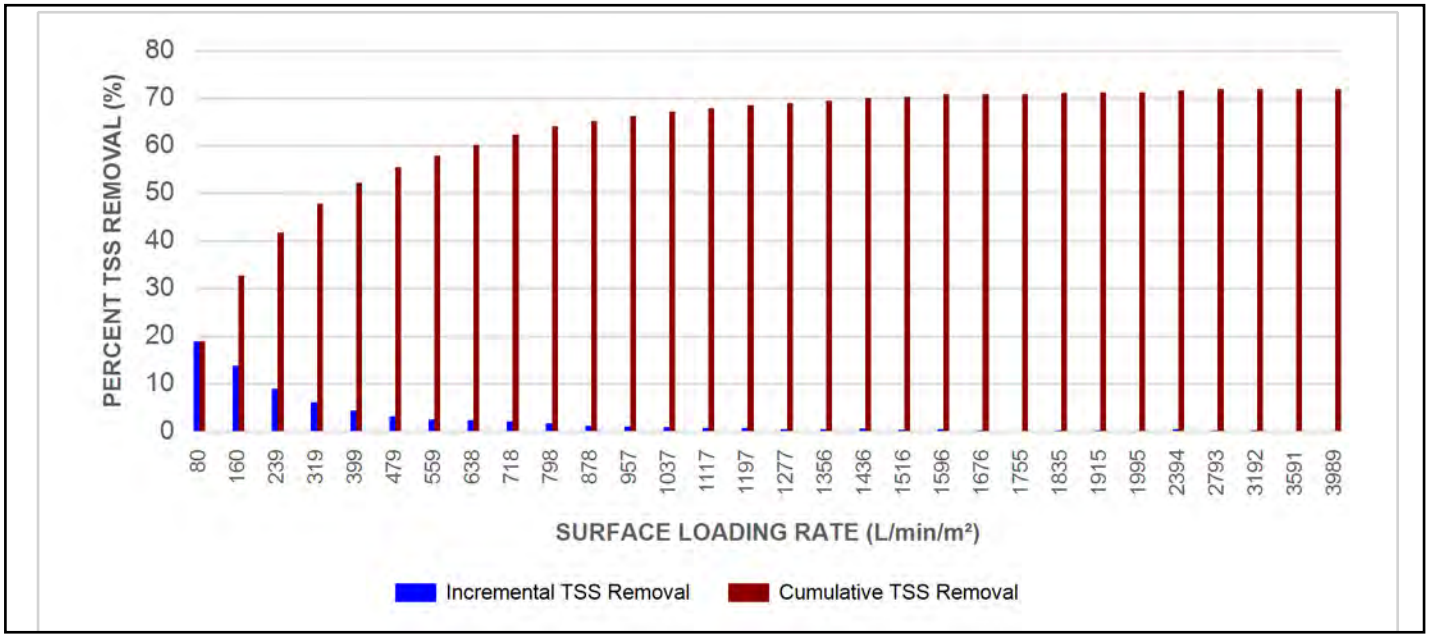
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.7	20.7	9.71	582.0	80.0	91	18.9	18.9
2	16.9	37.6	19.42	1165.0	160.0	82	13.8	32.7
3	11.8	49.4	29.12	1747.0	239.0	75	8.9	41.7
4	8.5	57.9	38.83	2330.0	319.0	72	6.2	47.8
5	6.4	64.3	48.54	2912.0	399.0	69	4.4	52.2
6	4.9	69.2	58.25	3495.0	479.0	66	3.2	55.4
7	3.9	73.2	67.95	4077.0	559.0	62	2.4	57.9
8	3.9	77.0	77.66	4660.0	638.0	60	2.3	60.2
9	3.6	80.6	87.37	5242.0	718.0	59	2.1	62.3
10	2.9	83.5	97.08	5825.0	798.0	59	1.7	64.0
11	1.9	85.4	106.79	6407.0	878.0	58	1.1	65.1
12	1.8	87.2	116.49	6990.0	957.0	58	1.1	66.2
13	1.6	88.8	126.20	7572.0	1037.0	57	0.9	67.1
14	1.3	90.1	135.91	8155.0	1117.0	55	0.7	67.8
15	1.4	91.5	145.62	8737.0	1197.0	53	0.7	68.5
16	0.8	92.3	155.32	9319.0	1277.0	51	0.4	68.9
17	0.9	93.2	165.03	9902.0	1356.0	50	0.4	69.4
18	1.3	94.5	174.74	10484.0	1436.0	48	0.6	70.0
19	0.8	95.3	184.45	11067.0	1516.0	45	0.4	70.3
20	1.0	96.3	194.16	11649.0	1596.0	43	0.4	70.8
21	0.2	96.5	203.86	12232.0	1676.0	41	0.1	70.8
22	0.0	96.5	213.57	12814.0	1755.0	39	0.0	70.8
23	0.5	97.0	223.28	13397.0	1835.0	37	0.2	71.0
24	0.5	97.5	232.99	13979.0	1915.0	36	0.2	71.2
25	0.0	97.5	242.69	14562.0	1995.0	34	0.0	71.2
30	1.4	98.9	291.23	17474.0	2394.0	28	0.4	71.6
35	0.7	99.6	339.77	20386.0	2793.0	25	0.2	71.8
40	0.4	100.0	388.31	23299.0	3192.0	22	0.1	71.9
45	0.0	100.0	436.85	26211.0	3591.0	19	0.0	71.9
50	0.0	100.0	485.39	29123.0	3989.0	17	0.0	71.9
Estimated Net Annual Sediment (TSS) Load Reduction =								**72 %**

Climate Station ID: 6144478 *Years of Rainfall Data*: 20

RAINFALL DATA FROM LONDON CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

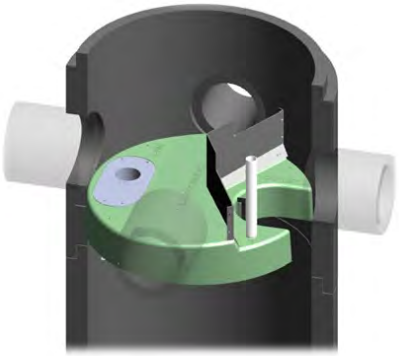
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

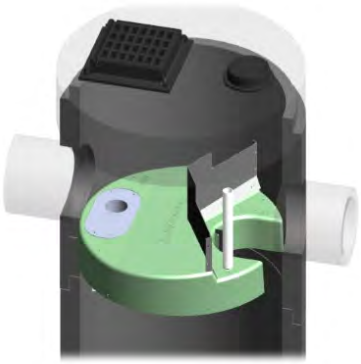
DESIGN FLEXIBILITY

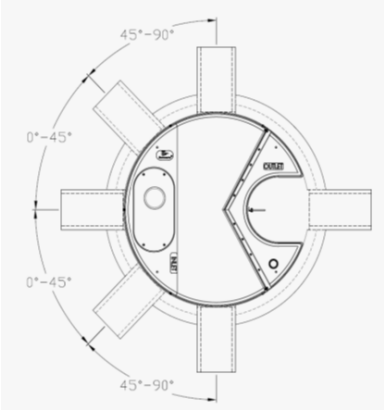
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a

surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor®

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Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

02/01/2022

Province:	Ontario
City:	London
Nearest Rainfall Station:	LONDON CS
Climate Station Id:	6144478
Years of Rainfall Data:	20
Site Name:	WESTERN ROAD
Drainage Area (ha):	1.47
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	51.14
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Western Rd Improvements
Project Number:	60661402
Designer Name:	Aws Nabeel
Designer Company:	AECOM
Designer Email:	aws.nabeel@aecom.com
Designer Phone:	519-731-3456
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	57
EFO6	71
EFO8	80
EFO10	86
EFO12	90

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 71

Water Quality Runoff Volume Capture (%): > 90

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THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

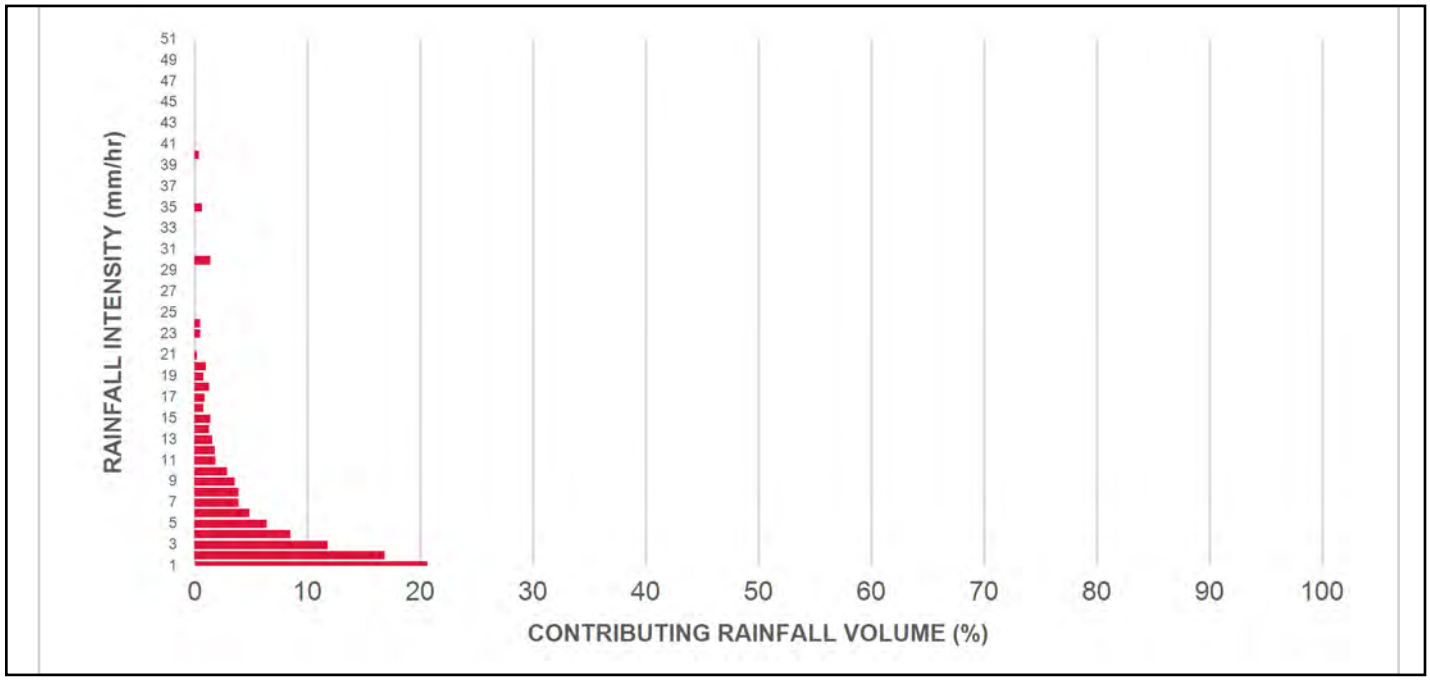
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

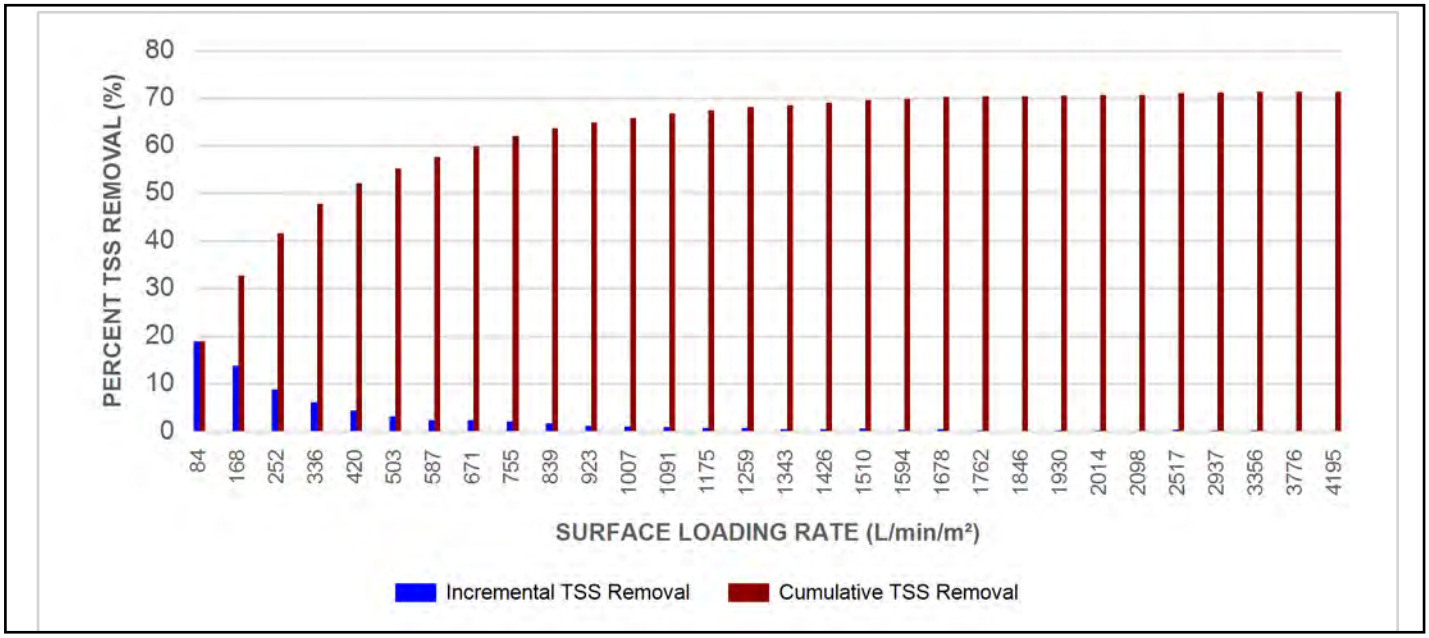
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.7	20.7	3.68	221.0	84.0	91	18.9	18.9
2	16.9	37.6	7.36	441.0	168.0	82	13.8	32.7
3	11.8	49.4	11.03	662.0	252.0	75	8.9	41.6
4	8.5	57.9	14.71	883.0	336.0	72	6.1	47.7
5	6.4	64.3	18.39	1103.0	420.0	68	4.3	52.1
6	4.9	69.2	22.07	1324.0	503.0	64	3.2	55.2
7	3.9	73.2	25.75	1545.0	587.0	61	2.4	57.6
8	3.9	77.0	29.42	1765.0	671.0	60	2.3	59.9
9	3.6	80.6	33.10	1986.0	755.0	59	2.1	62.0
10	2.9	83.5	36.78	2207.0	839.0	58	1.7	63.7
11	1.9	85.4	40.46	2427.0	923.0	58	1.1	64.8
12	1.8	87.2	44.14	2648.0	1007.0	57	1.1	65.8
13	1.6	88.8	47.81	2869.0	1091.0	55	0.9	66.7
14	1.3	90.1	51.49	3089.0	1175.0	54	0.7	67.4
15	1.4	91.5	55.17	3310.0	1259.0	52	0.7	68.1
16	0.8	92.3	58.85	3531.0	1343.0	50	0.4	68.5
17	0.9	93.2	62.52	3751.0	1426.0	48	0.4	69.0
18	1.3	94.5	66.20	3972.0	1510.0	45	0.6	69.5
19	0.8	95.3	69.88	4193.0	1594.0	43	0.3	69.9
20	1.0	96.3	73.56	4414.0	1678.0	41	0.4	70.3
21	0.2	96.5	77.24	4634.0	1762.0	39	0.1	70.4
22	0.0	96.5	80.91	4855.0	1846.0	37	0.0	70.4
23	0.5	97.0	84.59	5076.0	1930.0	35	0.2	70.5
24	0.5	97.5	88.27	5296.0	2014.0	34	0.2	70.7
25	0.0	97.5	91.95	5517.0	2098.0	33	0.0	70.7
30	1.4	98.9	110.34	6620.0	2517.0	27	0.4	71.1
35	0.7	99.6	128.73	7724.0	2937.0	23	0.2	71.2
40	0.4	100.0	147.12	8827.0	3356.0	21	0.1	71.3
45	0.0	100.0	165.51	9930.0	3776.0	18	0.0	71.3
50	0.0	100.0	183.90	11034.0	4195.0	17	0.0	71.3
Estimated Net Annual Sediment (TSS) Load Reduction =								**71 %**

Climate Station ID: 6144478 *Years of Rainfall Data*: 20

RAINFALL DATA FROM LONDON CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

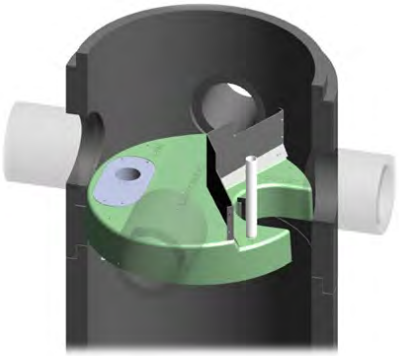
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

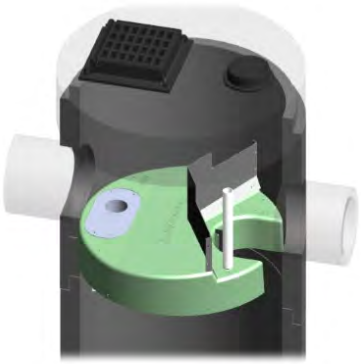
DESIGN FLEXIBILITY

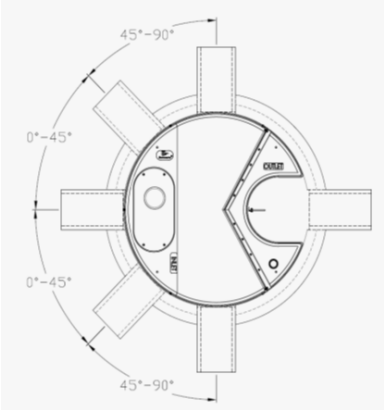
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a

surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

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STORMCEPTOR®
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02/01/2022

Province:	Ontario
City:	London
Nearest Rainfall Station:	LONDON CS
Climate Station Id:	6144478
Years of Rainfall Data:	20
Site Name:	WESTERN ROAD SOUTH
Drainage Area (ha):	1.6
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	55.66
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Western Rd Improvements
Project Number:	60661402
Designer Name:	Aws Nabeel
Designer Company:	AECOM
Designer Email:	aws.nabeel@aecom.com
Designer Phone:	519-731-3456
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	55
EFO6	70
EFO8	79
EFO10	85
EFO12	89

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 70

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

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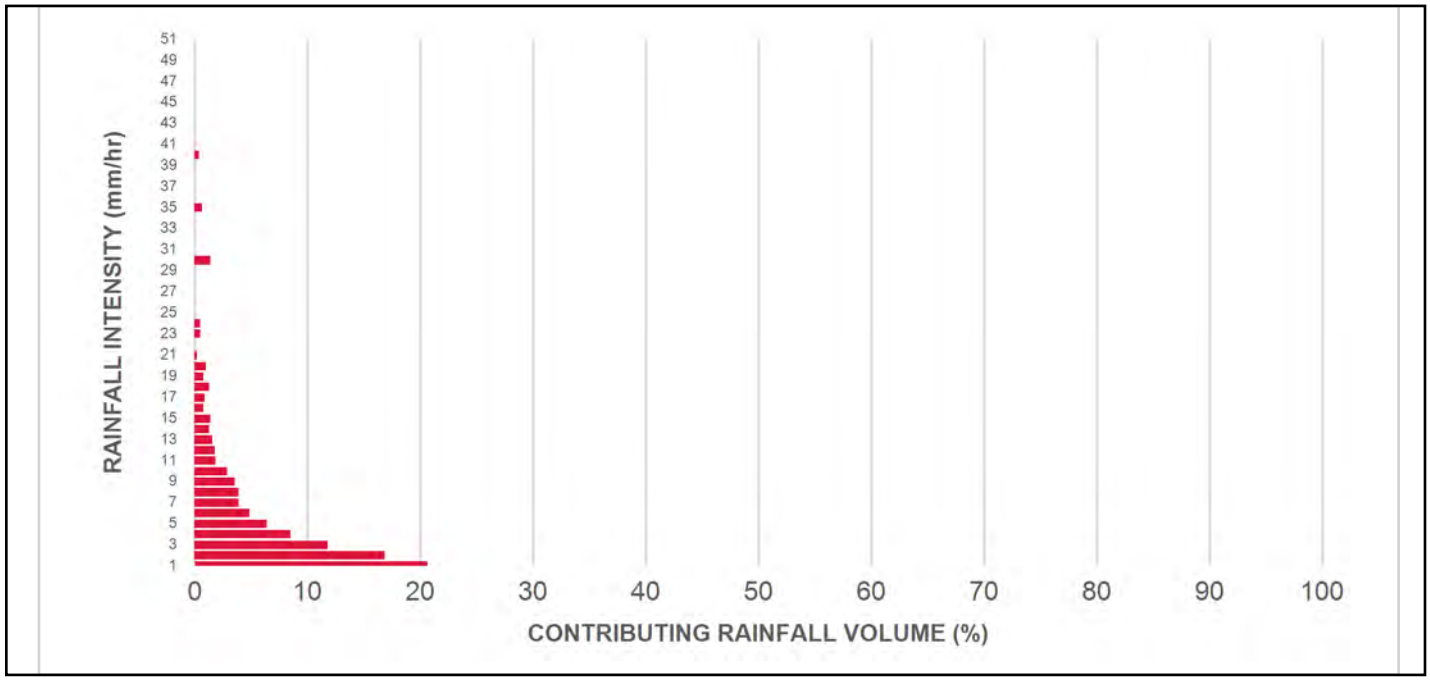
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

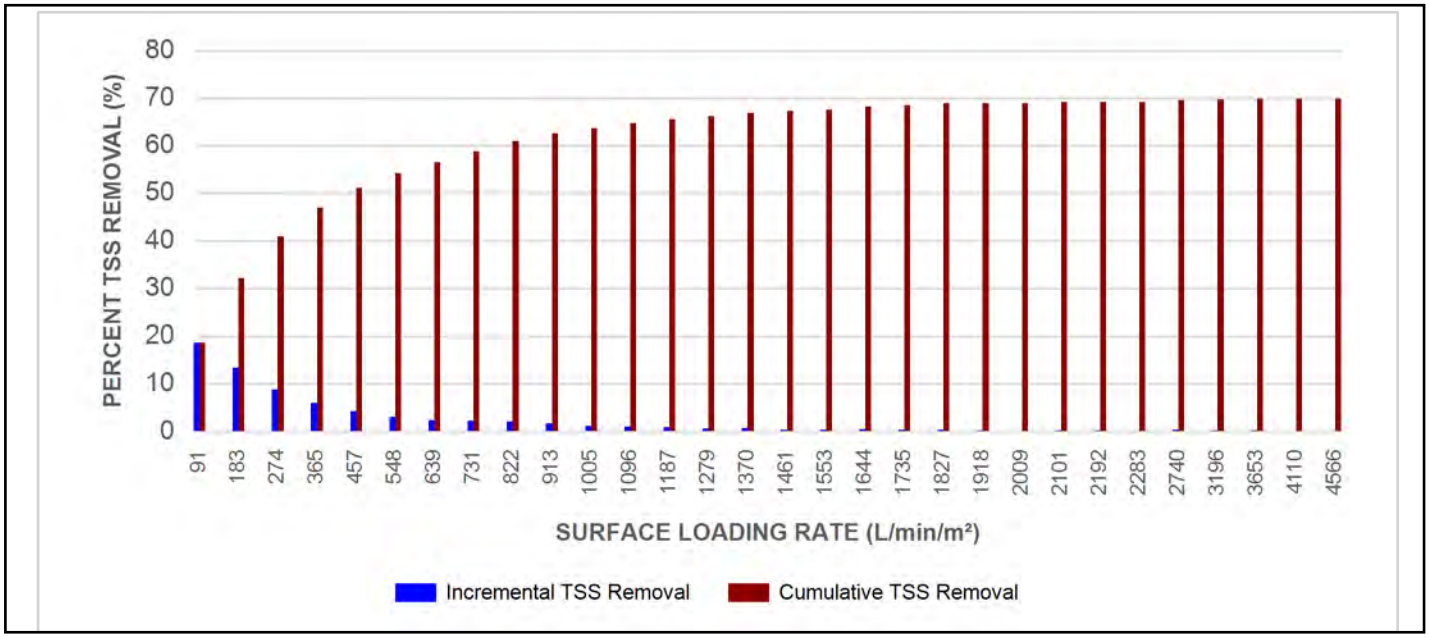
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.7	20.7	4.00	240.0	91.0	90	18.7	18.7
2	16.9	37.6	8.01	480.0	183.0	80	13.4	32.1
3	11.8	49.4	12.01	721.0	274.0	74	8.8	40.9
4	8.5	57.9	16.01	961.0	365.0	70	6.0	46.9
5	6.4	64.3	20.02	1201.0	457.0	66	4.2	51.1
6	4.9	69.2	24.02	1441.0	548.0	63	3.1	54.2
7	3.9	73.2	28.02	1681.0	639.0	60	2.3	56.5
8	3.9	77.0	32.03	1922.0	731.0	59	2.3	58.8
9	3.6	80.6	36.03	2162.0	822.0	58	2.1	60.9
10	2.9	83.5	40.03	2402.0	913.0	58	1.7	62.6
11	1.9	85.4	44.04	2642.0	1005.0	57	1.1	63.7
12	1.8	87.2	48.04	2882.0	1096.0	55	1.0	64.7
13	1.6	88.8	52.04	3122.0	1187.0	53	0.9	65.5
14	1.3	90.1	56.04	3363.0	1279.0	51	0.7	66.2
15	1.4	91.5	60.05	3603.0	1370.0	49	0.7	66.9
16	0.8	92.3	64.05	3843.0	1461.0	47	0.4	67.3
17	0.9	93.2	68.05	4083.0	1553.0	44	0.4	67.6
18	1.3	94.5	72.06	4323.0	1644.0	41	0.5	68.2
19	0.8	95.3	76.06	4564.0	1735.0	39	0.3	68.5
20	1.0	96.3	80.06	4804.0	1827.0	37	0.4	68.9
21	0.2	96.5	84.07	5044.0	1918.0	36	0.1	68.9
22	0.0	96.5	88.07	5284.0	2009.0	34	0.0	68.9
23	0.5	97.0	92.07	5524.0	2101.0	32	0.2	69.1
24	0.5	97.5	96.08	5765.0	2192.0	31	0.2	69.2
25	0.0	97.5	100.08	6005.0	2283.0	30	0.0	69.2
30	1.4	98.9	120.10	7206.0	2740.0	25	0.4	69.6
35	0.7	99.6	140.11	8407.0	3196.0	22	0.2	69.7
40	0.4	100.0	160.13	9608.0	3653.0	19	0.1	69.8
45	0.0	100.0	180.14	10809.0	4110.0	17	0.0	69.8
50	0.0	100.0	200.16	12010.0	4566.0	15	0.0	69.8
Estimated Net Annual Sediment (TSS) Load Reduction =								**70 %**

Climate Station ID: 6144478 *Years of Rainfall Data*: 20

RAINFALL DATA FROM LONDON CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

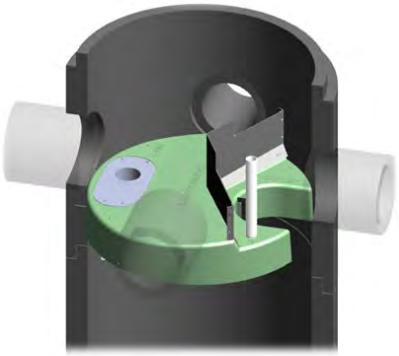
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

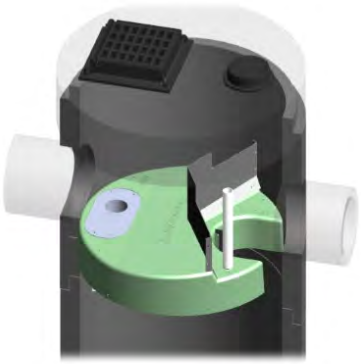
DESIGN FLEXIBILITY

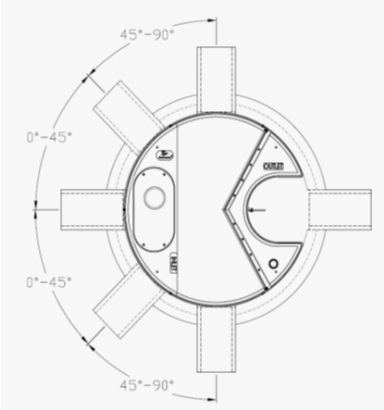
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a

surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/31/2022

Province:	Ontario
City:	London
Nearest Rainfall Station:	LONDON CS
Climate Station Id:	6144478
Years of Rainfall Data:	20
Site Name:	PHILIP AZIZ AVENUE
Drainage Area (ha):	2.57
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	89.41
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Western Rd Improvements
Project Number:	60661402
Designer Name:	Aws Nabeel
Designer Company:	AECOM
Designer Email:	aws.nabeel@aecom.com
Designer Phone:	519-731-3456
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	46
EFO6	62
EFO8	72
EFO10	79
EFO12	83

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 72

Water Quality Runoff Volume Capture (%): > 90

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THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

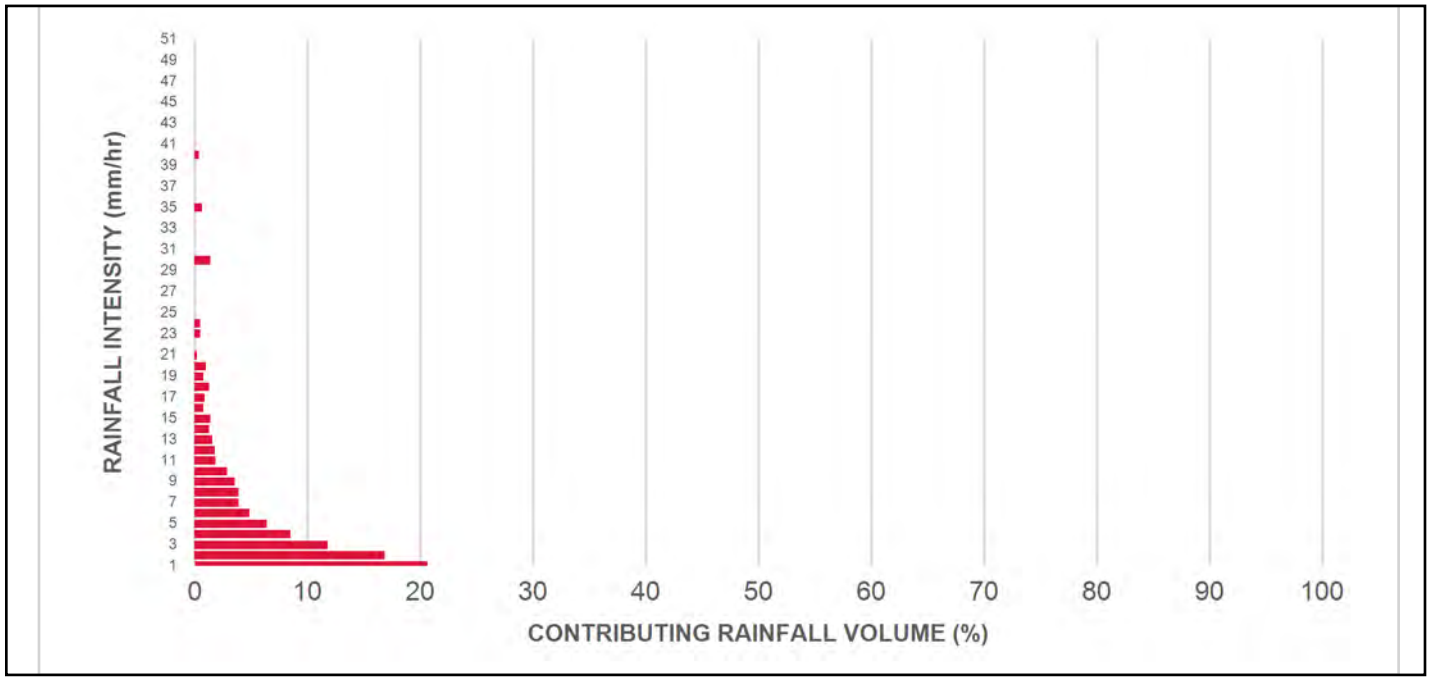
Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.7	20.7	6.43	386.0	82.0	91	18.9	18.9
2	16.9	37.6	12.86	772.0	164.0	82	13.8	32.7
3	11.8	49.4	19.29	1157.0	246.0	75	8.9	41.7
4	8.5	57.9	25.72	1543.0	328.0	72	6.2	47.8
5	6.4	64.3	32.15	1929.0	410.0	68	4.3	52.2
6	4.9	69.2	38.58	2315.0	493.0	65	3.2	55.3
7	3.9	73.2	45.01	2701.0	575.0	61	2.4	57.7
8	3.9	77.0	51.44	3086.0	657.0	60	2.3	60.1
9	3.6	80.6	57.87	3472.0	739.0	59	2.1	62.2
10	2.9	83.5	64.30	3858.0	821.0	58	1.7	63.9
11	1.9	85.4	70.73	4244.0	903.0	58	1.1	65.0
12	1.8	87.2	77.16	4630.0	985.0	57	1.1	66.0
13	1.6	88.8	83.59	5016.0	1067.0	56	0.9	66.9
14	1.3	90.1	90.02	5401.0	1149.0	54	0.7	67.6
15	1.4	91.5	96.45	5787.0	1231.0	52	0.7	68.3
16	0.8	92.3	102.88	6173.0	1313.0	51	0.4	68.7
17	0.9	93.2	109.31	6559.0	1395.0	49	0.4	69.2
18	1.3	94.5	115.74	6945.0	1478.0	46	0.6	69.8
19	0.8	95.3	122.17	7330.0	1560.0	44	0.3	70.1
20	1.0	96.3	128.60	7716.0	1642.0	41	0.4	70.5
21	0.2	96.5	135.03	8102.0	1724.0	40	0.1	70.6
22	0.0	96.5	141.46	8488.0	1806.0	38	0.0	70.6
23	0.5	97.0	147.89	8874.0	1888.0	36	0.2	70.8
24	0.5	97.5	154.32	9259.0	1970.0	35	0.2	70.9
25	0.0	97.5	160.75	9645.0	2052.0	33	0.0	70.9
30	1.4	98.9	192.90	11574.0	2463.0	28	0.4	71.3
35	0.7	99.6	225.05	13503.0	2873.0	24	0.2	71.5
40	0.4	100.0	257.21	15432.0	3283.0	21	0.1	71.6
45	0.0	100.0	289.36	17361.0	3694.0	19	0.0	71.6
50	0.0	100.0	321.51	19290.0	4104.0	17	0.0	71.6
Estimated Net Annual Sediment (TSS) Load Reduction =								**72 %**

Climate Station ID: 6144478 *Years of Rainfall Data*: 20

RAINFALL DATA FROM LONDON CS RAINFALL STATION



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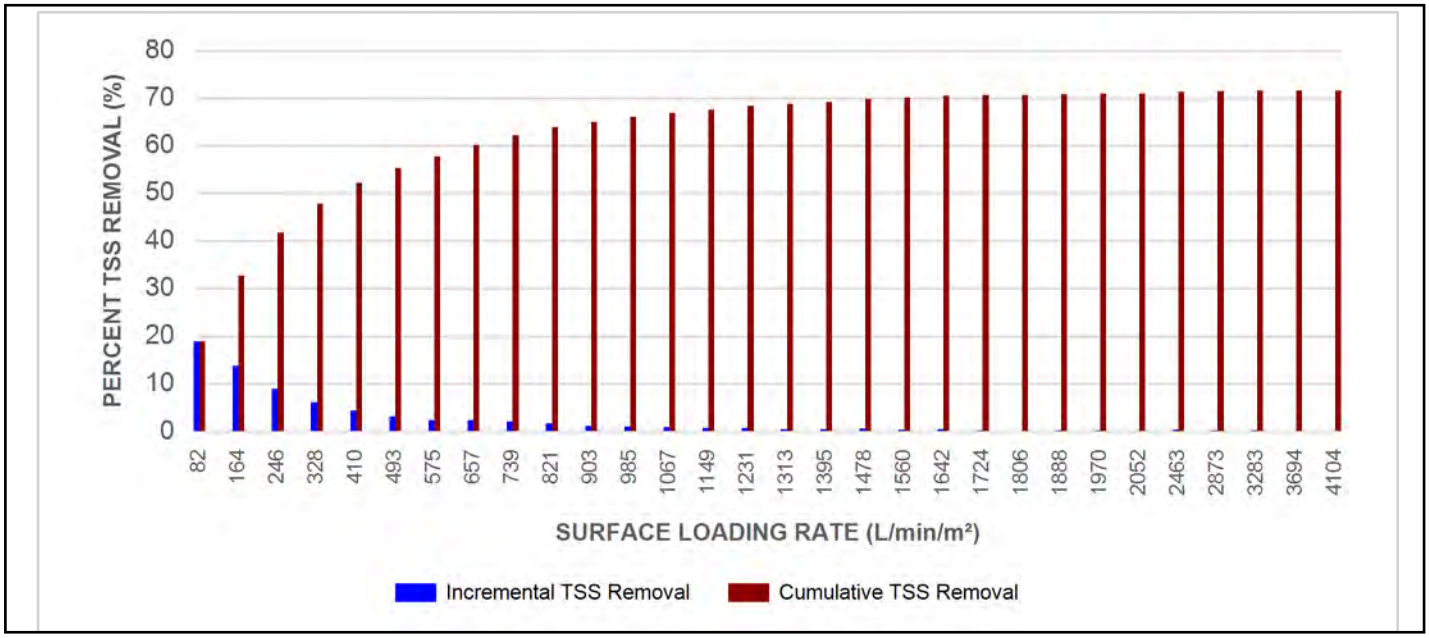

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EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
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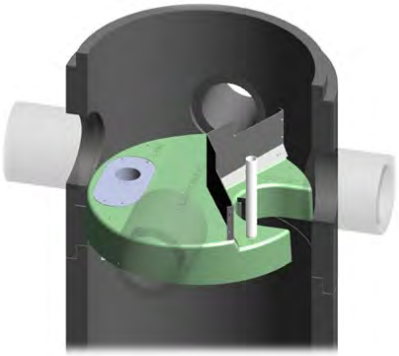

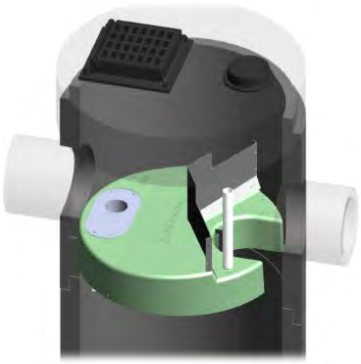

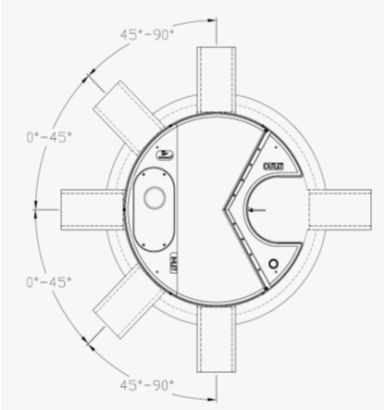

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The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a

surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor®

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Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

02/08/2022

Province:	Ontario
City:	London
Nearest Rainfall Station:	LONDON CS
Climate Station Id:	6144478
Years of Rainfall Data:	20
Site Name:	Western Rd. Improvements (Split 2)
Drainage Area (ha):	6.25
Runoff Coefficient 'c':	0.90
Particle Size Distribution:	Fine
Target TSS Removal (%):	70.0
Required Water Quality Runoff Volume Capture (%):	85.0
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Project Name:	Western Rd. Improvements
Project Number:	-
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	905-630-0359
EOR Name:	Aws Nabeel
EOR Company:	AECOM
EOR Email:	aws.nabeel@aecom.com
EOR Phone:	519-731-3456

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	29
EFO6	45
EFO8	55
EFO10	64
EFO12	70

Recommended Stormceptor EFO Model: EFO12

Estimated Net Annual Sediment (TSS) Load Reduction (%): 70

Water Quality Runoff Volume Capture (%): > 90

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THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (μm)	Percent Less Than	Particle Size Fraction (μm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor®

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Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.7	20.7	15.64	938.0	89.0	90	18.7	18.7
2	16.9	37.6	31.28	1877.0	179.0	81	13.6	32.3
3	11.8	49.4	46.91	2815.0	268.0	75	8.8	41.1
4	8.5	57.9	62.55	3753.0	357.0	71	6.0	47.2
5	6.4	64.3	78.19	4691.0	447.0	67	4.3	51.4
6	4.9	69.2	93.83	5630.0	536.0	63	3.1	54.5
7	3.9	73.2	109.46	6568.0	626.0	60	2.3	56.9
8	3.9	77.0	125.10	7506.0	715.0	59	2.3	59.2
9	3.6	80.6	140.74	8444.0	804.0	59	2.1	61.3
10	2.9	83.5	156.38	9383.0	894.0	58	1.7	62.9
11	1.9	85.4	172.01	10321.0	983.0	57	1.1	64.0
12	1.8	87.2	187.65	11259.0	1072.0	56	1.0	65.0
13	1.6	88.8	203.29	12197.0	1162.0	54	0.9	65.9
14	1.3	90.1	218.93	13136.0	1251.0	52	0.7	66.6
15	1.4	91.5	234.56	14074.0	1340.0	50	0.7	67.3
16	0.8	92.3	250.20	15012.0	1430.0	48	0.4	67.7
17	0.9	93.2	265.84	15950.0	1519.0	45	0.4	68.0
18	1.3	94.5	281.48	16889.0	1608.0	43	0.5	68.6
19	0.8	95.3	297.11	17827.0	1698.0	40	0.3	68.9
20	1.0	96.3	312.75	18765.0	1787.0	38	0.4	69.3
21	0.2	96.5	328.39	19703.0	1877.0	36	0.1	69.4
22	0.0	96.5	344.03	20642.0	1966.0	35	0.0	69.4
23	0.5	97.0	359.66	21580.0	2055.0	33	0.2	69.5
24	0.5	97.5	375.30	22518.0	2145.0	32	0.2	69.7
25	0.0	97.5	390.94	23456.0	2234.0	30	0.0	69.7
30	1.4	98.9	469.13	28148.0	2681.0	26	0.4	70.0
35	0.7	99.6	547.31	32839.0	3128.0	22	0.2	70.2
40	0.4	100.0	625.50	37530.0	3574.0	19	0.1	70.3
45	0.0	100.0	703.69	42221.0	4021.0	17	0.0	70.3
50	0.0	100.0	781.88	46913.0	4468.0	15	0.0	70.3
Estimated Net Annual Sediment (TSS) Load Reduction =								**70 %**

Climate Station ID: 6144478 *Years of Rainfall Data*: 20

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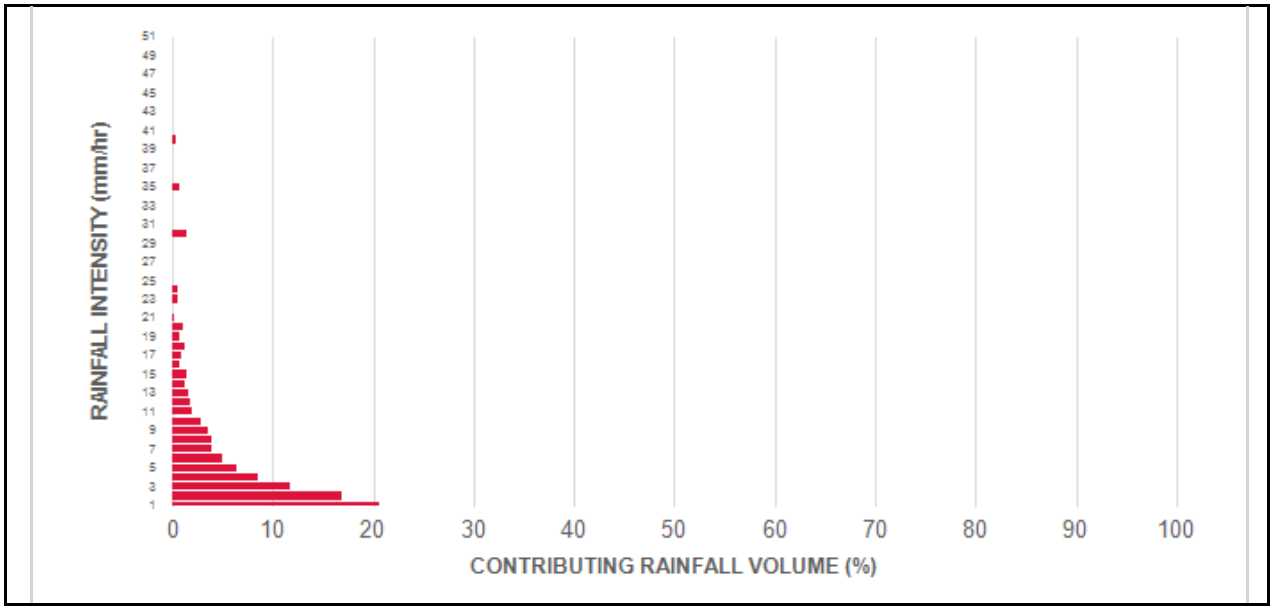
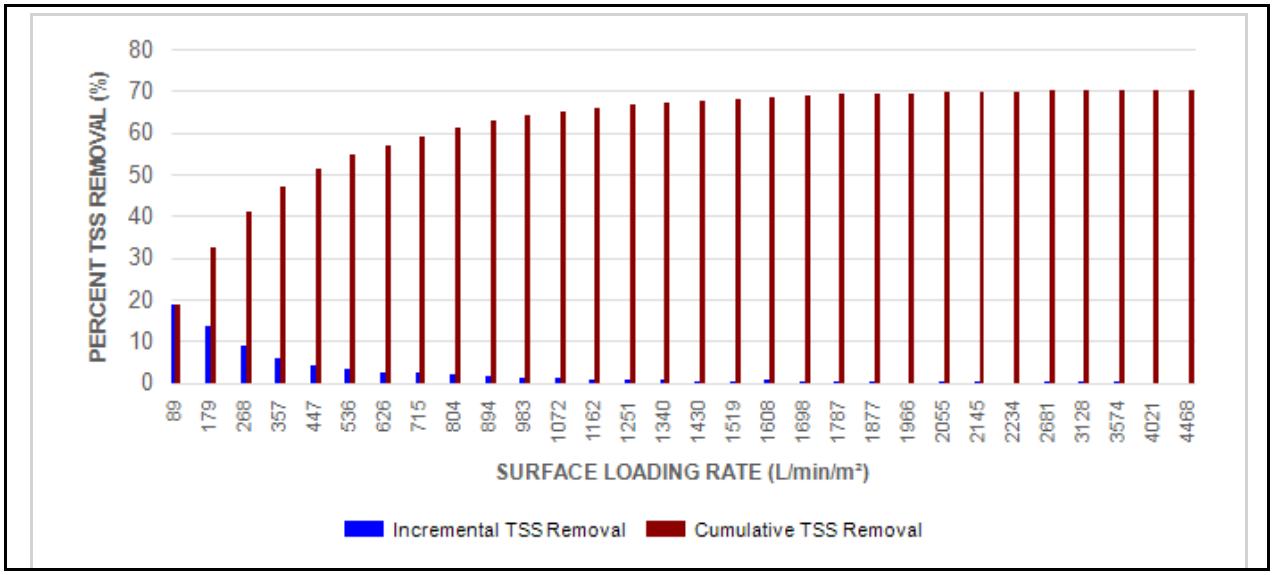
RAINFALL DATA FROM LONDON CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

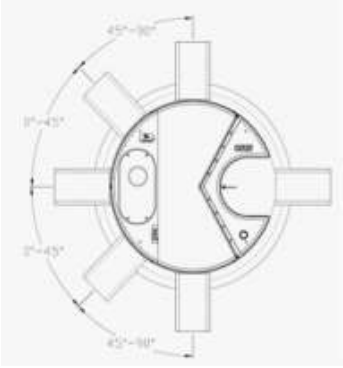
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

DESIGN FLEXIBILITY

►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

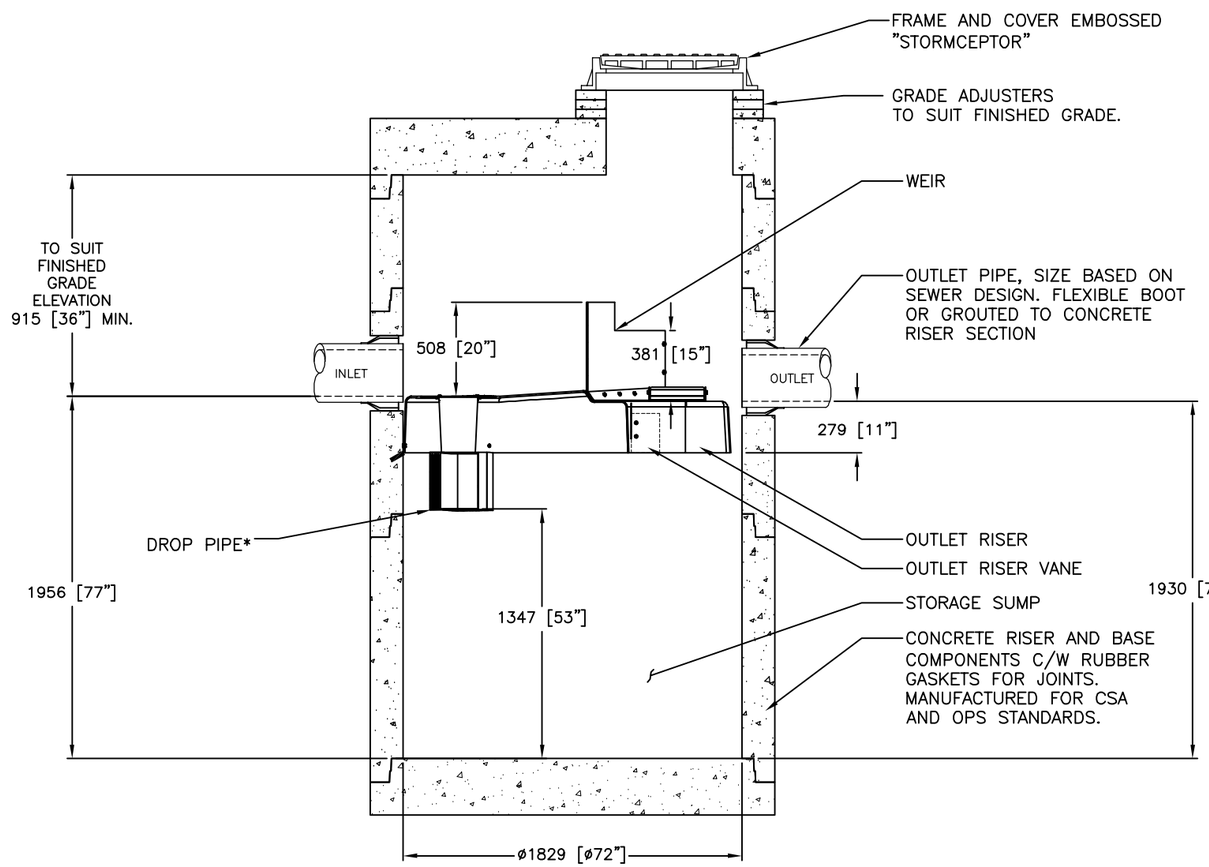
3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

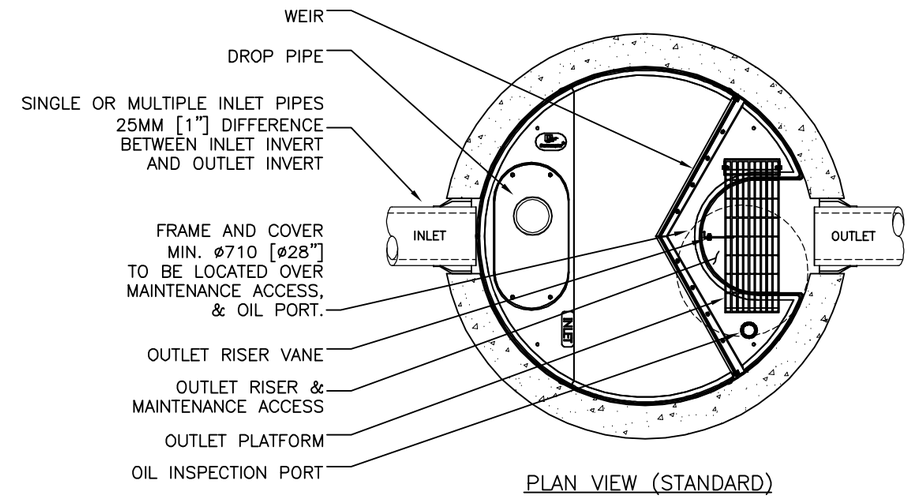
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

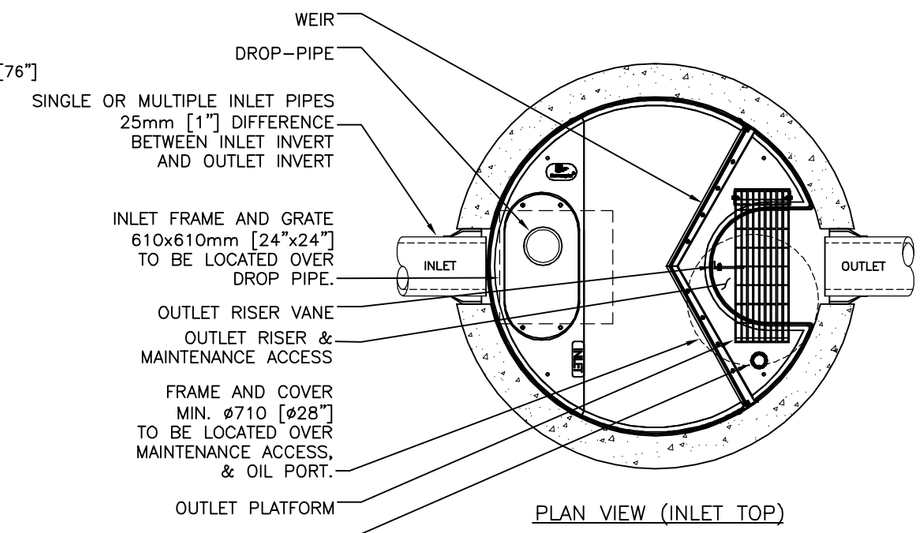
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF6 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO6 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

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B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF6				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	####
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####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	05/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

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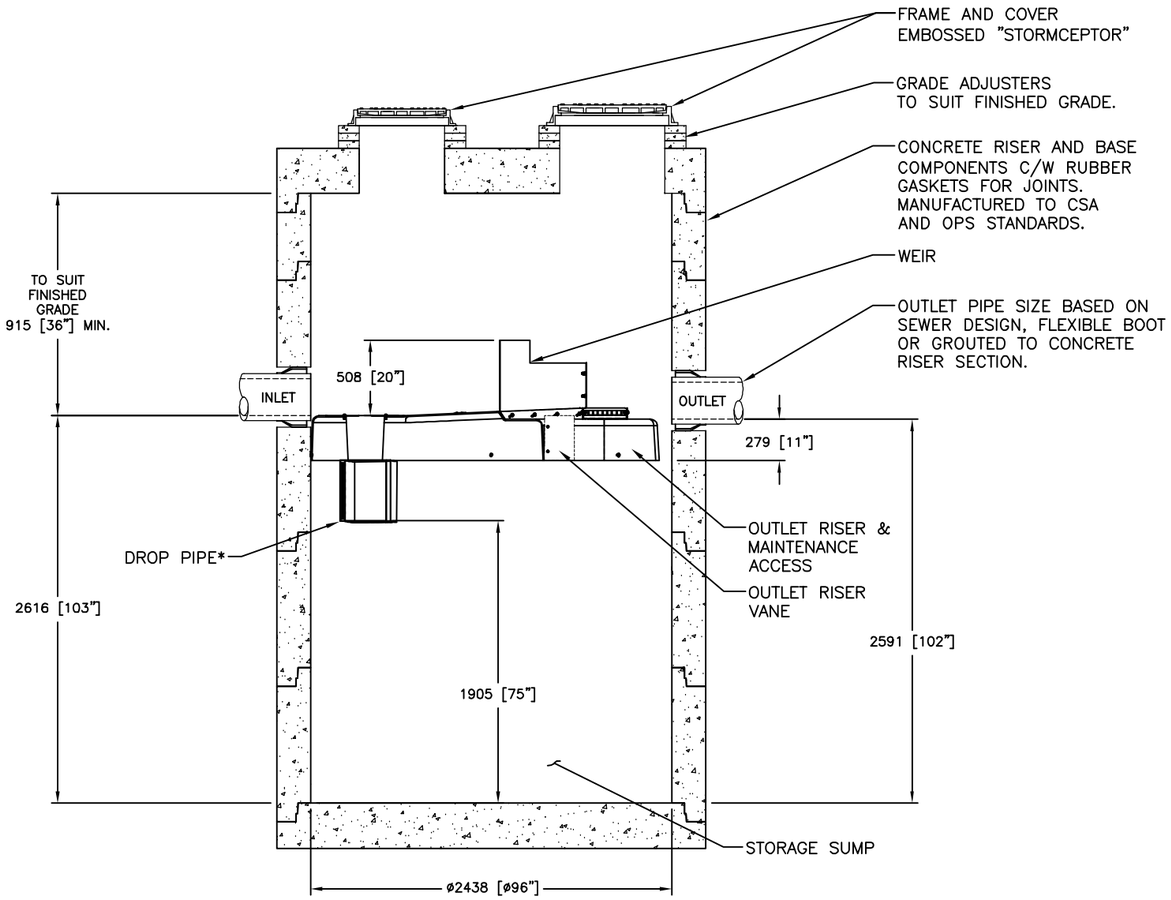
No. 2,280,744; 2,280,745; 2,280,746; 2,280,747; 2,280,748; 2,280,749 (Stormceptor®)
1 patent pending; 5 other pending. (Stormceptor®)
Other Patents: CA2,518,976; CA2,518,977; CA2,518,978; CA2,518,979; CA2,518,980 - CA2,518,981 (Stormceptor®)
Other Patents: CA2,546,147; CA2,546,148; CA2,546,149; CA2,546,150 - CA2,546,151 (Stormceptor®)

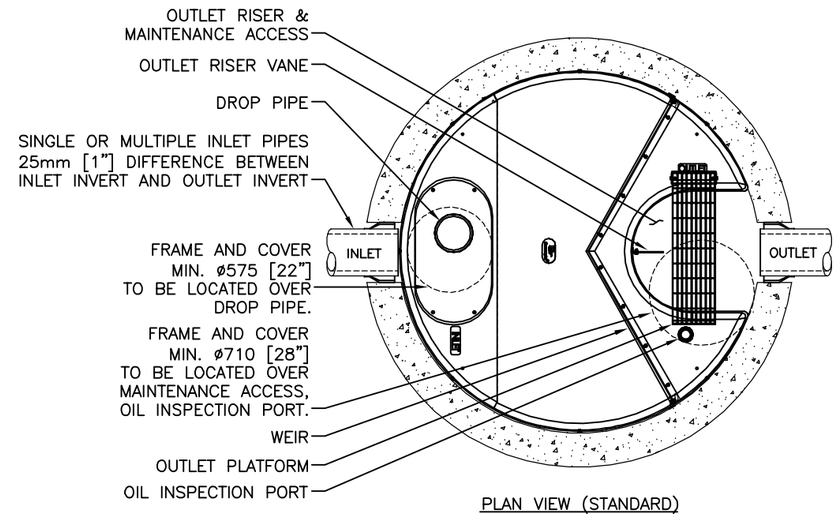
DATE: 5/26/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EF6	SEQUENCE No.: *
SHEET: 1 OF 1	

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EF6-DETAIL.DWG 4/12/2019 10:50 AM

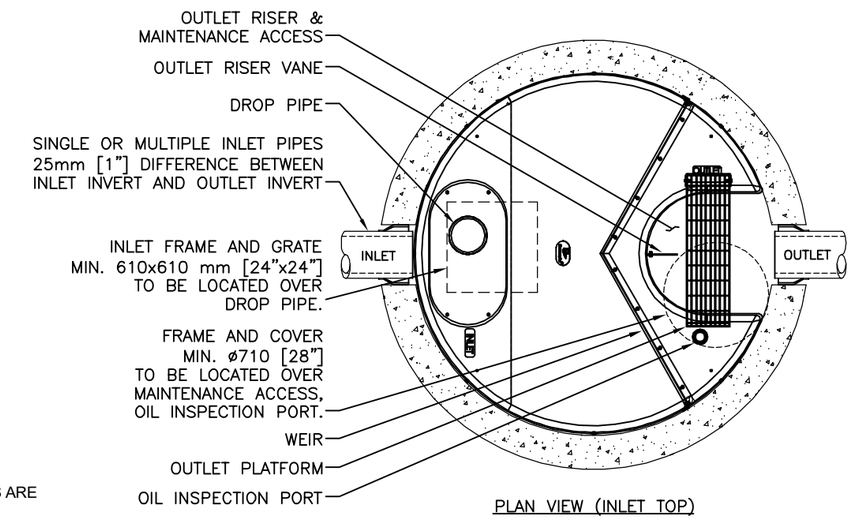
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
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INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
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E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF8				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
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####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
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TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

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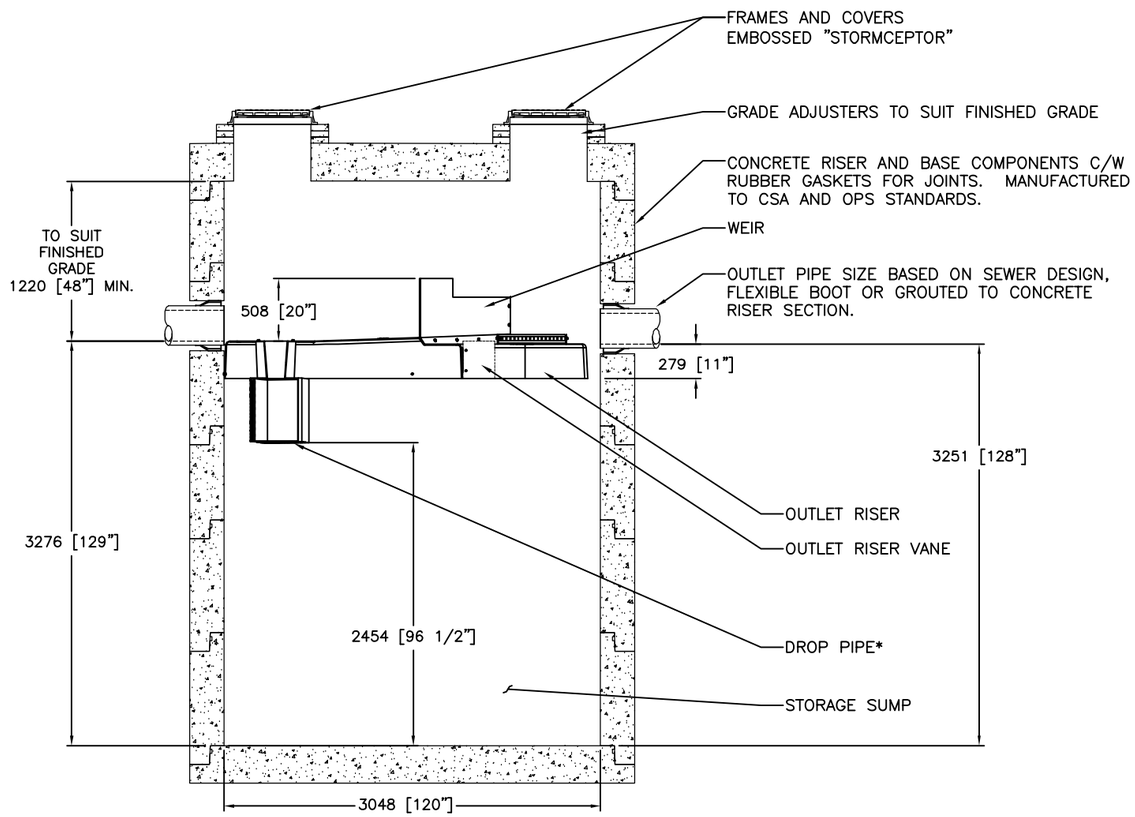
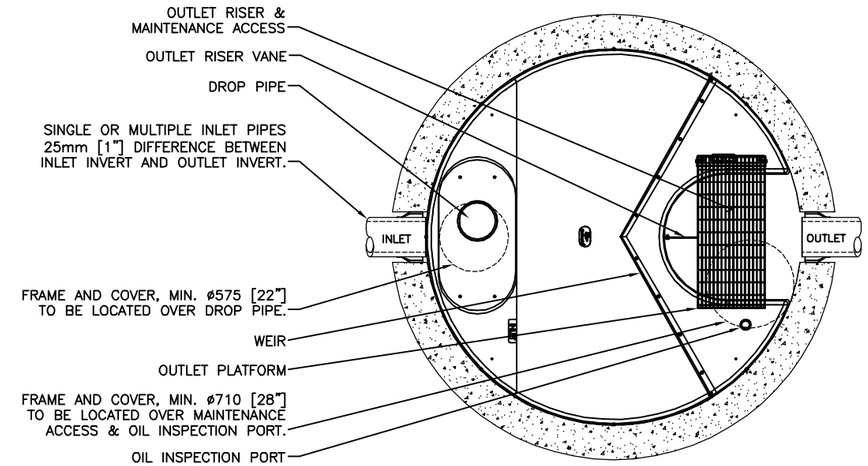
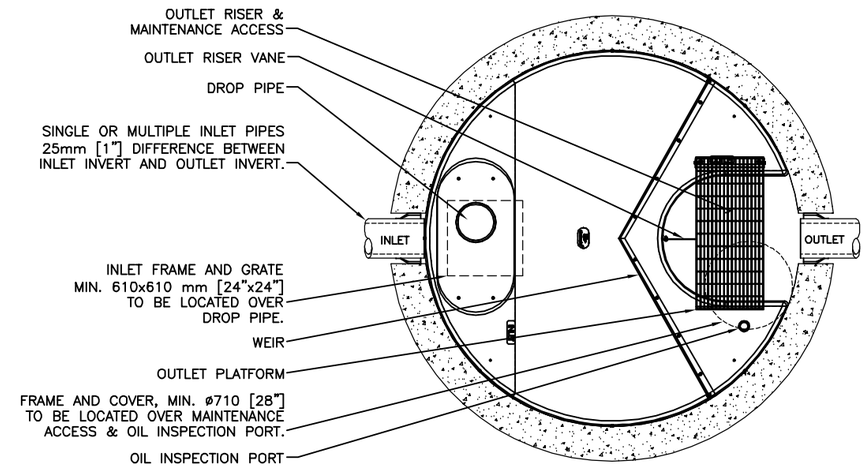
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF10 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO10 (OIL CAPTURE CONFIGURATION).

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STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO10				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

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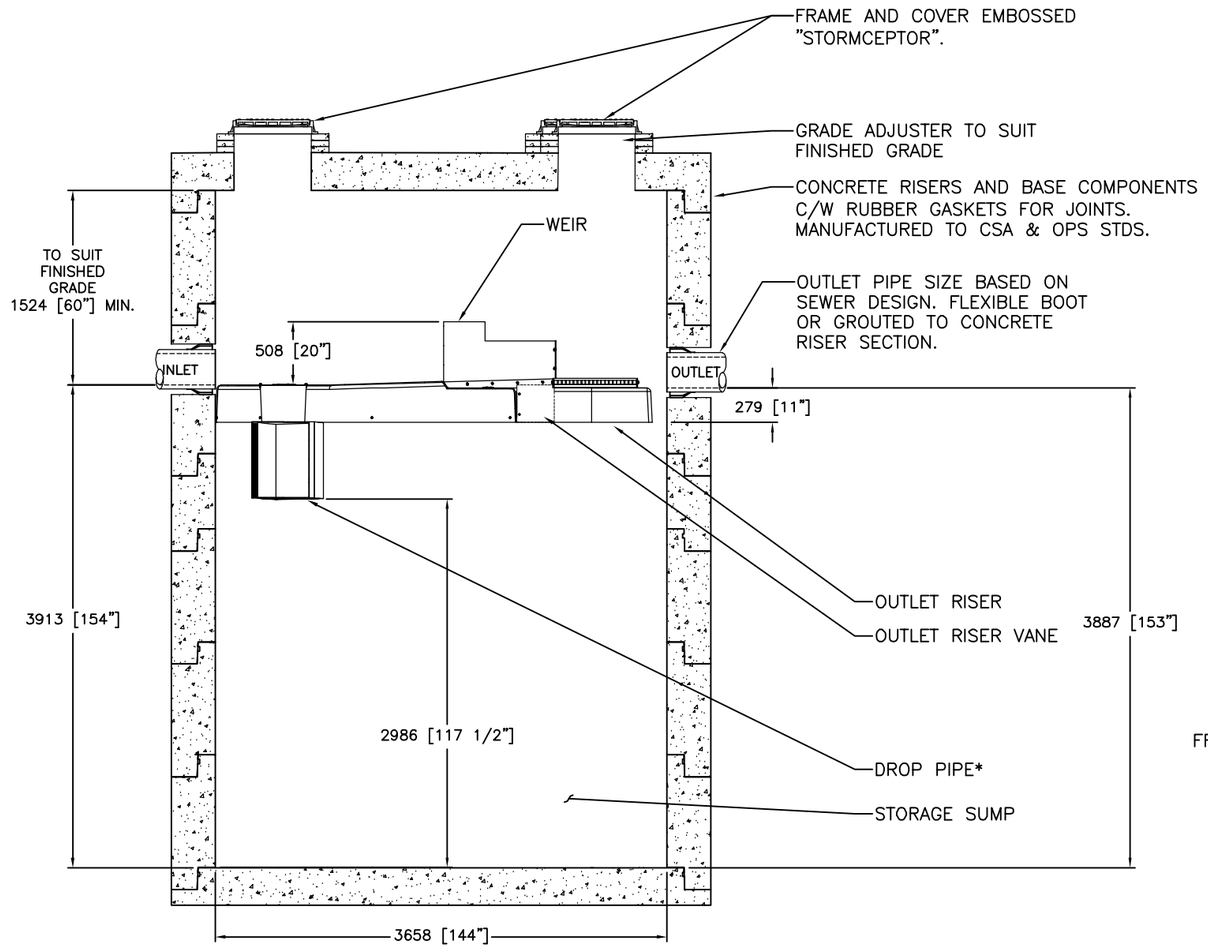
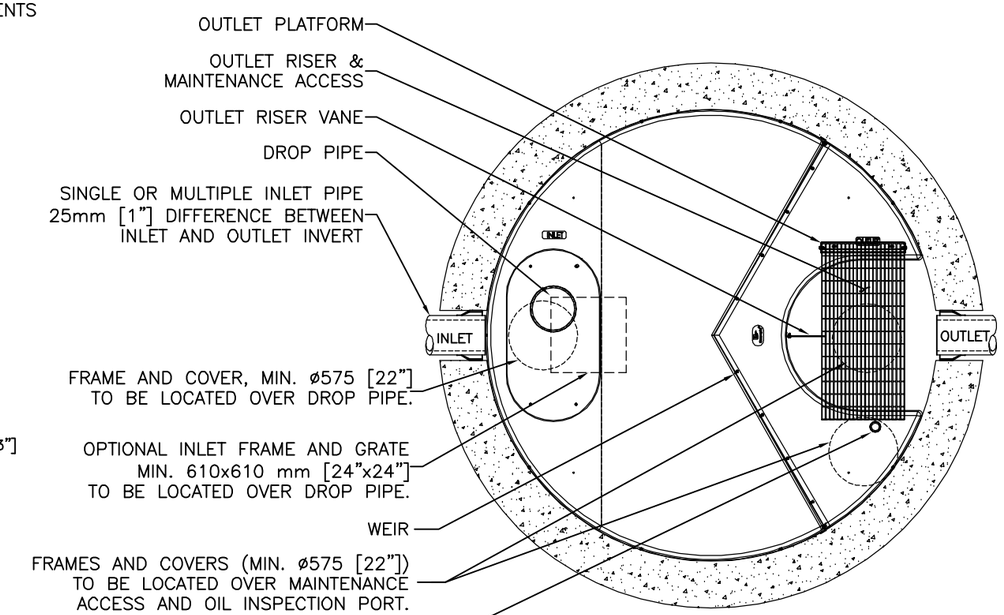
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF12 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO12 (OIL CAPTURE CONFIGURATION).

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STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO12				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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MARK	DATE	REVISION DESCRIPTION	BY
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####	####	####	####
####	####	####	####
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
7037 RIDGE ROAD, SUITE 350, HANOVER, MD 21076
USA 866-279-6628 CA 800-565-4601 INTL +1-410-683-880

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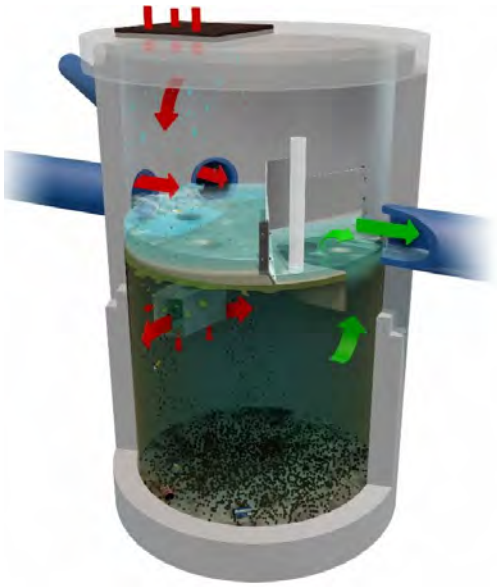
We’ve got you covered!

Forterra Stormceptor® Products now include a 5 year Quality Assurance Program.

Maintenance costs for Forterra’s industry leading line of Stormceptor® products are already much lower than competitive stormwater quality devices. Now we’ve sweetened the deal by introducing a new Quality Assurance Program that covers maintenance for up to 5 years.

Improving products, improving service.

We’ve recently expanded our already impressive line of Stormceptor® products with the addition of the Stormceptor® EF series – *simply the most cost competitive stormwater quality device on the market*. Now we’re improving our service by taking care of the maintenance on our entire Stormceptor product line for 5 years after installation.



At Forterra, we understand that maintaining a high standard of water quality is crucial to the environment and to our lives. That’s why, for the past 10 years, we’ve included a 2 year maintenance plan with every Stormceptor unit sold. As maintenance becomes more of a focus for many municipalities, we felt it was time to strengthen the program even further. We are now offering a complimentary 5 year maintenance program with every Stormceptor unit to ensure water quality continues to be at its best.

Stormceptor® Quality Assurance Program

Based on initial inspection results, there are two ways to ensure Stormceptor® performance:

First way *(5 years, no cleaning)*

- Six inspections over a 5 year period, with no cleaning required
- First inspection at 6 months, inspections every 12 months thereafter for 5 years
- Oil and sediment levels are documented along with maintenance recommendations, if necessary

Second way *(2.5 years, with cleaning)*

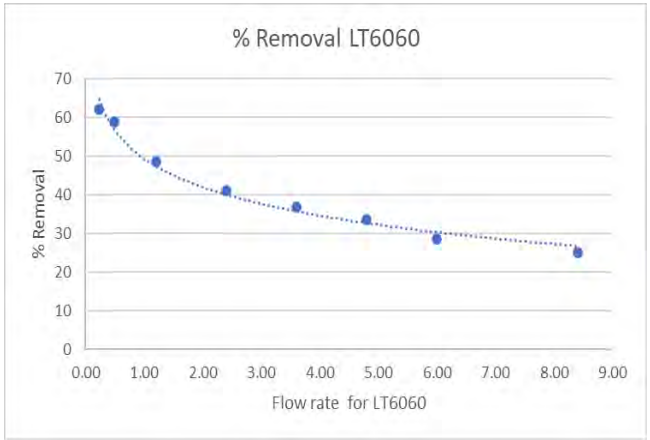
- Initial inspection and one post construction sediment cleaning at 6 months
- Two additional annual inspections, resulting in the unit being maintained for the first 30 months (2.5 years)

We’re taking care of your maintenance needs so you can focus on your next project. Trust Forterra to help you weather the storm.

Stormceptor®

FORTERRA

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5



Enviropod- LittaTrap Annual TSS Removal Rates

Catchment Parameters	Value
Assessment Method	**25 mm 4 hr**
Storm Depth (mm) For Events*	**25**
Catchment Area (ha)	**0.12**
Runoff Coefficient	**0.9**

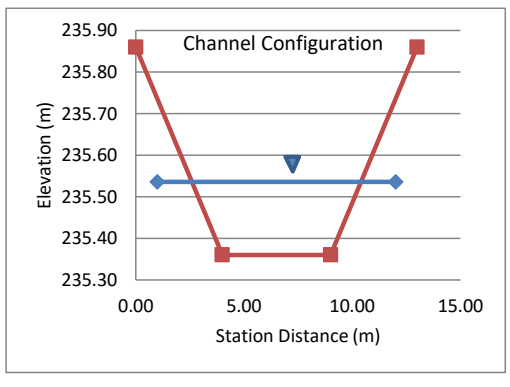
Results	Value
Average Flow Rate (L/min)	**112.7**
Average Surface Loading Rate (L/min/m^2)	**313**
Average Removal Rate (%)	**50%**

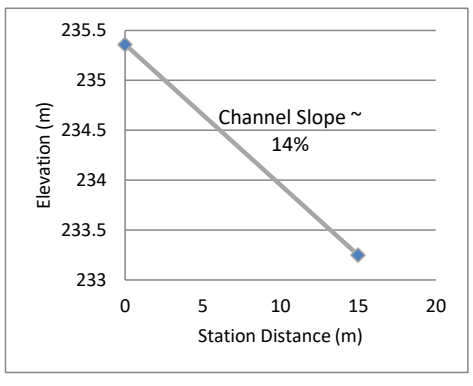
Assumptions and limitations of the tool
*The Storm Depth parameter only applies to the SCS Rainfall Event assessment methods
· Assumes the Littatrap is installed correctly in a standard 600 mm x 600 mm catchbasin
· Assumes an event-mean TSS concrentration which is congruent with influent concentrations applied during ETV testing
· Assumes a particle size distribution congruent with the distributions used during ETV testing
· Not suitable for catchment areas too large for the Rational Method to apply
· Does not account for snowfall or snowmelt
· For preliminary assessment purposes only

Summary of Channel Capacity for storm sewer outlet / drainage ditch to the Philip Aziz Ave 0+055 Outlet Option 1 near Western University

Description	Trapezoidal Channel Configuration			
	Bottom width (m)	Side slope	Side slope factor	Manning Roughness
Philip Aziz Ave 0+055 Outlet Option 1	5.00	8.0	8.0	0.04

Slope = 14.1%										
Description	Event	Discharge (m^3/s)	Trapezoidal Channel Findings							
			Computed Discharge (m^3/s)	Depth (m)	Channel Area (m^2)	Wetted Perimeter P (m)	Hydraulic Radius (m)	Channel Slope (m/m)	Velocity (m/s)
Philip Aziz Ave 0+055 Outlet Option 1	**5-yr**	2.90	2.90	0.18	1.13	7.84	0.14	0.141	2.57





From Equation 10.4

TW depth =	0.18	m
TW =	0.4D	
Culvert Dia =	1.2	m
Discharge =	2.90	m^3/s
Gravity	9.81	m/s^2
D_{50} =	250	mm
$D_{50\ max}$ =	375	mm

Channel configuration

Station (m)	Elev (m)
0.00	235.86
4.00	235.36
9.00	235.36
13.00	235.86

From MTO Scour Protection (Figure 7)

Channel V =	2.6	m/s	Pipe Exit V =	2.8 m/s
1.5 times V =	3.9	m/s	1.5 times V =	4.2 m/s
D_{50} =	550	mm	D_{50} =	600 mm
$D_{50\ max}$ =	825	mm	$D_{50\ max}$ =	900 mm

From Table 10.1 using D_{50} from MTO method

Apron Length =	10.0	m
Apron Depth =	1.1	m

RIPRAP APRON

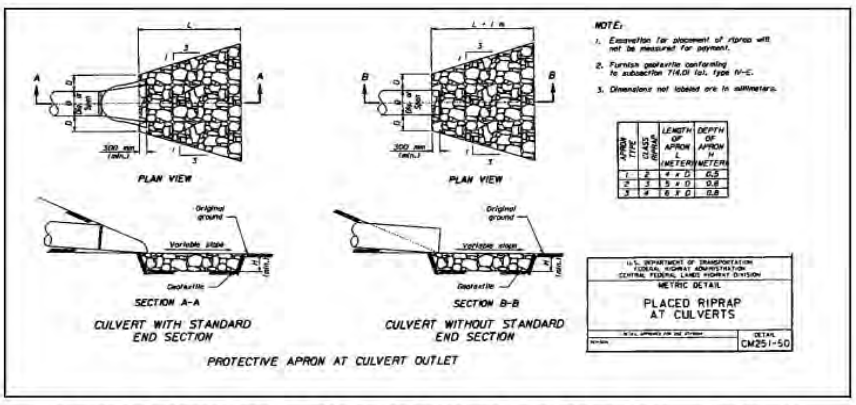


Figure 10.4. Placed Riprap at Culverts (Central Federal Lands Highway Division)

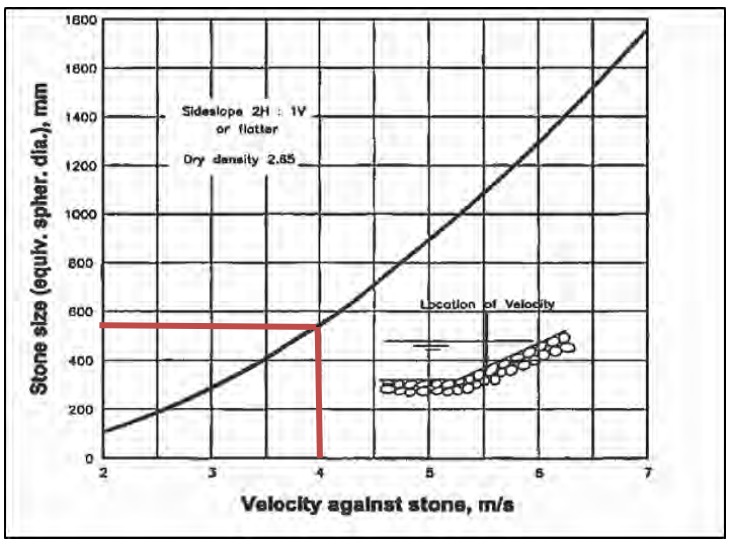


Figure 7 from Scour Protection Transportation Association of Canada's Guide to Bridge Hydraulics (June 2001)

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{gD^{2.5}}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

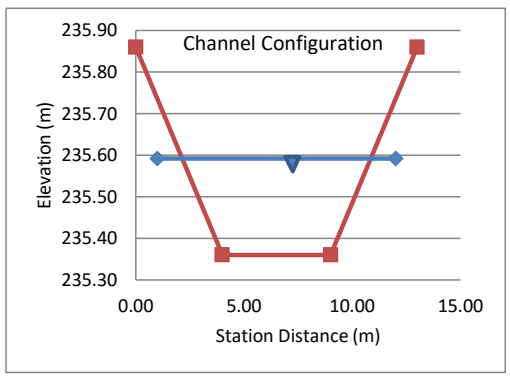
[1]D is the culvert rise.

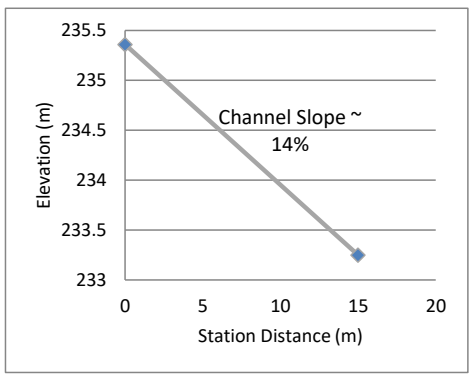
Source: Federal Highway Administration - Hydraulic Engineering Circular No. 14, Third Edition

Summary of Channel Capacity for storm sewer outlet / drainage ditch to the Philip Aziz Ave 0+055 Outlet Option 2 near Western University

Description	Trapezoidal Channel Configuration			
	Bottom width (m)	Side slope	Side slope factor	Manning Roughness
Philip Aziz Ave 0+055 Outlet Option 2	5.00	8.0	8.0	0.04

Slope = 14.1%										
Description	Event	Discharge (m^3/s)	Trapezoidal Channel Findings							
			Computed Discharge (m^3/s)	Depth (m)	Channel Area (m^2)	Wetted Perimeter P (m)	Hydraulic Radius (m)	Channel Slope (m/m)	Velocity (m/s)
Philip Aziz Ave 0+055 Outlet Option 2	**5-yr**	4.79	4.79	0.23	1.59	8.74	0.18	0.141	3.01





From Equation 10.4

TW depth =	0.23	m
TW =	0.4D	
Culvert Dia =	1.45	m
Discharge =	4.79	m^3/s
Gravity	9.81	m/s^2
D_{50} =	250	mm
$D_{50\ max}$ =	375	mm

Channel configuration

Station (m)	Elev (m)
0.00	235.86
4.00	235.36
9.00	235.36
13.00	235.86

From MTO Scour Protection (Figure 7)

Channel V =	3.0	m/s	Pipe Exit V =	3.0 m/s
1.5 times V =	4.6	m/s	1.5 times V =	4.5 m/s
D_{50} =	750	mm	D_{50} =	700 mm
$D_{50\ max}$ =	1125	mm	$D_{50\ max}$ =	1050 mm

From Table 10.1 using D_{50} from MTO method

Apron Length =	11.6	m
Apron Depth =	1.5	m

RIPRAP APRON

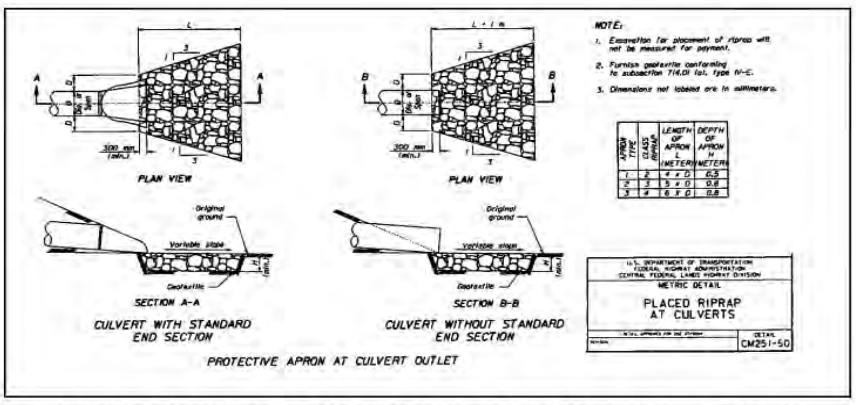


Figure 10.4. Placed Riprap at Culverts (Central Federal Lands Highway Division)

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

D_{50} = riprap size, m (ft)
Q = design discharge, m^3/s (ft^3/s)
D = culvert diameter (circular), m (ft)
TW = tailwater depth, m (ft)
g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

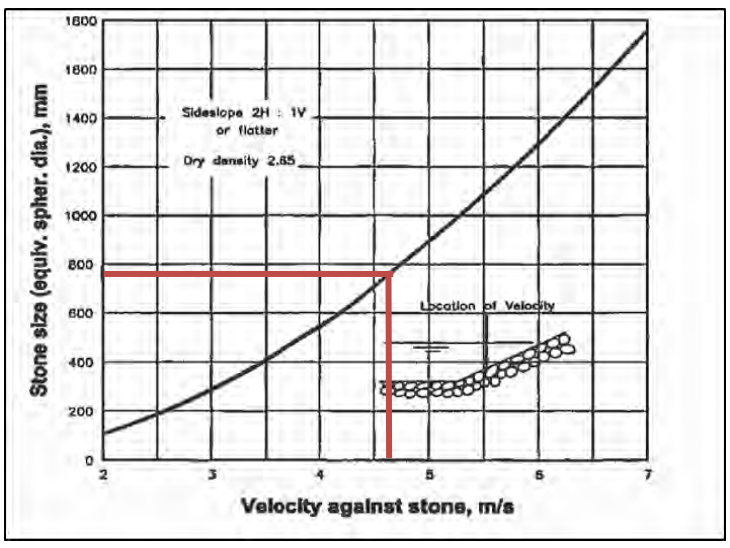


Figure 7 from Scour Protection Transportation Association of Canada's Guide to Bridge Hydraulics (June 2001)

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

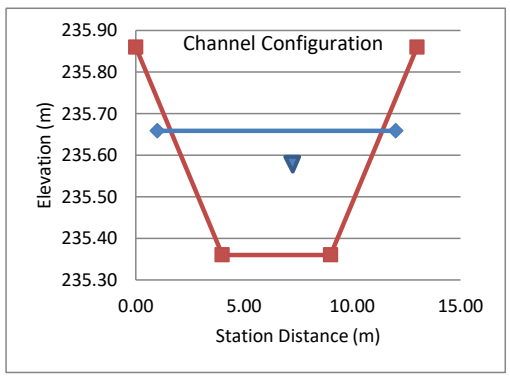
[1]D is the culvert rise.

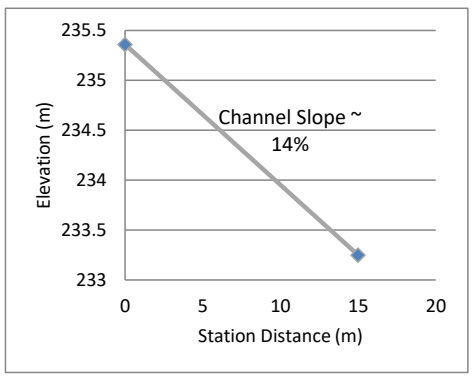
Source: Federal Highway Administration - Hydraulic Engineering Circular No. 14, Third Edition

Summary of Channel Capacity for storm sewer outlet / drainage ditch to the Philip Aziz Ave 0+055 Outlet Option 3 near Western University

Description	Trapezoidal Channel Configuration			
	Bottom width (m)	Side slope	Side slope factor	Manning Roughness
Philip Aziz Ave 0+055 Outlet Option 2	5.00	8.0	8.0	0.04

Slope = 14.1%										
Description	Event	Discharge (m^3/s)	Trapezoidal Channel Findings							
			Computed Discharge (m^3/s)	Depth (m)	Channel Area (m^2)	Wetted Perimeter P (m)	Hydraulic Radius (m)	Channel Slope (m/m)	Velocity (m/s)
Philip Aziz Ave 0+055 Outlet Option 2	**5-yr**	7.65	7.65	0.30	2.21	9.82	0.22	0.141	3.47





From Equation 10.4

TW depth =	0.30	m
TW =	0.4D	
Culvert Dia =	1.7	m
Discharge =	7.65	m^3/s
Gravity	9.81	m/s^2
D_{50} =	250	mm
$D_{50\ max}$ =	375	mm

Channel configuration

Station (m)	Elev (m)
0.00	235.86
4.00	235.36
9.00	235.36
13.00	235.86

From MTO Scour Protection (Figure 7)

Channel V =	3.5	m/s	Pipe Exit V =	3.0 m/s
1.5 times V =	5.3	m/s	1.5 times V =	4.5 m/s
D_{50} =	1050	mm	D_{50} =	700 mm
$D_{50\ max}$ =	1575	mm	$D_{50\ max}$ =	1050 mm

From Table 10.1 using D_{50} from MTO method

Apron Length =	13.6	m
Apron Depth =	2.1	m

RIPRAP APRON

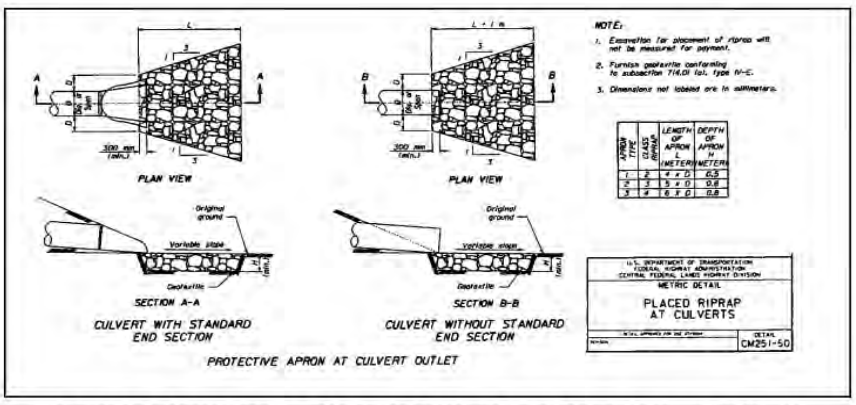


Figure 10.4. Placed Riprap at Culverts (Central Federal Lands Highway Division)

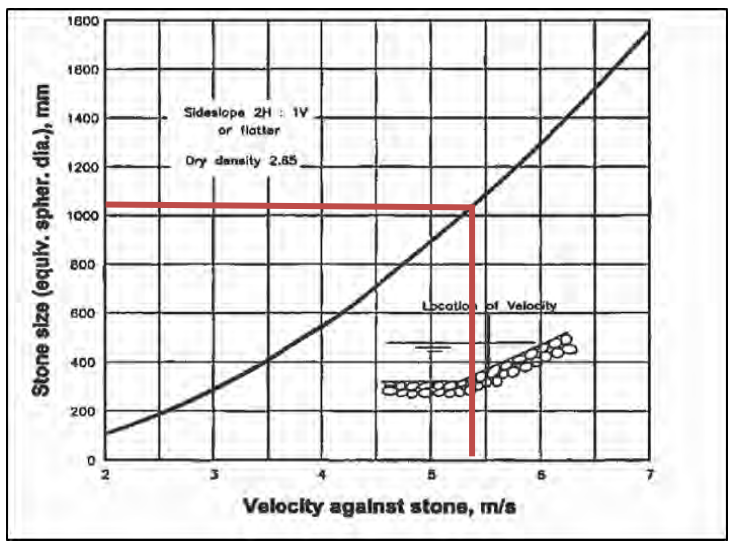


Figure 7 from Scour Protection Transportation Association of Canada's Guide to Bridge Hydraulics (June 2001)

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

Table 10.1. Example Riprap Classes and Apron Dimensions

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Source: Federal Highway Administration - Hydraulic Engineering Circular No. 14, Third Edition

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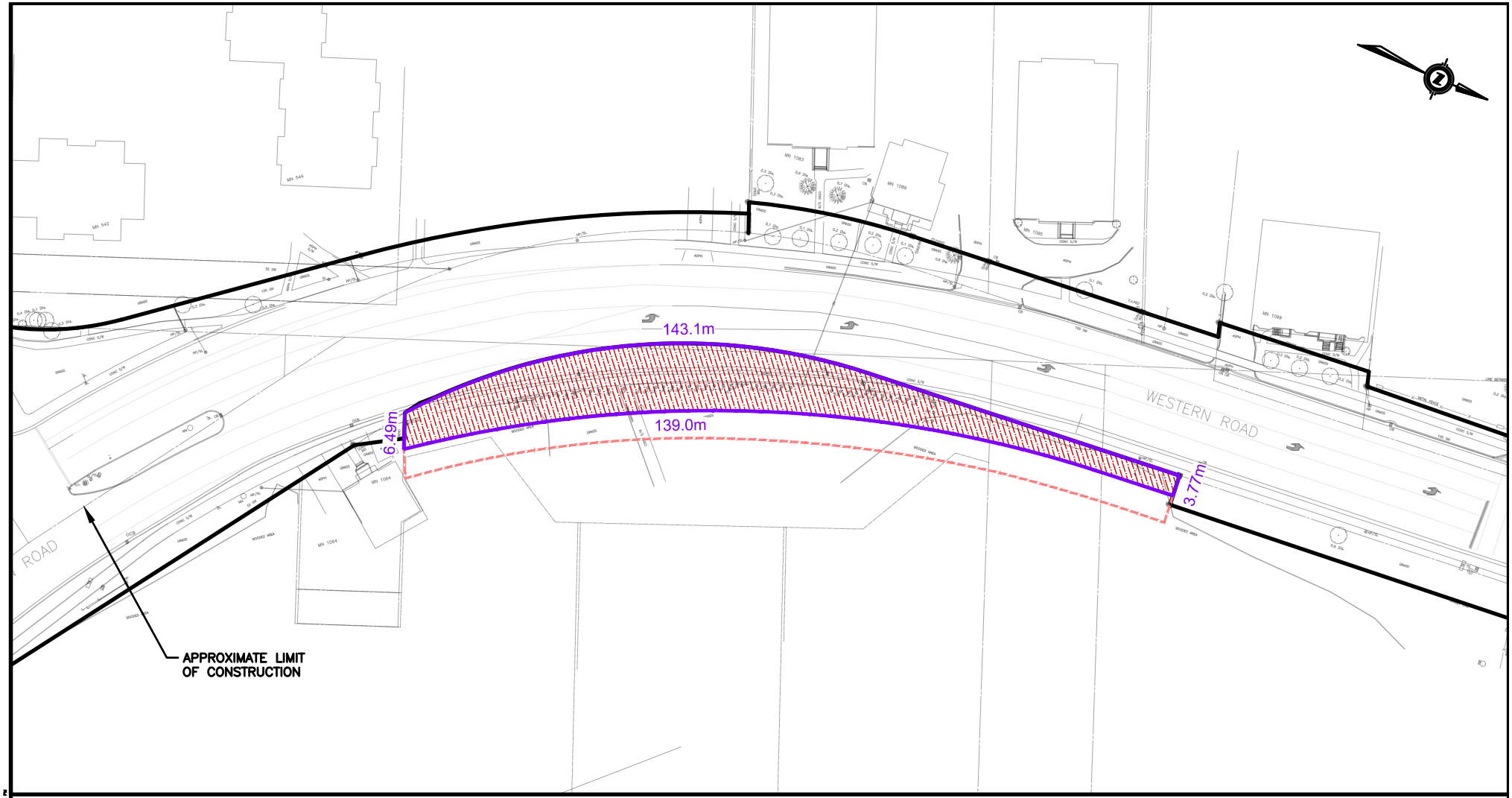
Appendix C

C.1 Preliminary Property Requirements



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London
CANADA

AECOM

WESTERN ROAD

WESTERN ROAD
IMPROVEMENTS

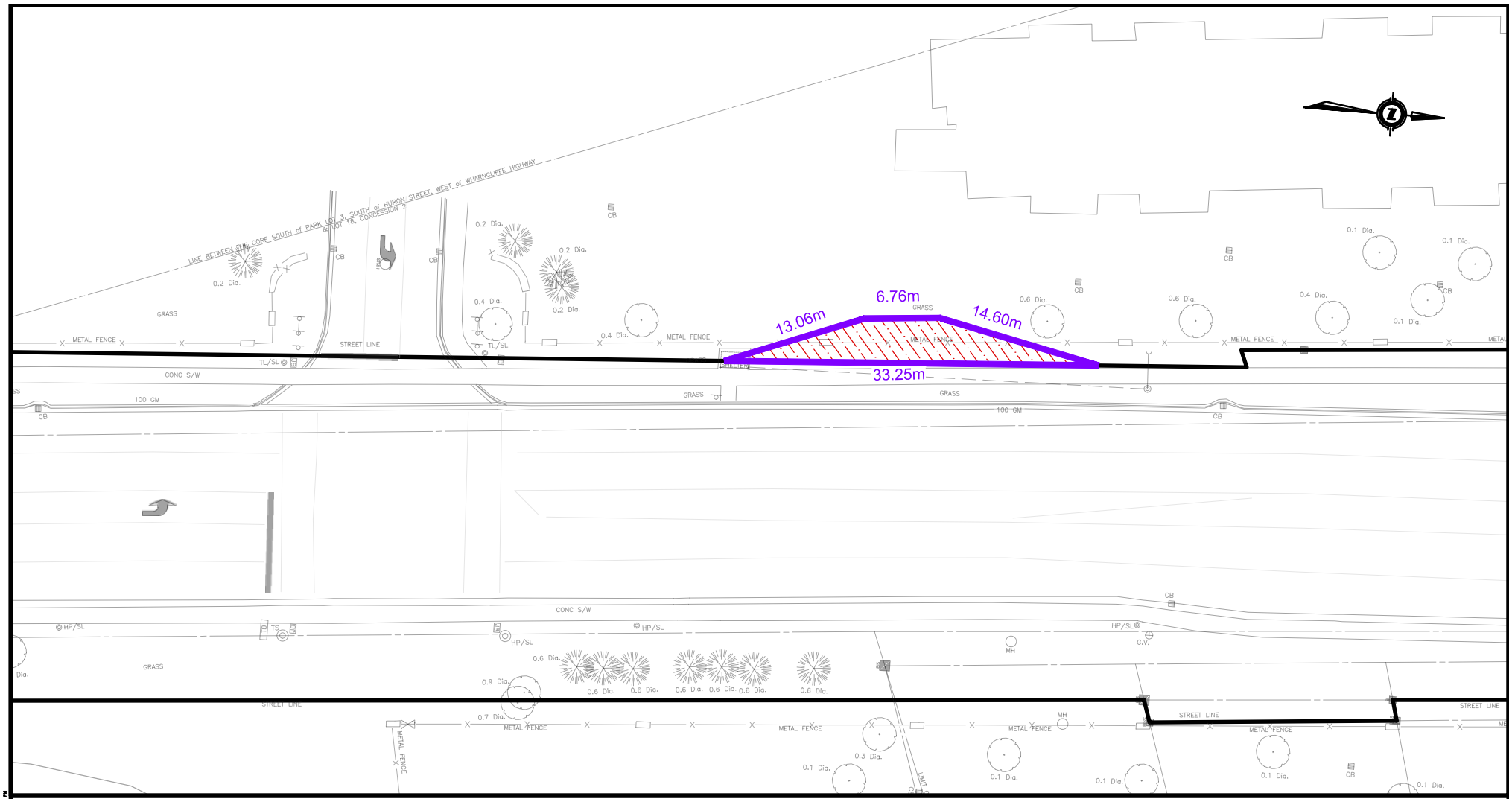
Permanent Property Impact Area:
1149.042m² 0.114ha 0.282acres

Temporary Construction Easement:
689.677m² 0.069ha 0.170acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1125

WESTERN ROAD IMPROVEMENTS

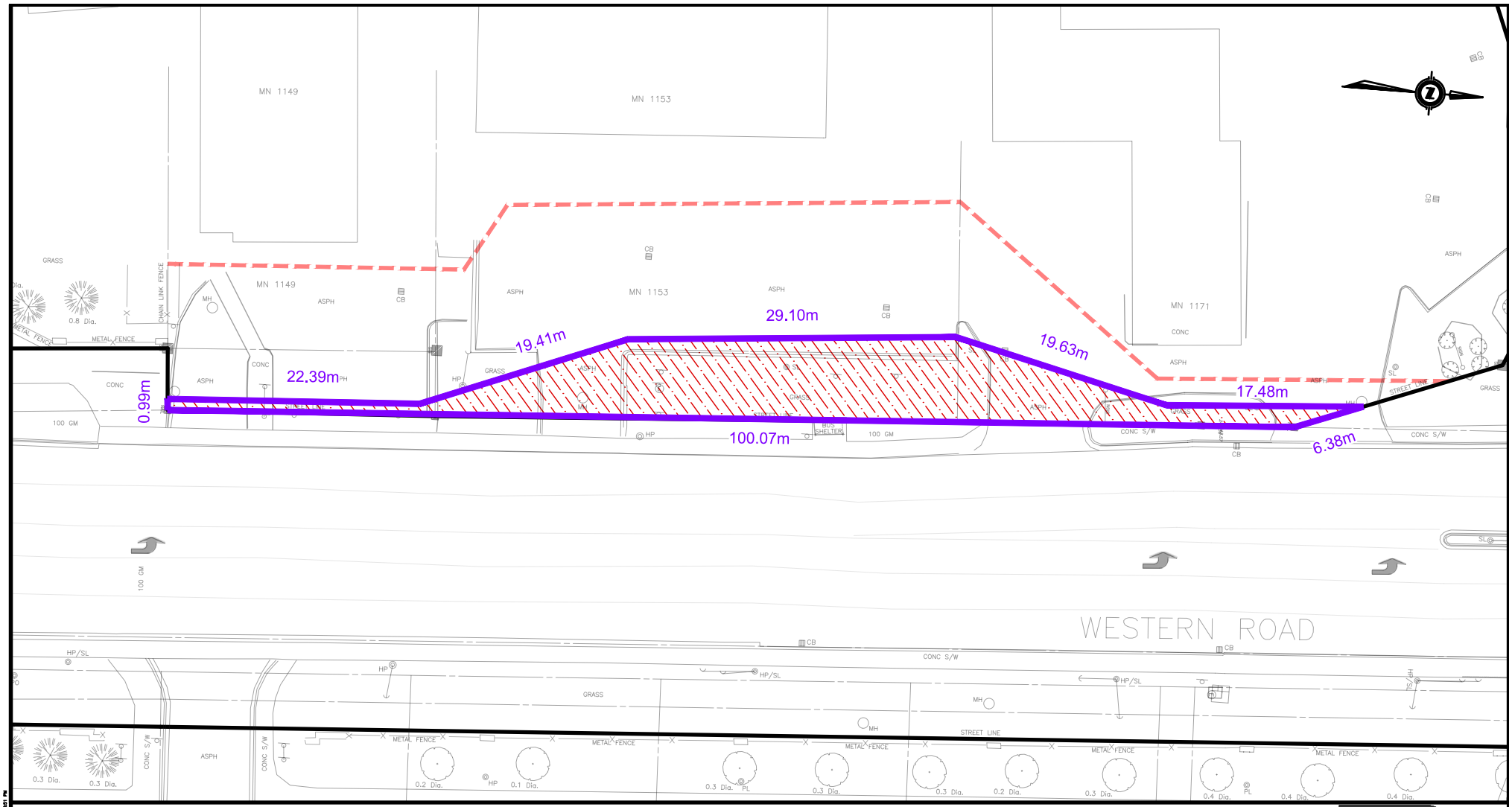
Permanent Property Impact Area:
79.488m² 0.008ha 0.020acres

Temporary Construction Easement:
0.000m² 0.000ha 0.000acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1149 / 1153 / 1171

WESTERN ROAD IMPROVEMENTS

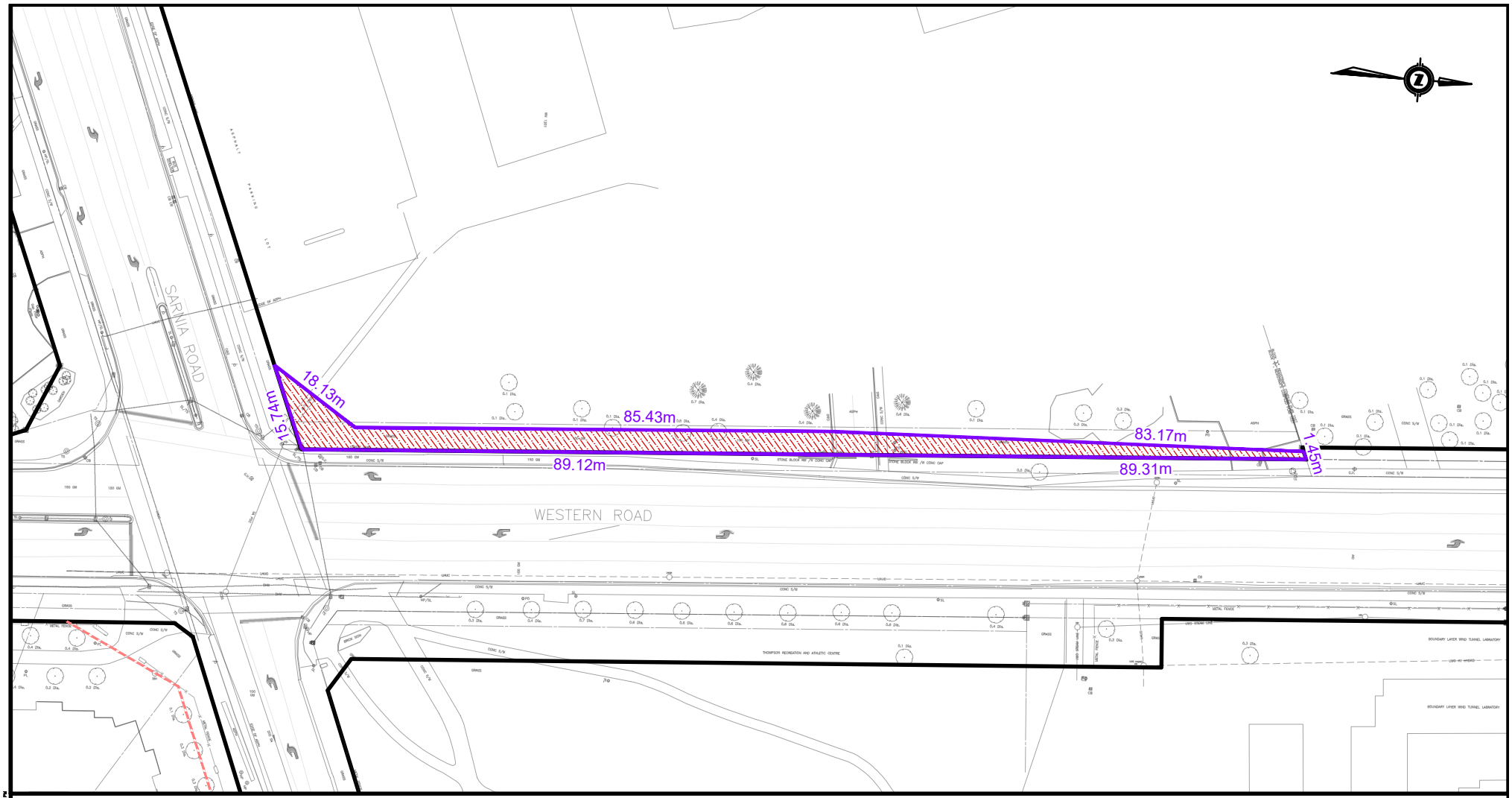
Permanent Property Impact Area:
424.878m² 0.042ha 0.105acres

Temporary Construction Easement:
1039.536m² 0.104ha 0.257acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1201

WESTERN ROAD IMPROVEMENTS

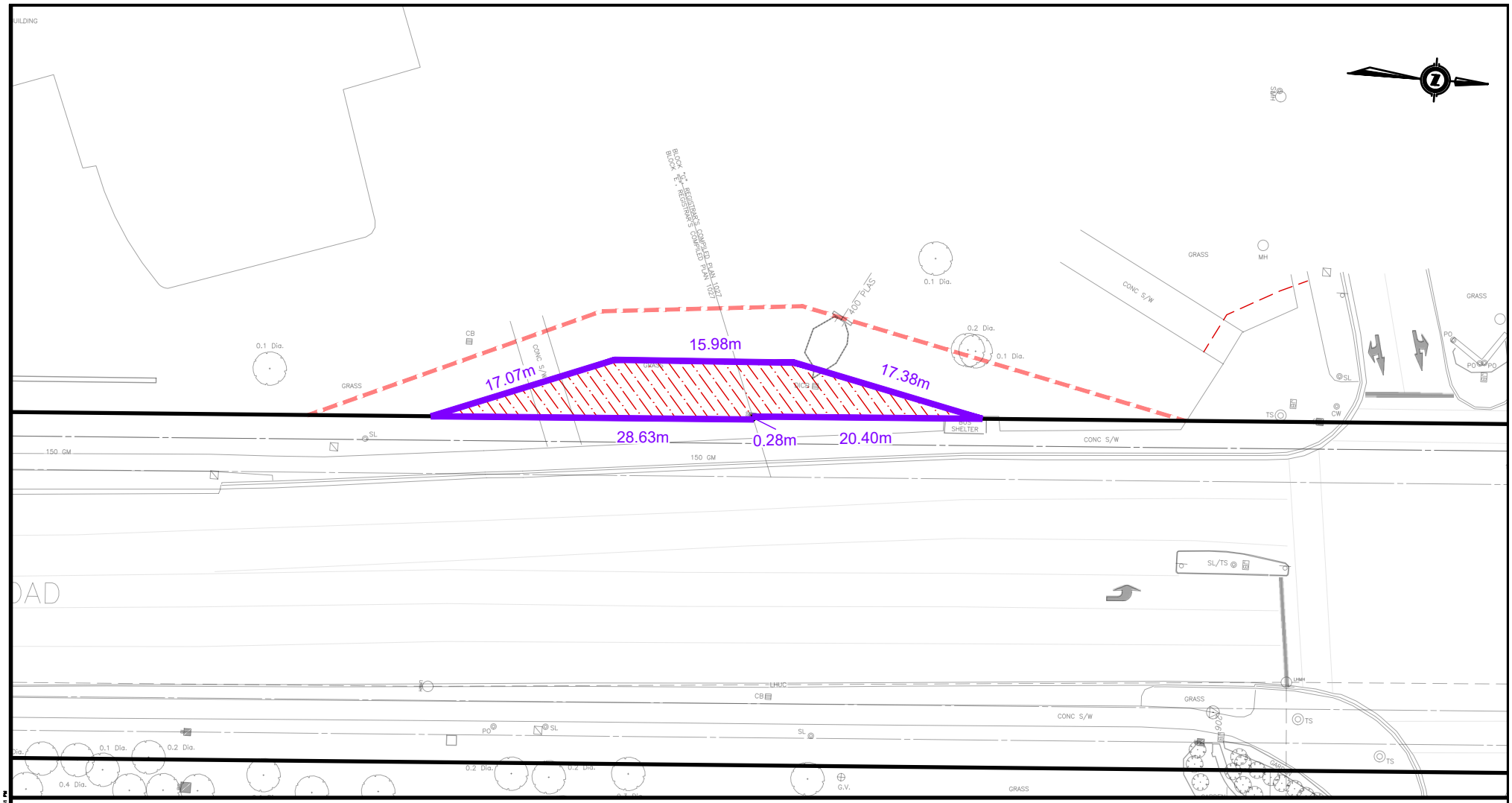
Permanent Property Impact Area:
671.866m² 0.067ha 0.166acres

Temporary Construction Easement:
0.000m² 0.000ha 0.000acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1285 / 1255

Permanent Property Impact Area:
163.253m² 0.016ha 0.040acres

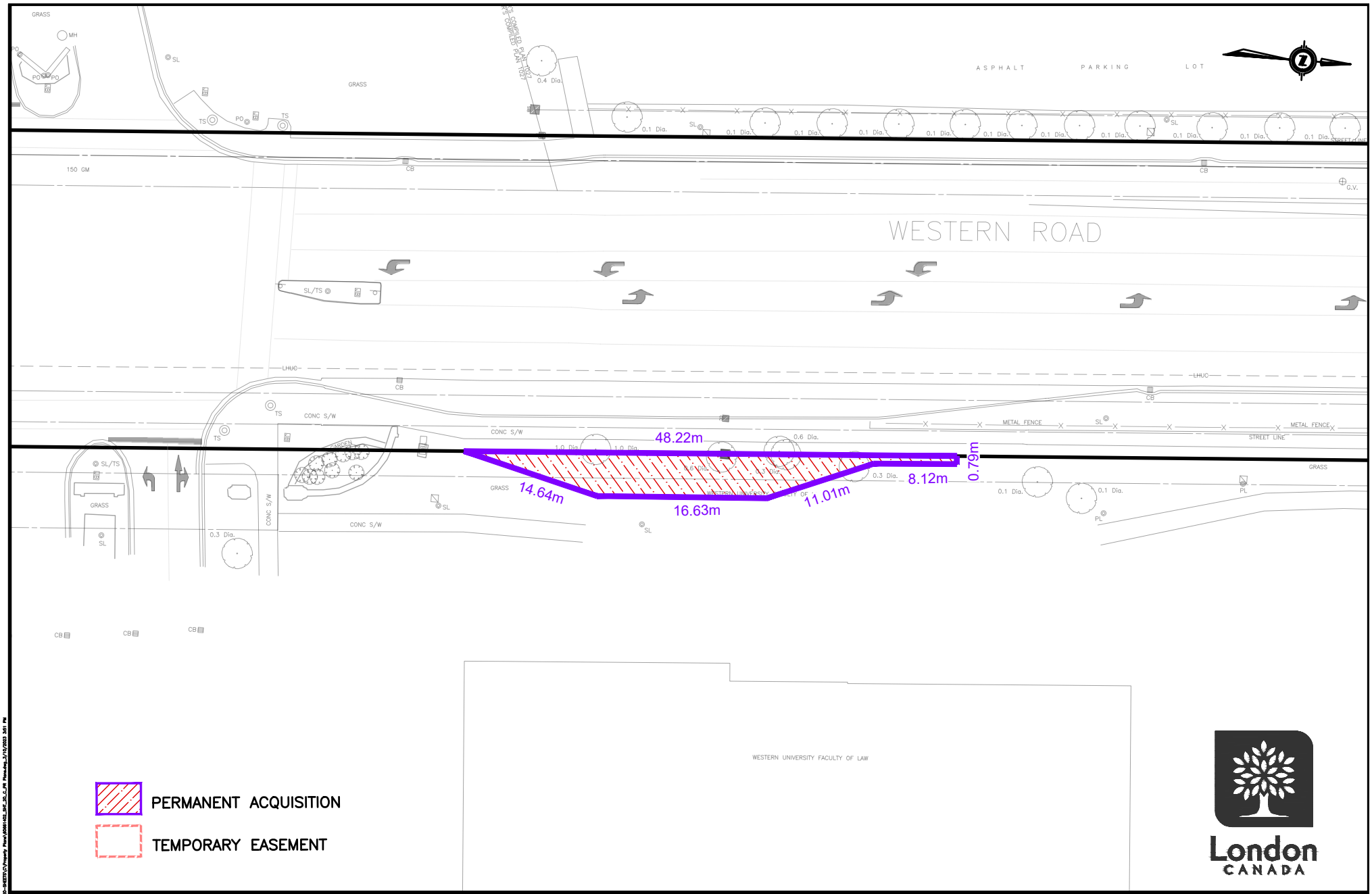
Temporary Construction Easement:
324.360m² 0.032ha 0.080acres

WESTERN ROAD IMPROVEMENTS

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1400

WESTERN ROAD IMPROVEMENTS

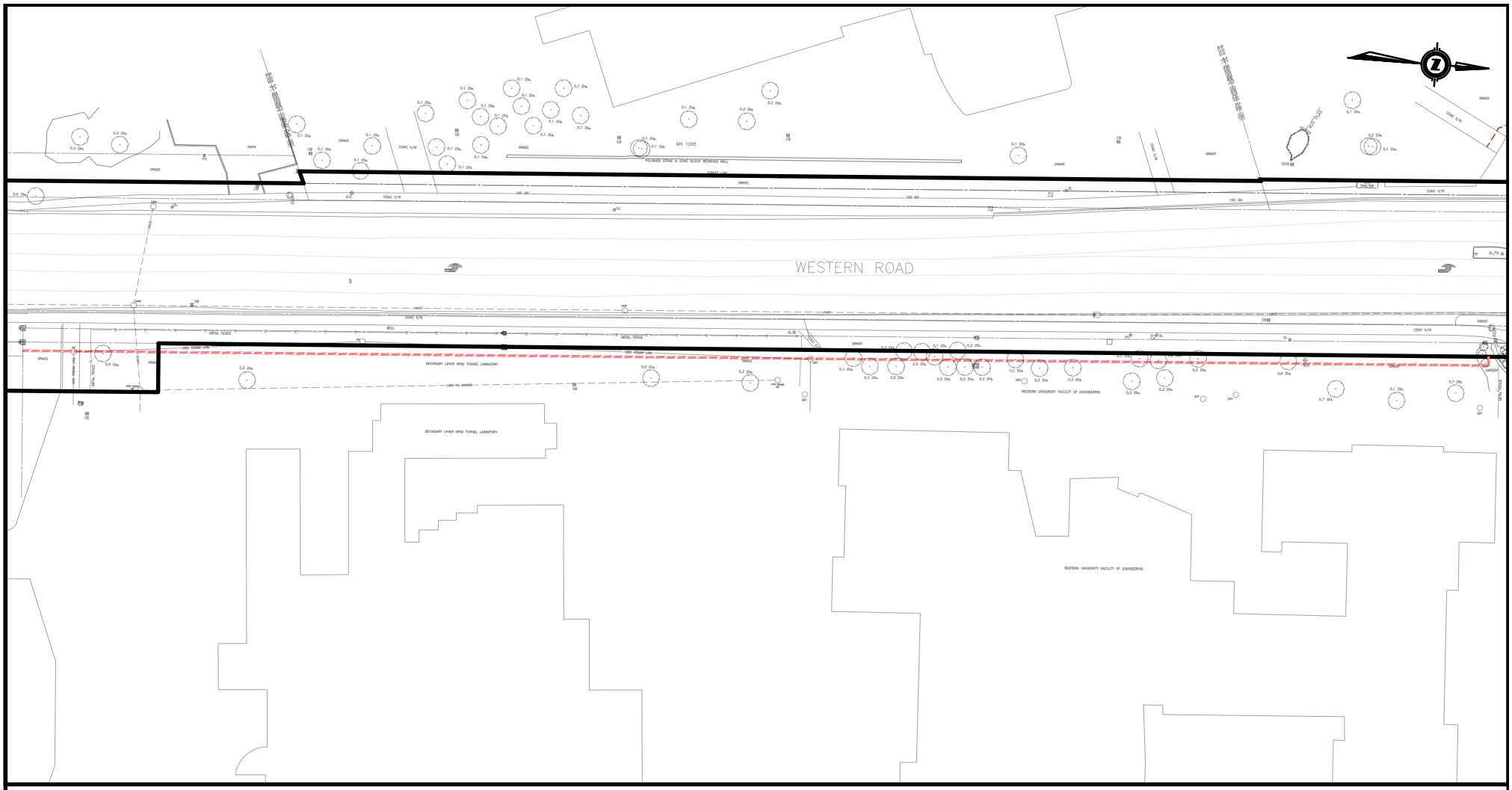
Permanent Property Impact Area:
132.314m² 0.013ha 0.033acres

Temporary Construction Easement:
0.000m² 0.000ha 0.000acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1400

WESTERN ROAD IMPROVEMENTS

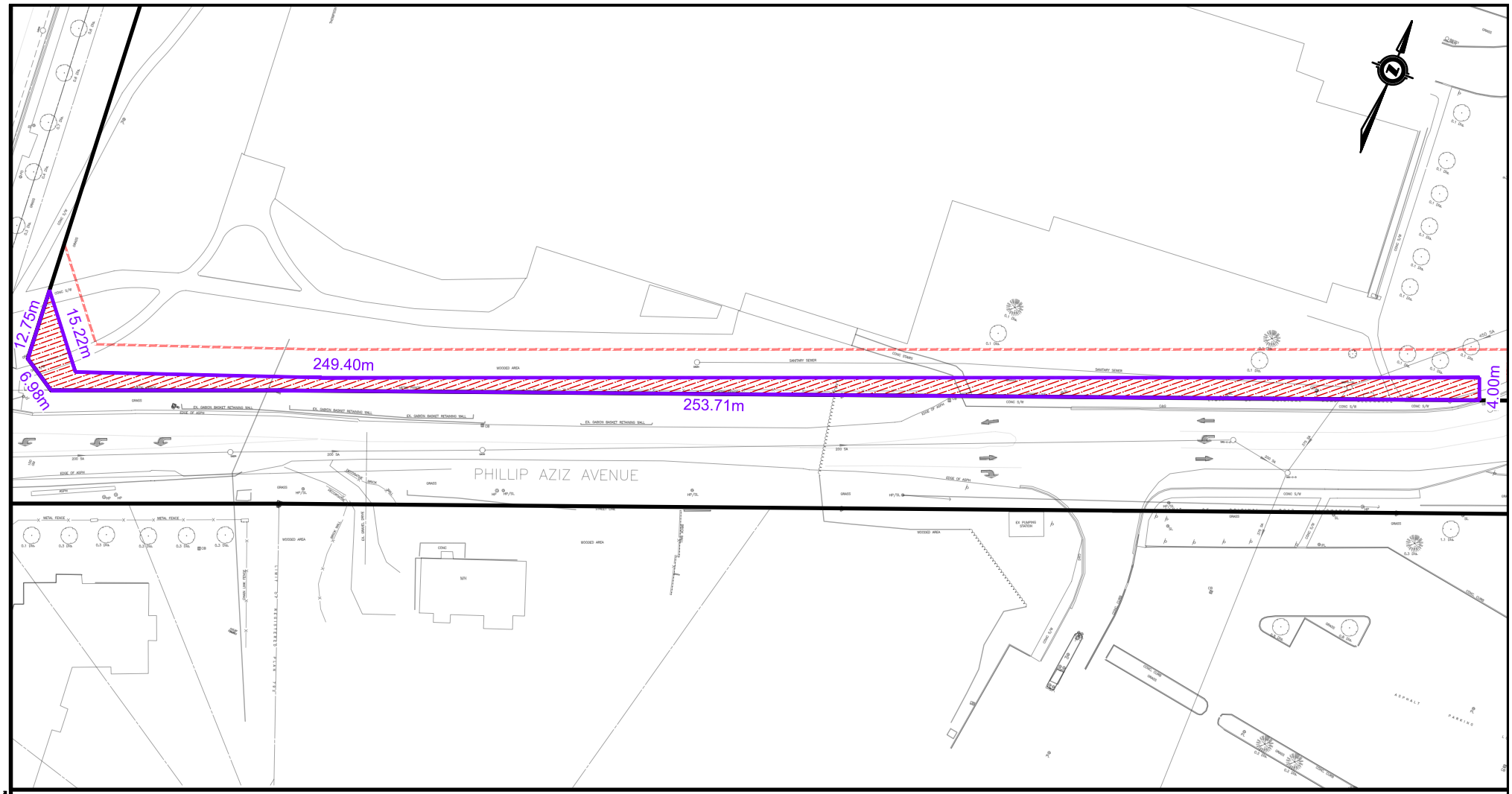
Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
398.696m² 0.040ha 0.099acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1400

Permanent Property Impact Area:
857.517m² 0.086ha 0.212acres

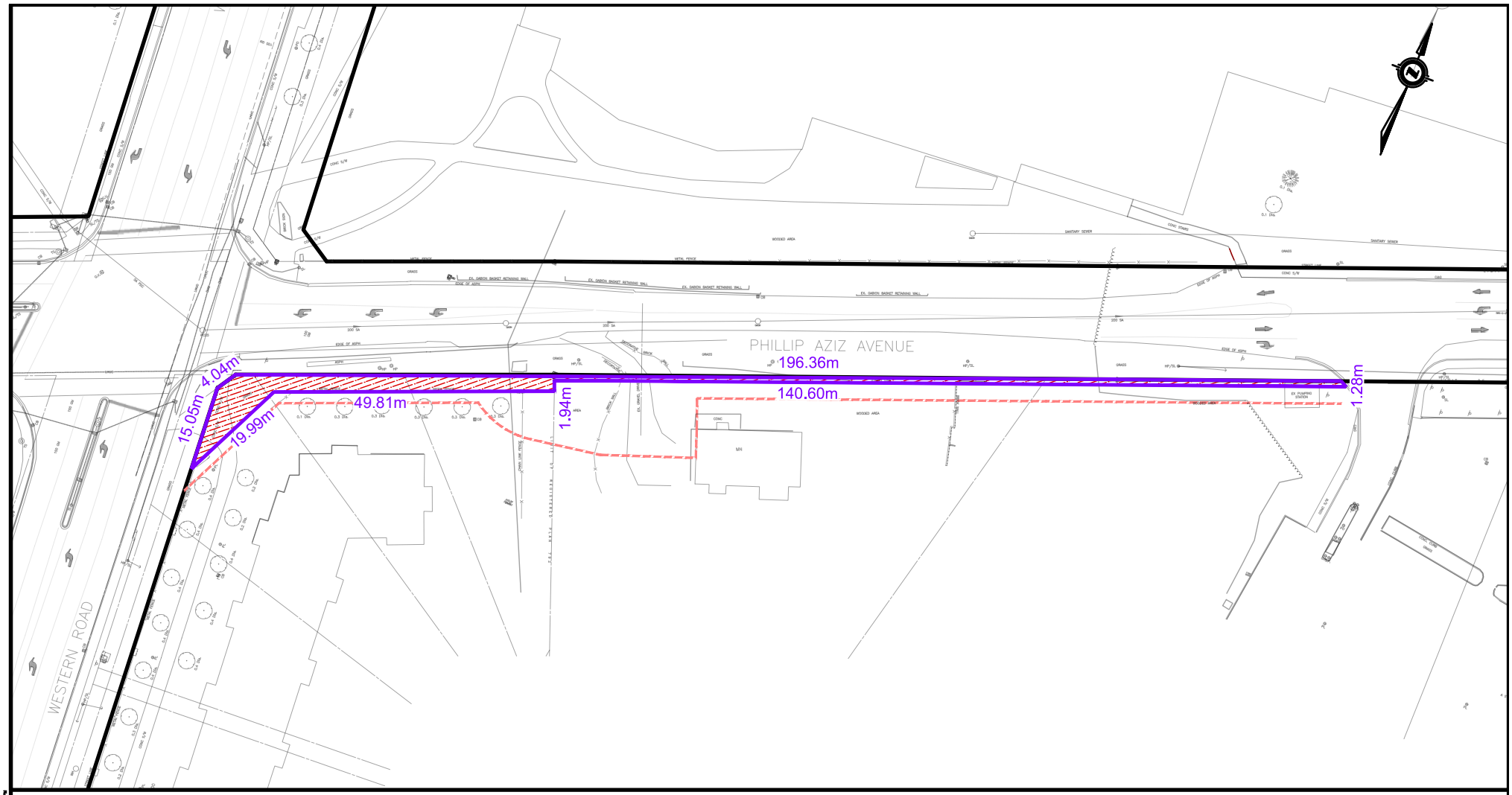
Temporary Construction Easement:
1343.278m² 0.134ha 0.332acres

WESTERN ROAD IMPROVEMENTS

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

PHILIP AZIZ AVENUE
MN. 100 / 150

WESTERN ROAD IMPROVEMENTS

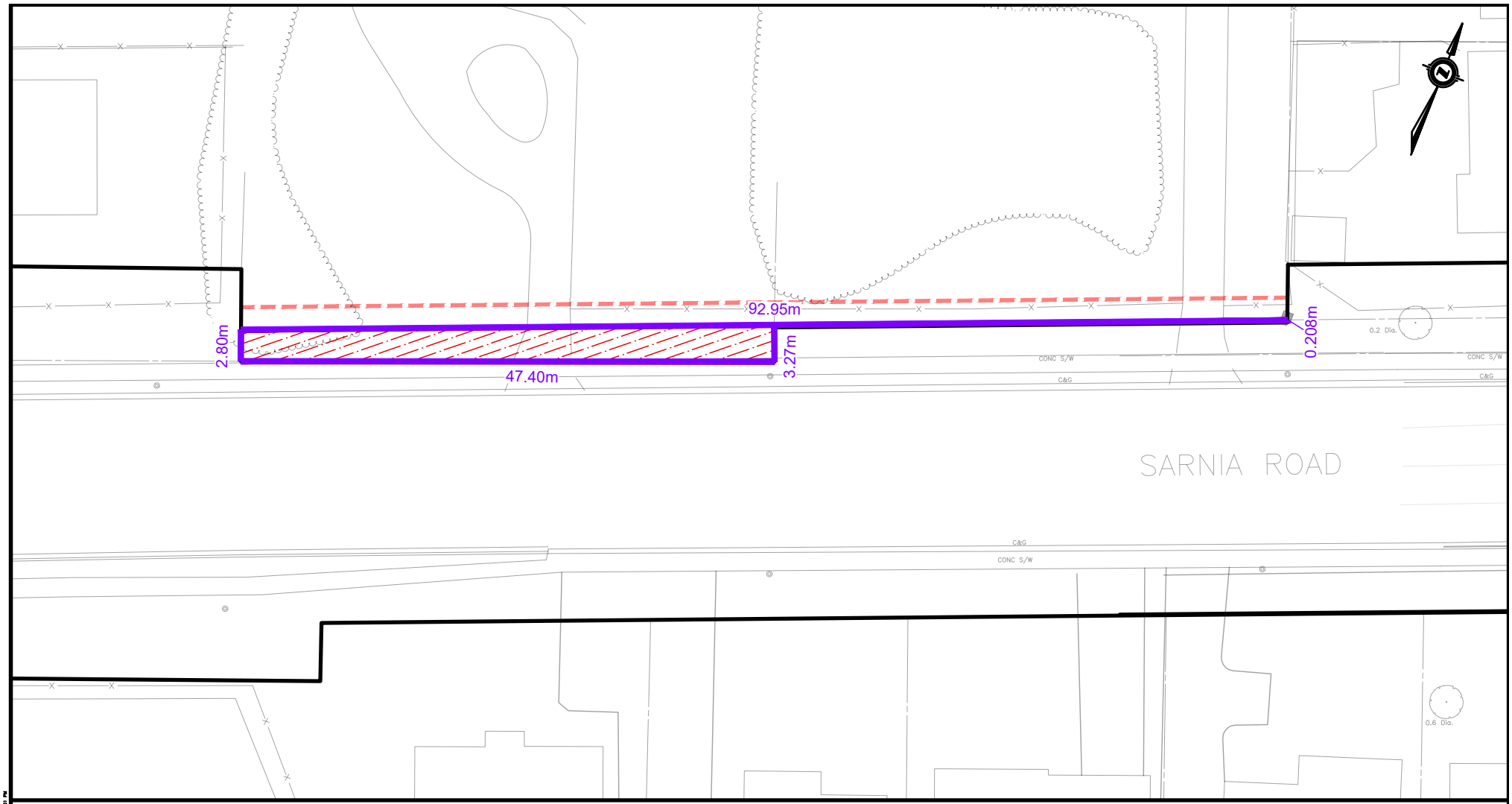
Permanent Property Impact Area:
384.716m² 0.038ha 0.095acres

Temporary Construction Easement:
885.075m² 0.089ha 0.219acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

SARNIA ROAD
MN. 307 / 299

WESTERN ROAD IMPROVEMENTS

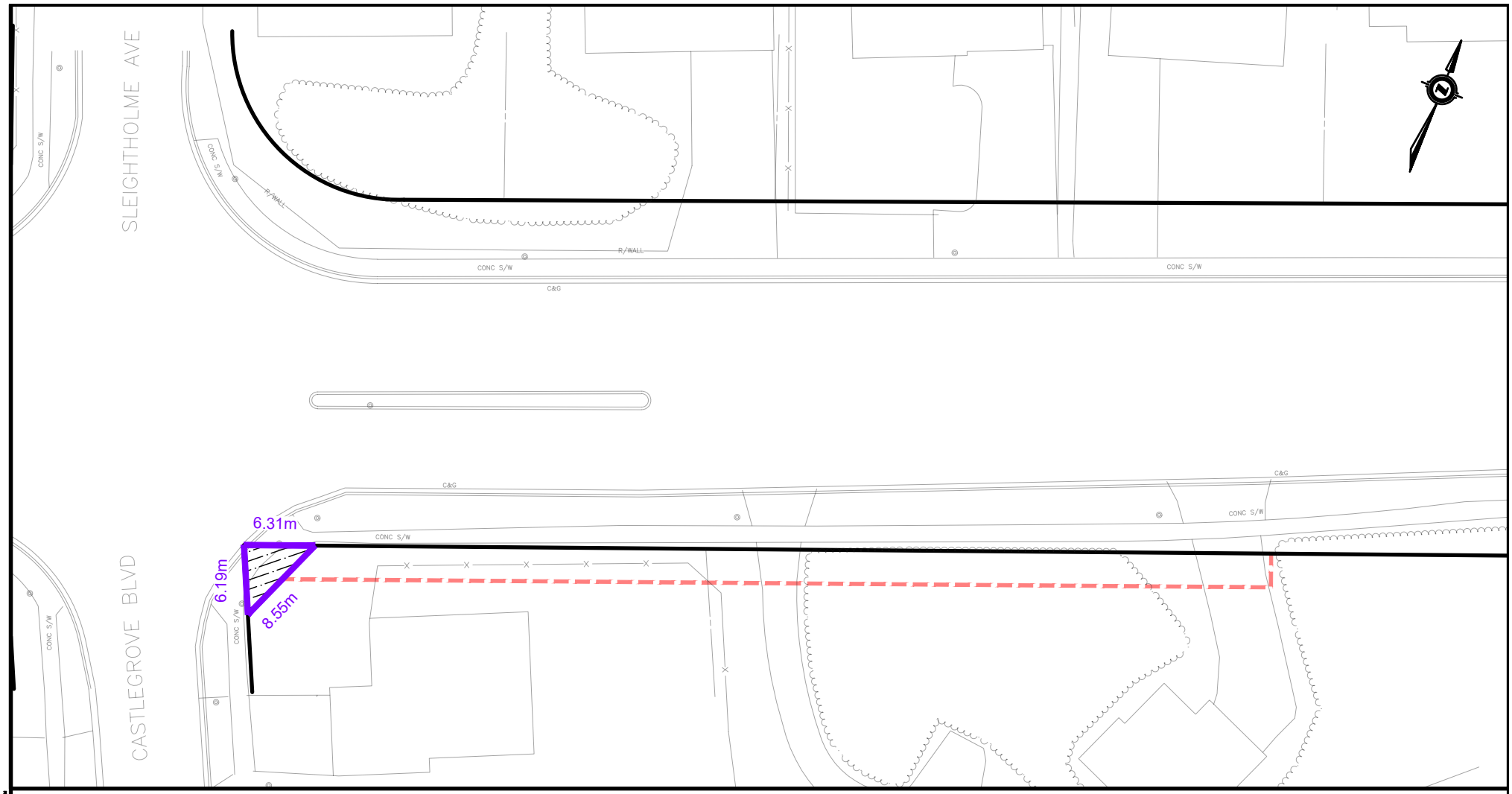
Permanent Property Impact Area:
153.514m² 0.015ha 0.038acres

Temporary Construction Easement:
185.890m² 0.019ha 0.046acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

CASTLEGROVE BOULEVARD
MN. 97

WESTERN ROAD IMPROVEMENTS

Permanent Property Impact Area:
19.482m² 0.002ha 0.005acres

Temporary Construction Easement:
259.060m² 0.026ha 0.064acres

Scale: NTS

Date: MAR 2023

PN: 60661402

PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

SARNIA ROAD
MN. 357 / 353 / 349 / 345 / 341 / 337

WESTERN ROAD IMPROVEMENTS

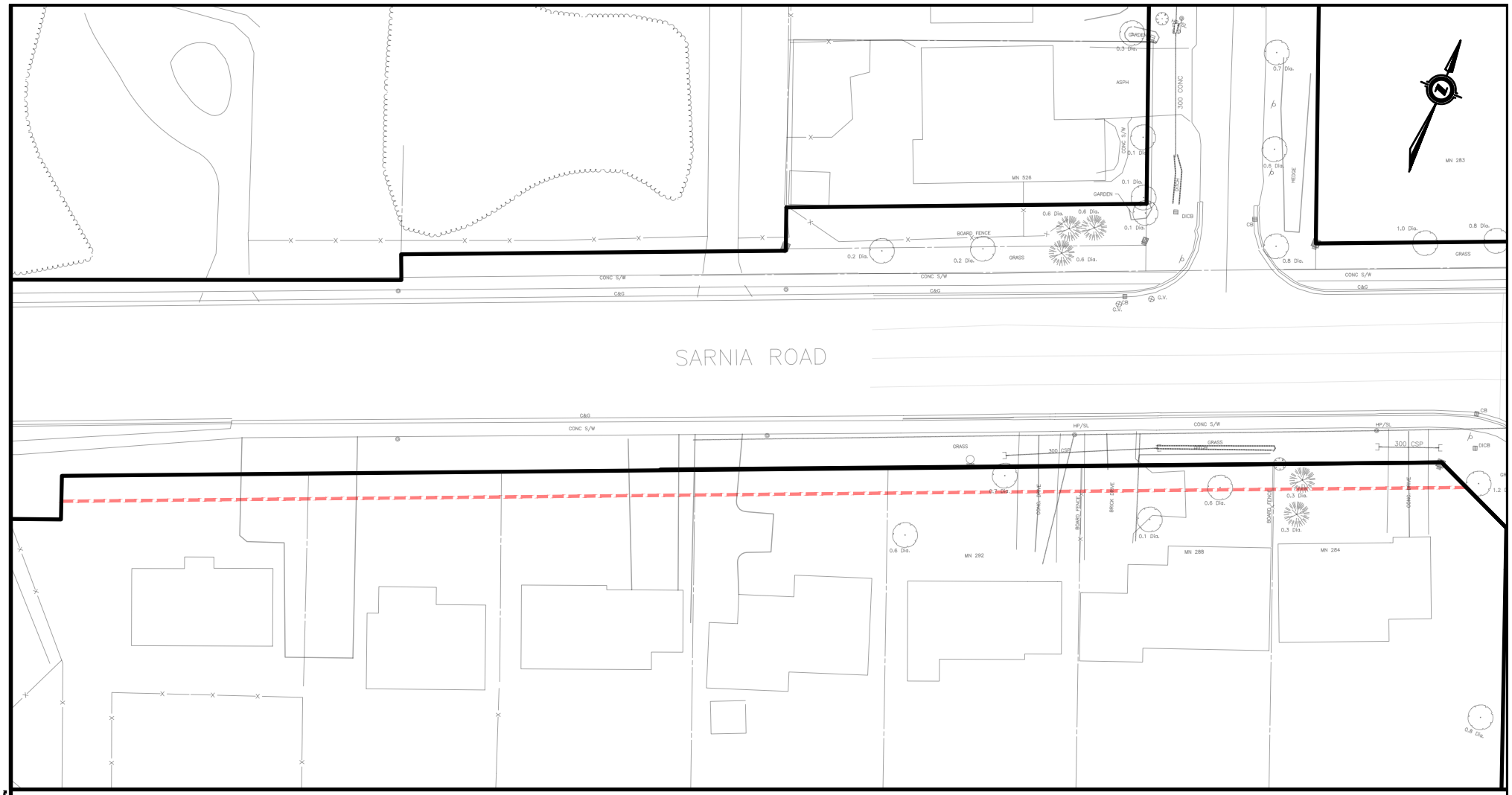
Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
259.060m² 0.026ha 0.064acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

SARNIA ROAD
MN. 310 / 306 / 302 / 296 / 292 / 288 / 284

WESTERN ROAD IMPROVEMENTS

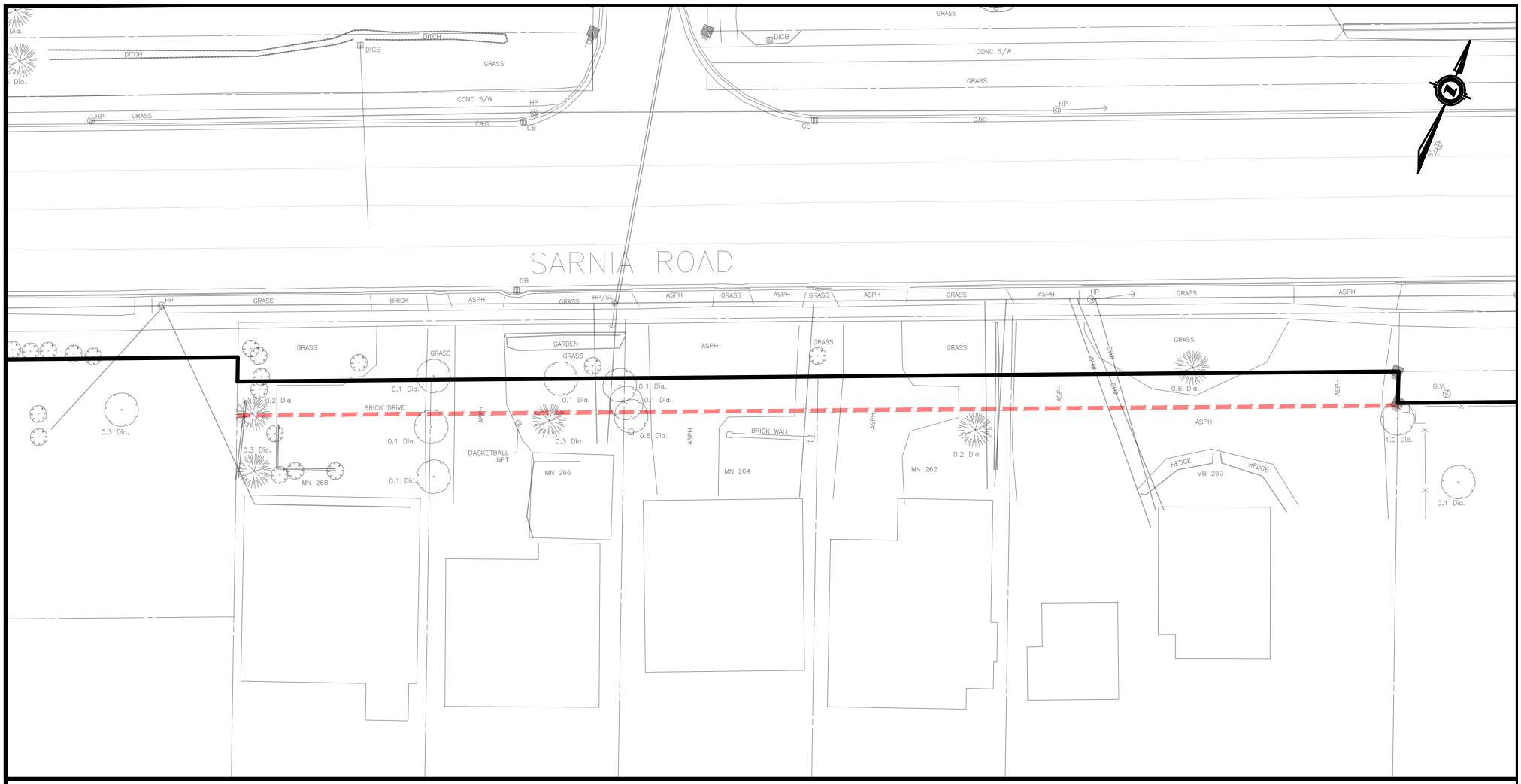
Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
259.060m² 0.026ha 0.064acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

SARNIA ROAD
MN. 268 / 266 / 264 / 262 / 260

WESTERN ROAD IMPROVEMENTS

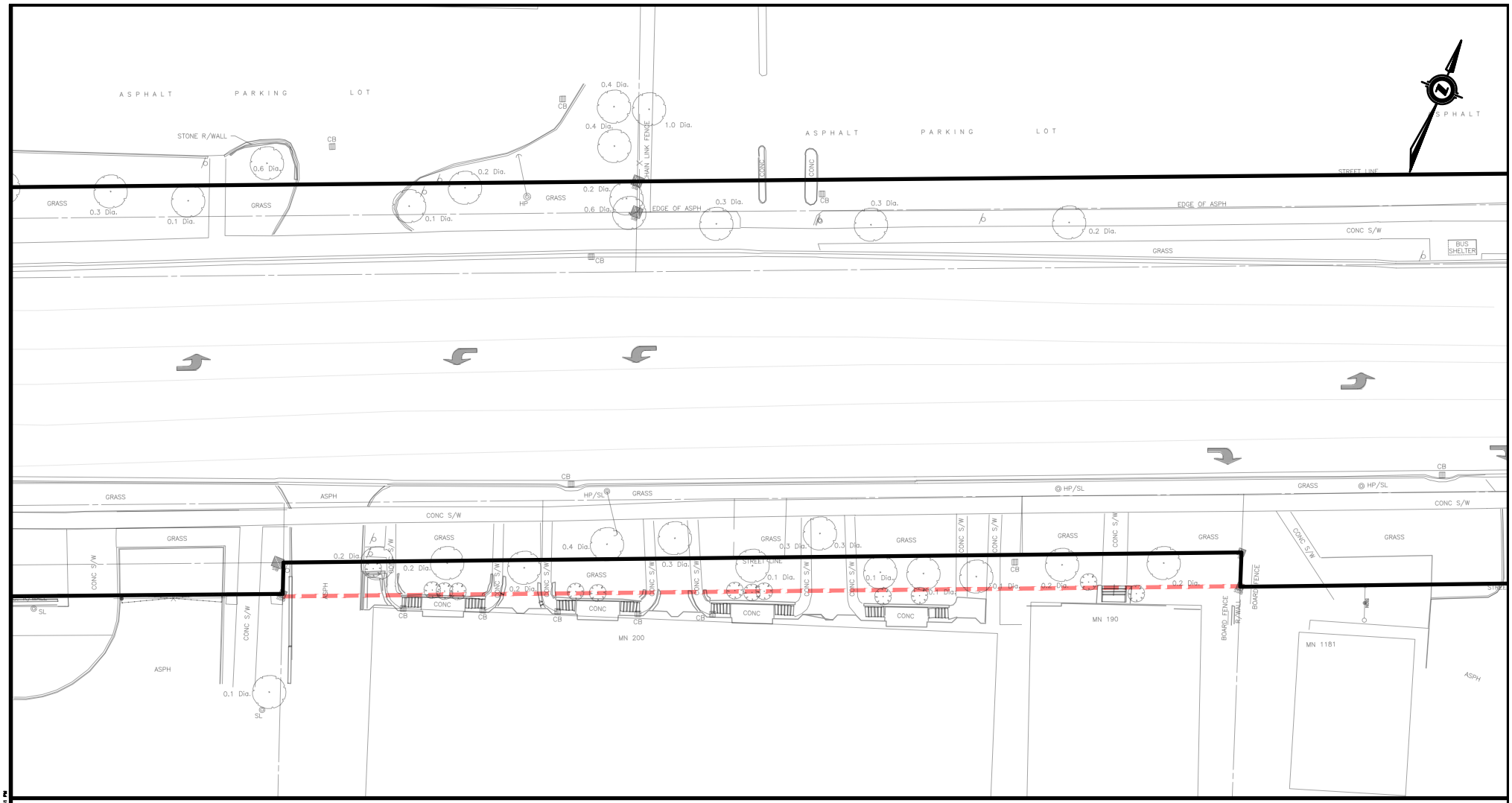
Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
259.060m² 0.026ha 0.064acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

SARNIA ROAD
MN. 200 / 190

WESTERN ROAD IMPROVEMENTS

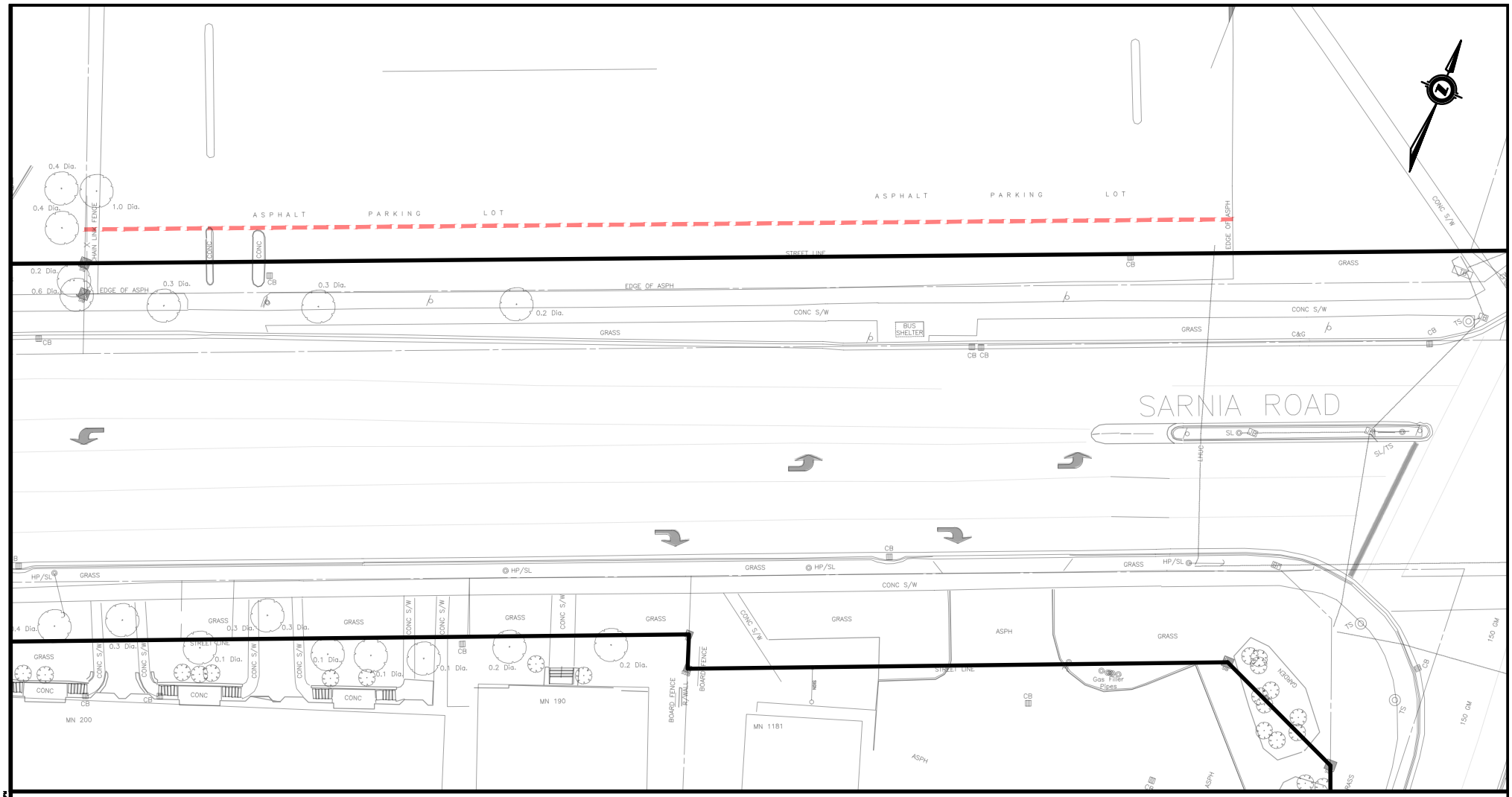
Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
259.060m² 0.026ha 0.064acres

Scale: NTS

Date: MAR 2023

PN: 60661402



PERMANENT ACQUISITION

TEMPORARY EASEMENT

London CANADA

AECOM

WESTERN ROAD
MN. 1201

WESTERN ROAD IMPROVEMENTS

Permanent Property Impact Area:
0.000m² 0.000ha 0.000acres

Temporary Construction Easement:
305.948m² 0.031ha 0.076acres

Scale: NTS

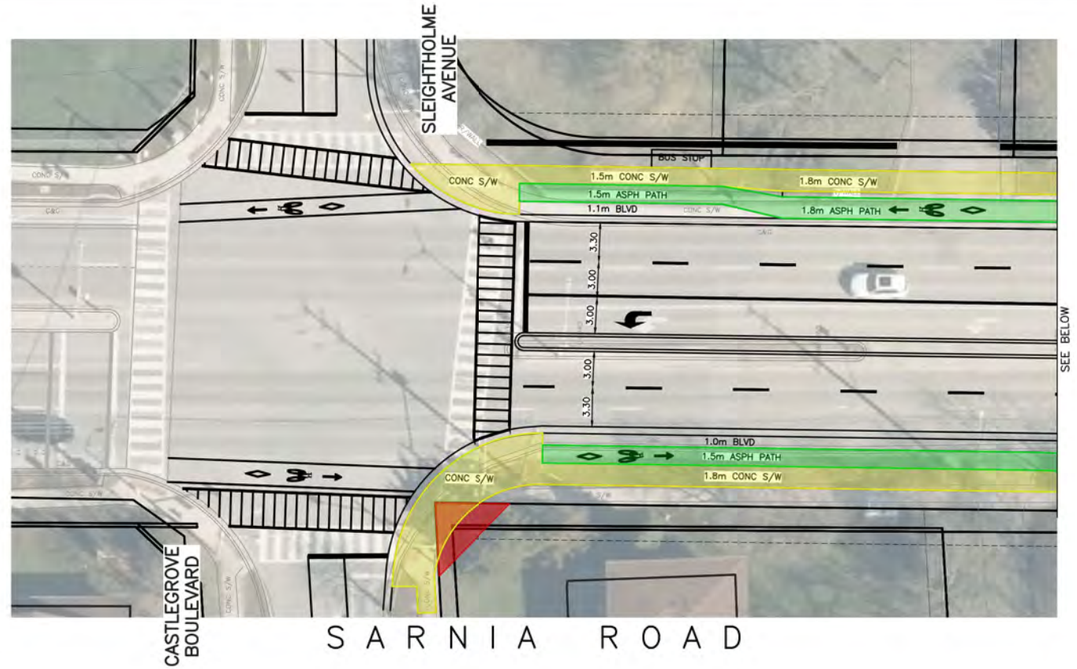
Date: MAR 2023

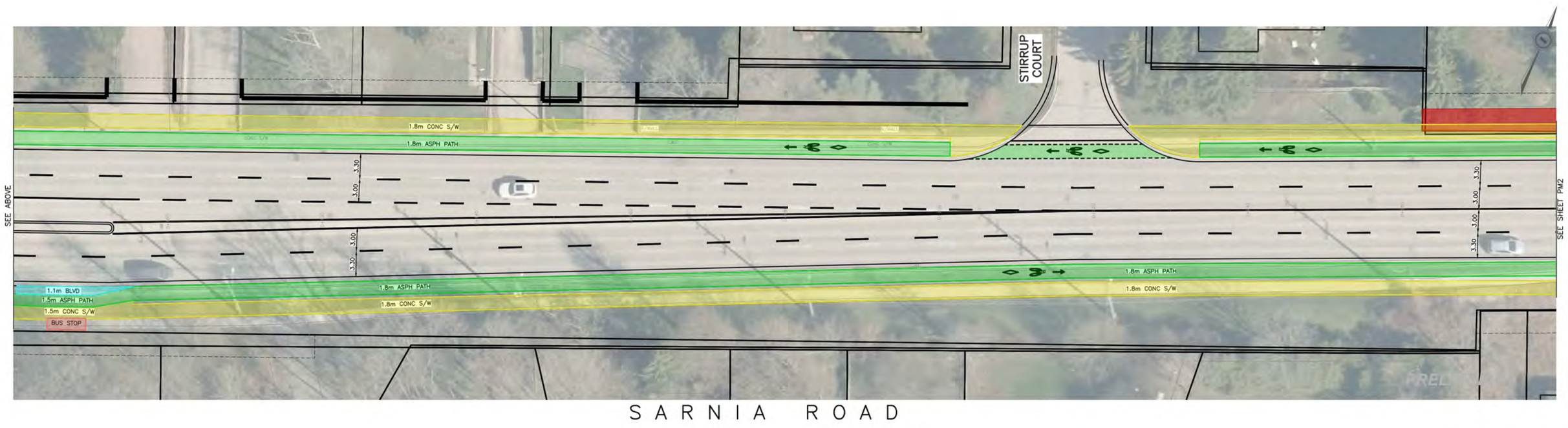
PN: 60661402

AECOM

Appendix C

C.2 Preliminary Design Pavement Markings





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DRAWN BY	MDB/JMP				
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APPROVED					
DATE	OCT. 2022				

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519.673.0510

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CORPORATION OF THE CITY OF LONDON
London CANADA

SCALE
HORIZONTAL – 1:250
2.5 0 5m
VERTICAL – 1:50
0.5 0 1m

WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

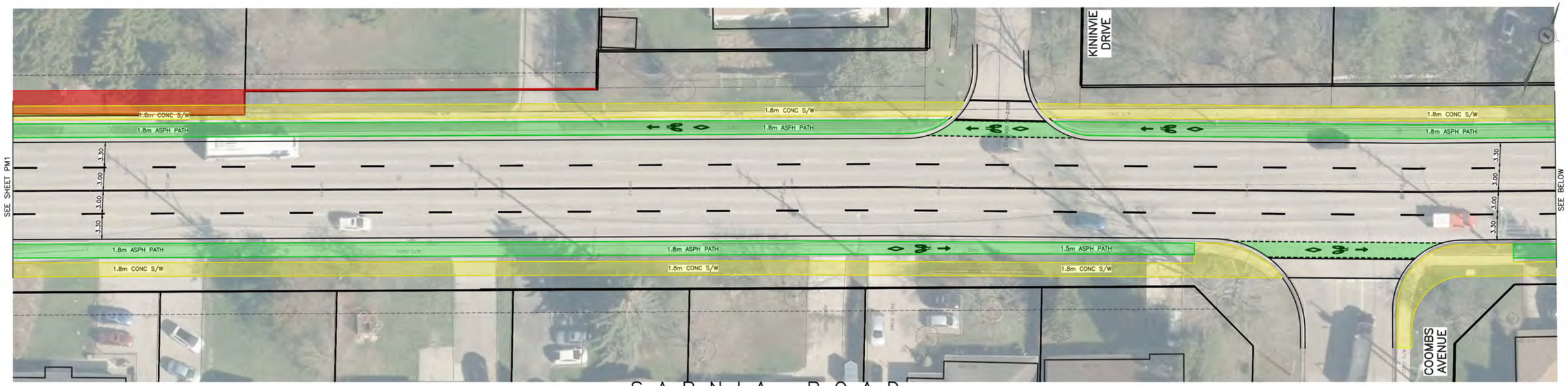
SARNIA ROAD

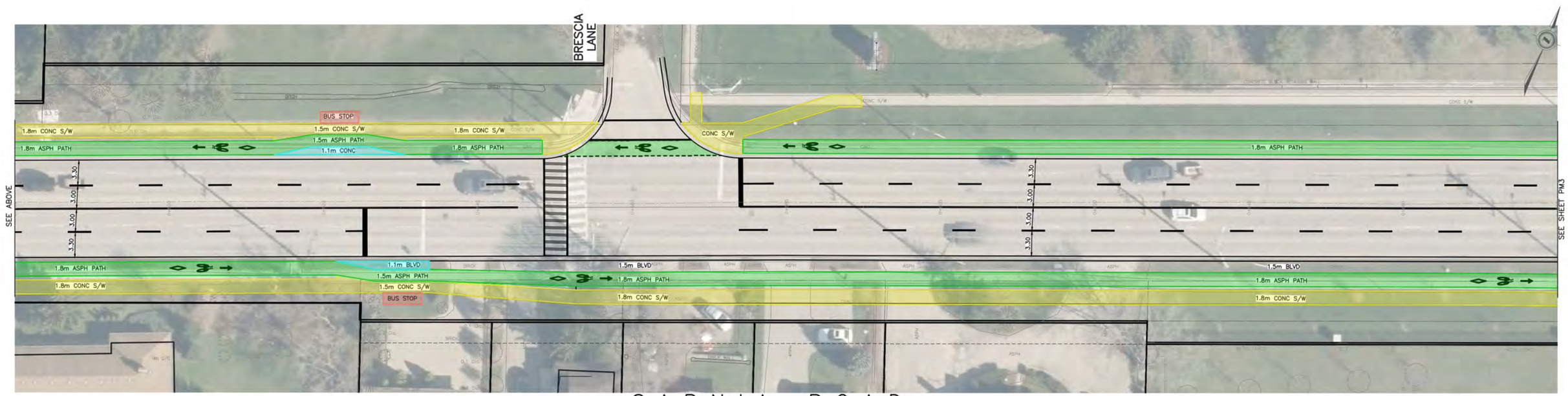
FROM CASTLEGROVE BOULEVARD TO STA 0+080

PROJECT No. 60661402

SHEET No. PM1

PLAN FILE No.





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0.5 0 1m

WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

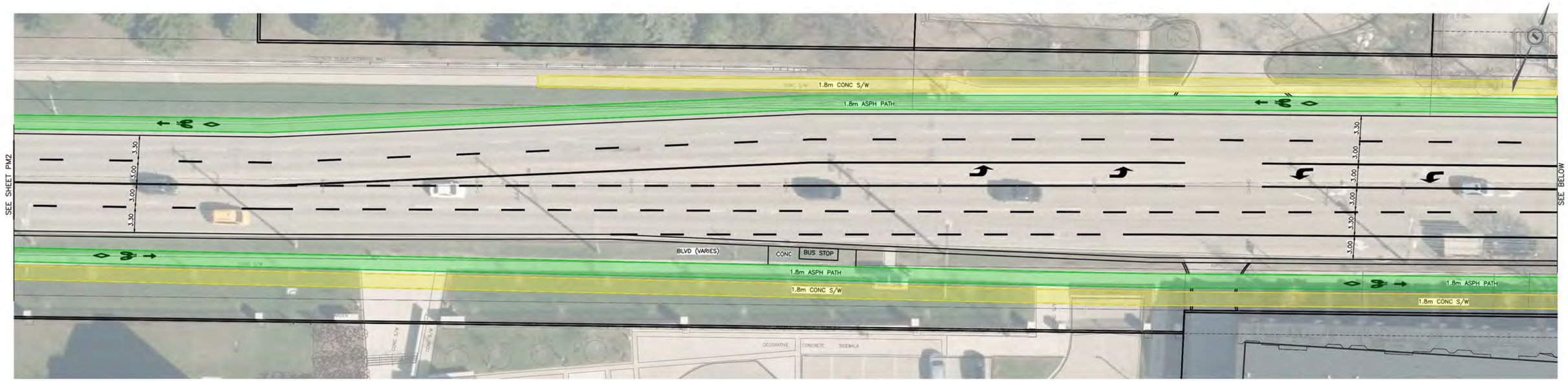
SARNIA ROAD

FROM STA 0+280 TO STA 0+680

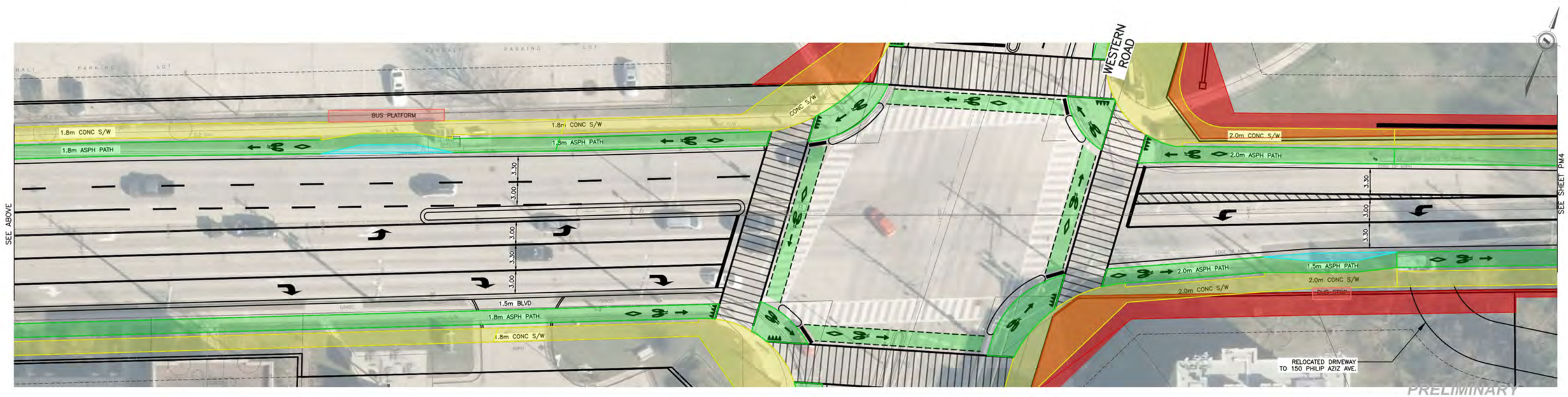
PROJECT No. 60661402

SHEET No. PM2

PLAN FILE No.



S A R N I A R O A D



S A R N I A R O A D / P H I L I P
A Z I Z A V E N U E

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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

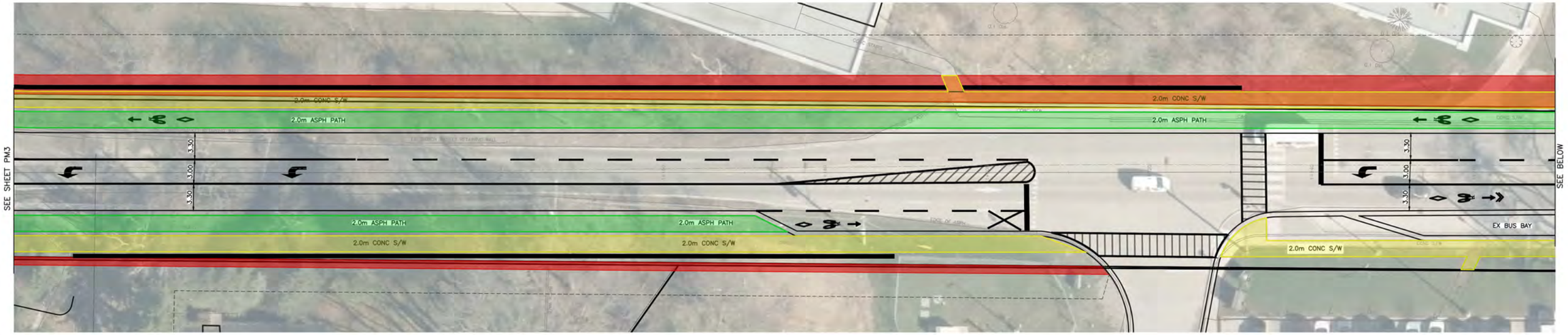
SARNIA ROAD / PHILIP AZIZ AVENUE

FROM STA 0+680 TO STA 1+080

PROJECT No. 60661402

SHEET No. PM3

PLAN FILE No.



PHILIP AZIZ AVENUE

PHILIP AZIZ AVENUE

PRELIMINARY

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
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					DATE OCT. 2022				

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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

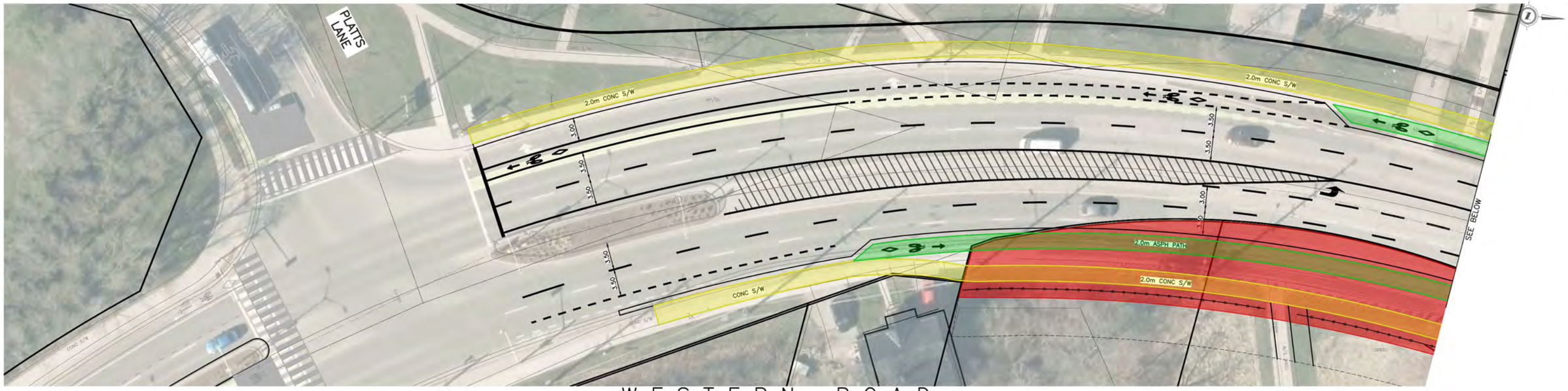
PHILIP AZIZ AVENUE

FROM STA 1+080 TO STA 1+430

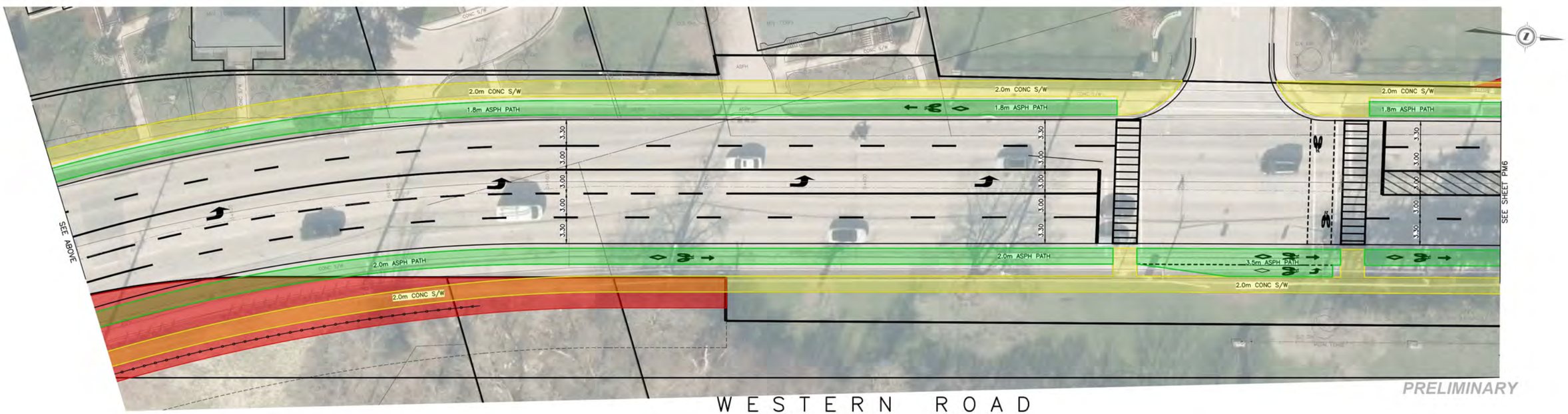
PROJECT No. 60661402

SHEET No. PM4

PLAN FILE No.



WESTERN ROAD



WESTERN ROAD

PRELIMINARY

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION

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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

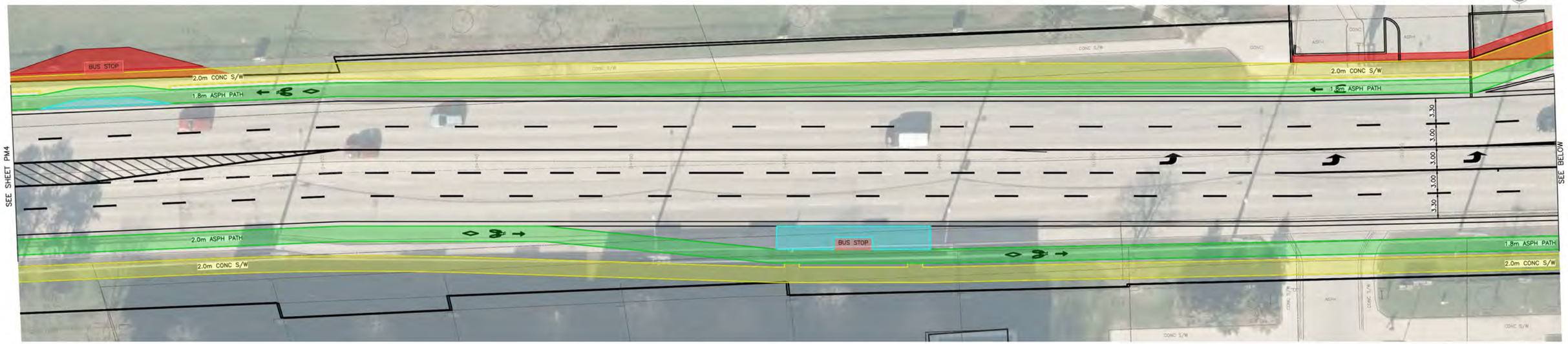
WESTERN ROAD

FROM STA 0+330 TO STA 0+680

PROJECT No. 60661402

SHEET No. PM5

PLAN FILE No.



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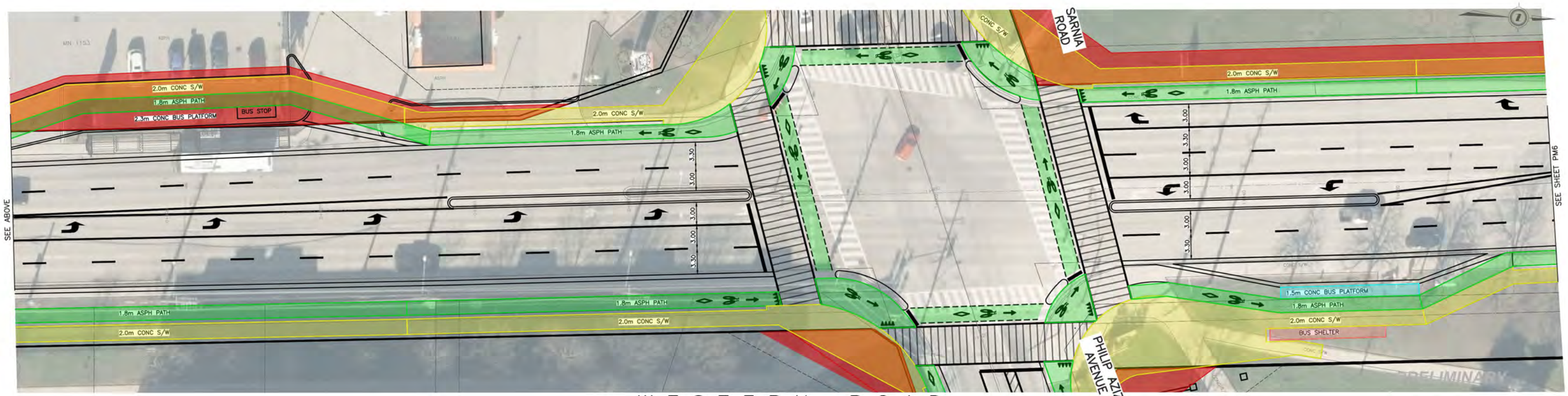

WESTERN ROAD

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION

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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

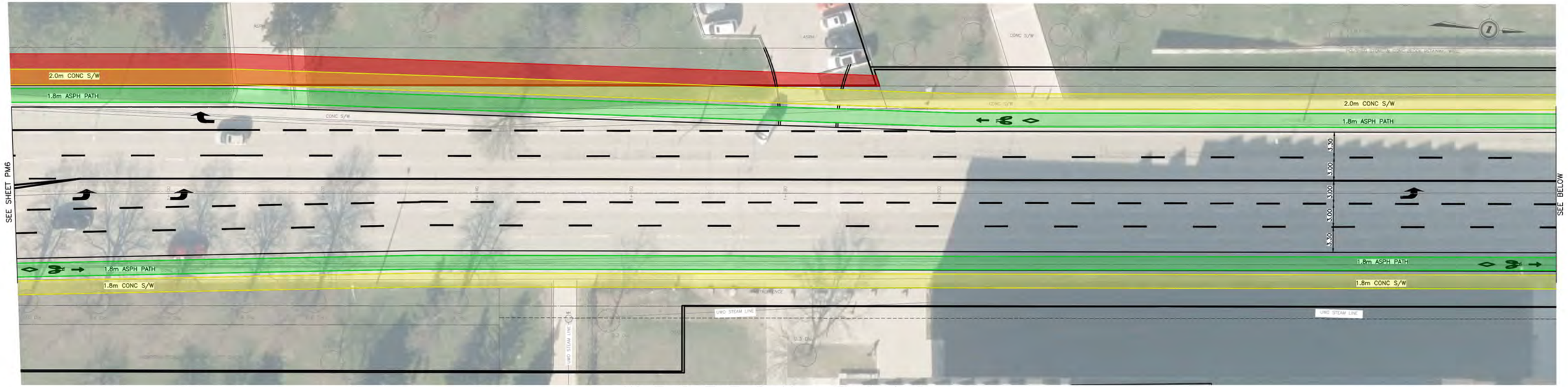
WESTERN ROAD

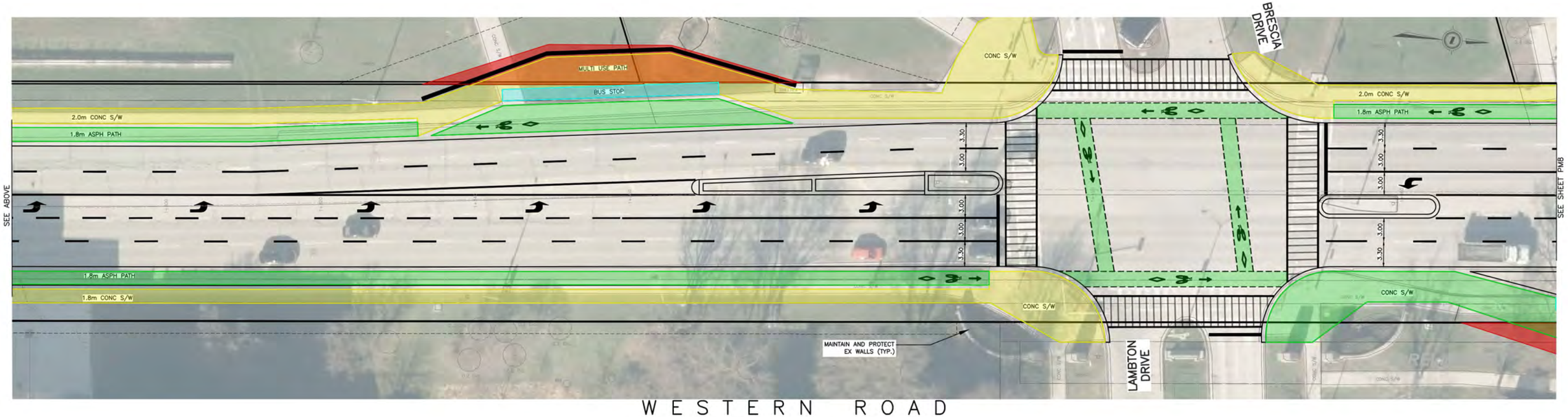
FROM STA 0+680TO STA 1+080

PROJECT No. 60661402

SHEET No. PM6

PLAN FILE No.





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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

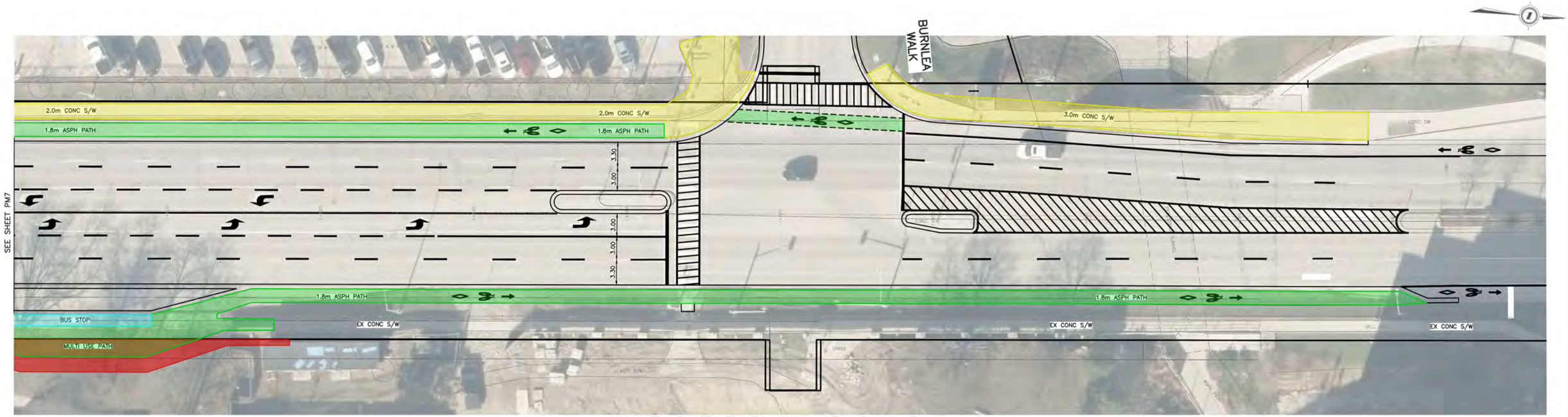
WESTERN ROAD

FROM STA 1+080 TO STA 1+480

PROJECT No. 60661402

SHEET No. PM7

PLAN FILE No.



WESTERN ROAD

PRELIMINARY

EXISTING SERVICES	DRAWING #, SOURCE	DATE	AS CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
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					DATE OCT. 2022				

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WESTERN ROAD AND SARNIA ROAD / PHILIP AZIZ AVENUE IMPROVEMENTS

WESTERN ROAD

FROM STA 1+480 TO STA 1+680

PROJECT No. 60661402

SHEET No. PM8

PLAN FILE No.

AECOM

Appendix C

C.3 Preliminary Cost Estimate

Municipal Class Environmental Assessment
Western Road / Sarnia Road / Philip Aziz Avenue Preliminary Cost Estimate

		Total	2024	2025
TOTAL PART 1 -	REMOVALS	$1,413,900	$205,050	$1,208,850
TOTAL PART 2 -	SANITARY SERVICING	$145,800	$145,800	$0
TOTAL PART 3 -	STORM SERVICING	$3,445,625	$919,800	$2,525,825
TOTAL PART 4 -	WATER SERVICING	$800,000	$0	$800,000
TOTAL PART 5 -	ROADWORKS	$10,463,150	$2,287,210	$8,175,940
TOTAL PART 6 -	ELECTRICAL	$860,000	$478,000	$382,000
TOTAL PART 7 -	UTILITY RELOCATIONS	$1,009,000	$1,000,000	$9,000
TOTAL PART 8 -	LANDSCAPING	$150,000	$60,550	$89,450
TOTAL PART 9 -	MISCELLANEOUS	$813,000	$122,740	$690,260
SUBTOTAL		**$19,100,475**	**$5,219,150**	**$13,881,325**
Construction Contingency (10%)		$1,910,048	$521,915	$1,388,133
TOTAL ESTIMATED CAPITAL VALUE		**$21,010,523**	**$5,741,065**	**$15,269,458**
Engineering (Detailed Design / Contract Administration) (12%)		**$2,521,263**	**$688,928**	**$1,832,335**
CONTINGENCY for Preliminary Estimate (15%)		**$3,151,578**	**$861,160**	**$2,290,418**
PRELIMINARY TOTAL PROJECT ESTIMATE (rounded nearest $10,000)		**$26,690,000**	**$7,300,000**	**$19,390,000**
With 5% Inflation Rate*			**$7,665,000**	**$20,359,500**
	Land Acquisition (±1060 m2) (does not include Western property)	$400,000		

AECOM PN: 60661402