# Committee of the Whole

**Meeting Date:** **September 28, 2021**

**Submitted by:** **Durk Vanderwerff, Director of Planning**

**SUBJECT:** **PROPOSED PLAN OF SUBDIVISION, MUNICIPALITY OF MIDDLESEX CENTRE, FILE NO. 39T-MC2004, 2270942 Ontario Ltd.**

## BACKGROUND:

2270942 Ontario Ltd. is proposing to develop a residential plan of subdivision on a 5.39 ha (13.3 ac) property within Komoka. The development would create 48 lots for single detached dwellings and 1 block for townhouse dwellings on full municipal services as well an internal road network and stormwater management pond.

The subject lands are within the 'Residential' designation of the Kilworth-Komoka Urban Settlement Areas and Secondary Plan in Middlesex Centre's Official Plan, and the lands are currently vacant of development but were previously subject to aggregate extraction. The surrounding land uses include residential uses to the north and southwest of the lands, agricultural lands immediately to the east and a golf course to the southeast.

This plan of subdivision was processed under the integrated planning model that has been developed between the County and the Municipality. This included a combined circulation process and a common planning review and analysis. The municipal planning reports, authored by Marion-Frances Cabral, as provided to Middlesex Centre Council, are attached along with a location map, a copy of the proposed plan, and the proposed conditions of draft plan approval.

This report is a short summary of the issues from the perspective of the County as the Approval Authority and recommends draft plan approval of this subdivision subject to conditions.

## ANALYSIS:

The submission was accepted as complete on September 25, 2020, and the Municipality held a statutory public meeting on December 16, 2020. Middlesex Centre Council supported the application on September 8, 2021. It is noted that there was some delay in processing the plan of subdivision as a result of the identification of need for additional engineering analysis to address several matters including stormwater management (to address groundwater contaminants as identified by Ministry of Environment, Conservation and Parks) and slope / engineered fill requirements. The layout of the plan was modified during this process.

An agency / ministry circulation was undertaken, and the comments received were either addressed (through additional engineering, enhanced landscaping work) or can appropriately be addressed as conditions of draft plan approval. The draft plan conditions include matters to satisfy the Upper Thames River Conservation Authority (storm water management) and the Municipality (subdivision agreement, stormwater management, engineered fill, etc).

The Provincial Policy Statement (PPS) and the County Official Plan encourages new development to occur in settlement areas, like Komoka, where full municipal services can be provided. The County Official Plan designates Komoka as an 'Urban Settlement Area' and the lands are located within the ‘Residential' designation of the Middlesex Centre Official Plan.

The attached municipal planning reports address the land use planning issues in detail and also outlines the documents and studies submitted in support of the proposal. I have reviewed this material throughout the process and am satisfied that the proposed plan is consistent with the Provincial Policy Statement, conforms with the County’s Official Plan, conforms with the Municipality’s Official Plan, and represents sound land use planning. I am, therefore, recommending draft plan approval of the plan of subdivision subject to conditions.

## RECOMMENDATION:

That the proposed Plan of Subdivision (File No. 39T-MC2004) be granted draft plan approval subject to conditions and that a Notice of Decision be circulated as required by the Planning Act.

Attachments

Attachment 1 Location Map

Attachment 2 Proposed Plan of Subdivision

Attachment 3 Preliminary Draft Conditions

Attachment 4 Local Planning Report September 8, 2021

Attachment 5 Local Planning Report December 16, 2020

## LOCATION MAP

Description:
PROPOSED PLAN OF SUBDIVISION
CUDNEY BLUE
MUNICIPALITY OF MIDDLESEX CENTRE

File Number:
39T-MC2004

Prepared by: Planning Department
The County of Middlesex, September 28, 2020.

## LEGEND

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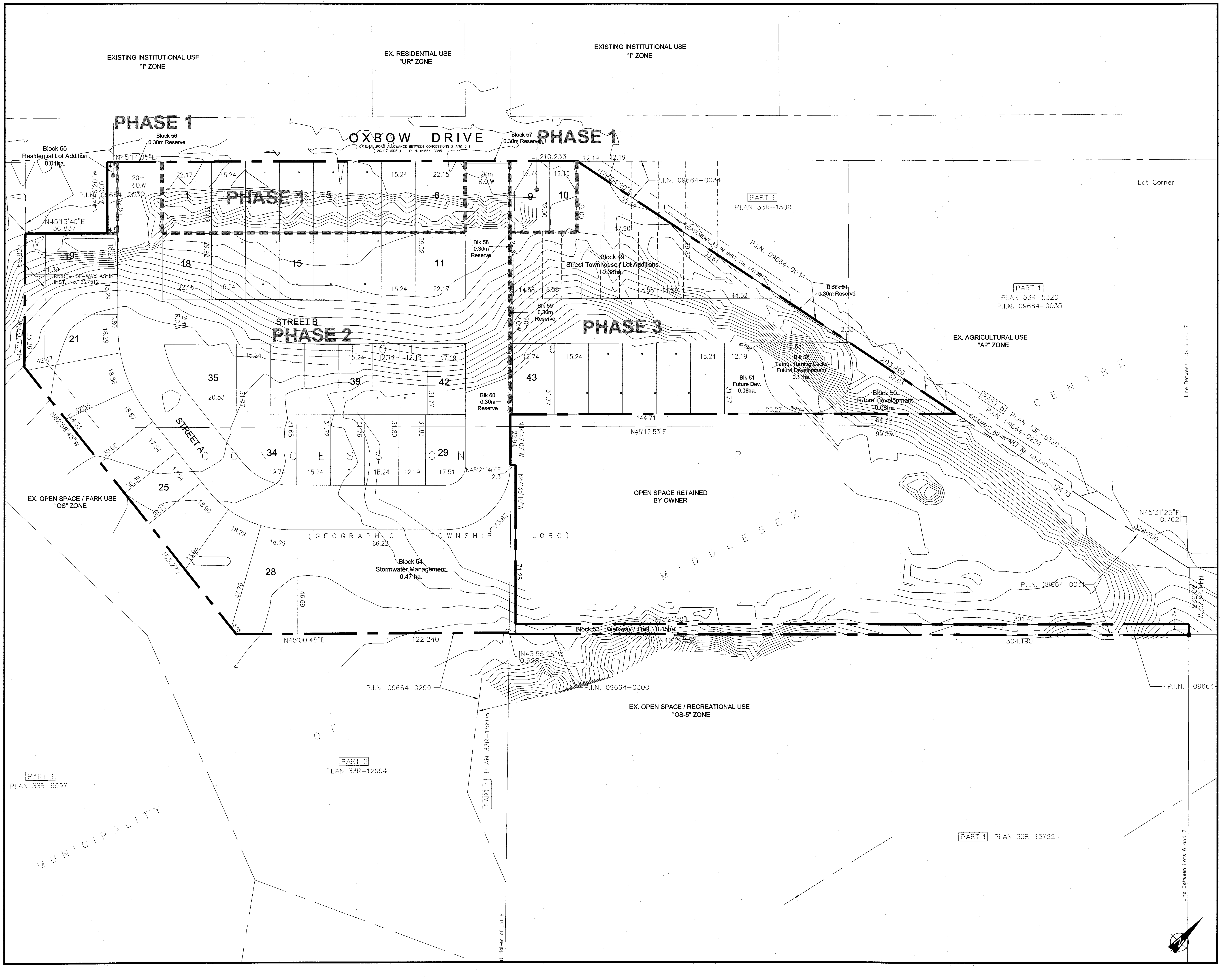
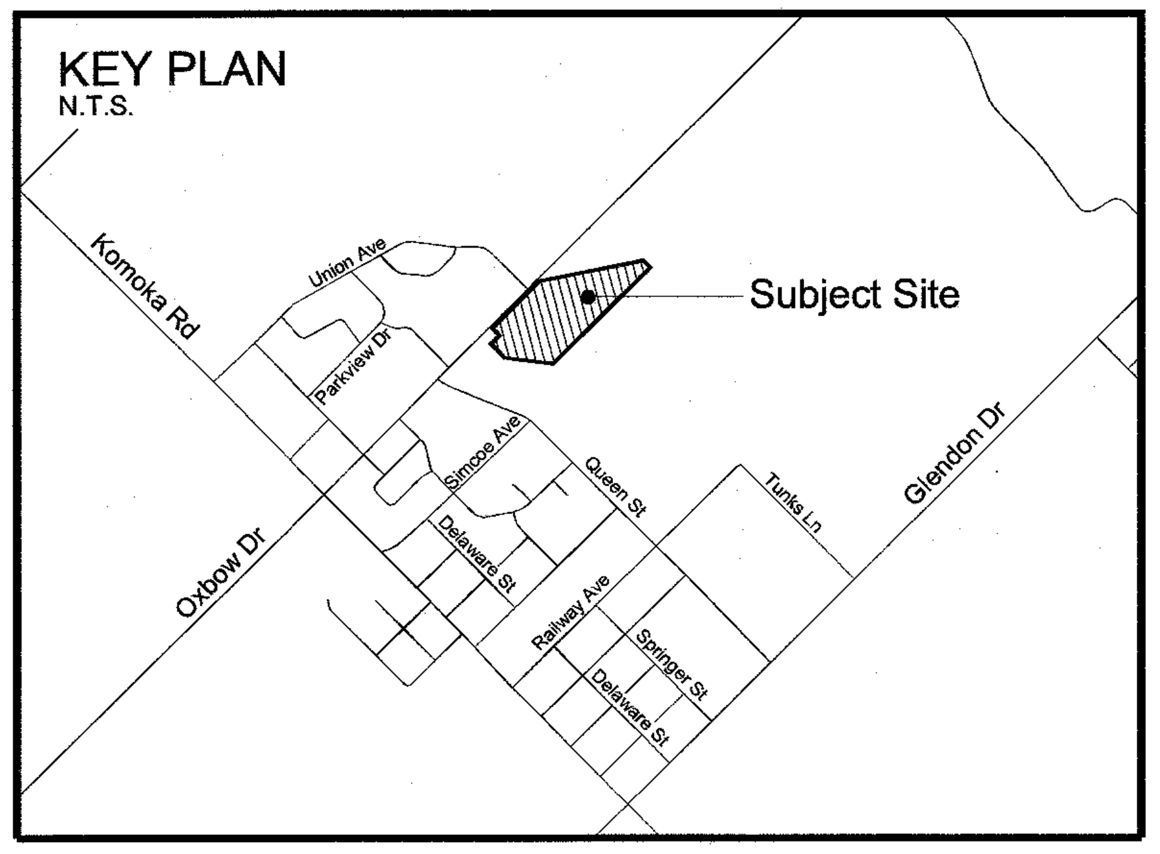
🟥 SUBJECT LANDS

1:4,000

0 100 200

Meters





# DRAFT PLAN OF SUBDIVISION

Part of Lot 6
Concession 2
(Geographic Township of Lobo)
Municipality of
Middlesex Centre

## 10125 Oxbow Drive

## LAND USE SCHEDULE

| PHASE 1 | LOTS/BLKS. | UNITS | AREA (ha.) |
|---|---|---|---|
| Single Detached Residential | 1-10 | 10 | 0.53 |
| Residential Lot Addition | 55 | | 0.01 |
| Total | | 10 | 0.54 |
| **PHASE 2** | LOTS/BLKS. | UNITS | AREA (ha.) |
| Single Detached Residential | 11-42 | 32 | 1.90 |
| Walkway / Trail | 53 | | 0.15 |
| Stormwater Management | 54 | | 0.47 |
| 0.3m Reserve | 56-57 | | 0.00 |
| Road | | | 1.12 |
| Total | | 32 | 3.64 |
| **PHASE 3** | LOTS/BLKS. | UNITS | AREA (ha.) |
| Single Detached Residential | 43-48 | 6 | 0.30 |
| Street Townhouse / Lot Addition | 49 | 8 | 0.38 |
| Future Development | 50-51 | | 0.14 |
| Temp. Turning Circle / Future Dev | 52 | | 0.11 |
| 0.3m Reserve | 58-61 | | 0.00 |
| Road | | | 0.28 |
| Total | | 14 | 1.21 |
| TOTAL | | 56 | 5.39 |

## ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON THE DRAFT PLAN.

h) Municipal water supply
i) Brown silt
k) All sanitary and storm sewers as required

## OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO

Heather Johnston-Inglis Sept 1/2021
OWNER DATE

## SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

P.R. Levac Sept 1, 2021
P.R. LEVAC, O.L.S. DATE

GSP group
PLANNING I URBAN DESIGN I LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS
June 2, 2021
July 6, 2021

| | | |
|---|---|---|
| Date: June 12, 2020 | Drawn By: MN | Dwg. File Name:dp18015f SEPT 1 2021.dwg |
| Scale: 1: 750 metric | Project No.: 18015 | |

| | | | |
|---|---|---|---|
| **Applicant:** | 2270942 Ontario Limited | **Date of Decision:** | DRAFT |
| **File No.:** | 39T-MC2004 | **Date of Notice:** | DRAFT |
| **Municipality:** | Municipality of Middlesex Centre | **Last Date of Appeal:** | DRAFT |
| **Subject Lands:** | LOBO CON 2 PT LOT 6 | **Lapsing Date:** | DRAFT |

The conditions and amendments to final plan of approval for registration of this Subdivision as provided by the County of Middlesex are as follows:

**No. Conditions**

1. That this approval applies to the draft plan of subdivision prepared and signed by P.R. Levac, OLS dated September 1, 2021 which shows:
    - Lots 1 to 48 for single detached dwellings;
    - Block 55 for residential lot addition;
    - Block 49 for street townhouse/lot addition
    - Blocks 50 and 51 for future development;
    - Block 52 for temporary turning circle/future development;
    - Block 53 for a 4.82 m wide walkway/trail;
    - Block 54 for stormwater management;
    - Blocks 56 to 61 for 0.3 m reserves; and
    - Public roads.

2.
    a) No development of the Plan of Subdivision may begin until all external infrastructure and services required for the development of the Plan of Subdivision are in place; including municipal water supply, treatment and conveyance infrastructure and sewage treatment and waste water conveyance infrastructure. For the purpose of these conditions, services being “in place” means that the infrastructure exists and is operational to the satisfaction of the Municipality and that capacity in such infrastructure has been formally allocated by the Municipality for use in connection with the development of the Plan of Subdivision. External capacity of any services will be formally allocated through the execution of a Development Agreement for each phase of the development as Municipal capacity allows. Should the Municipal Engineer deem there to be insufficient external capacity for any of the required municipal services, the Municipality has no obligation to provide such capacity within the lapse period, or at any time. The Municipality may include language in each Development Agreement regarding the allocation of external capacity.

    b) that, in connection with all financing proposals and commitments and all offers and agreements of purchase and sale made by or to the Owner involving all or any part of the land covered by the Plan of Subdivision that has not been registered, there shall be a written acknowledgement given by the other party or parties of item 2.a. above and of receiving a copy of the draft plan conditions which acknowledgement will be produced by the Owner to the Municipality on request.

3. That the development of the draft plan of subdivision shall be undertaken in phases to the satisfaction of the Municipality and that all phases of development will be subject to conditions 1 - 31 unless indicated otherwise.

4. That dead ends or open sides of road allowances of municipal roads created by this draft plan of subdivision shall be terminated in 0.3 metre reserves and the reserves are to be conveyed to and held in trust by the Municipality.

5. That prior to the final approval of Phase 3, the Owner dedicate to the Municipality all applicable blocks and reserves for the turning circle on Street B, and that such turning circle be constructed to a permanent standard unless otherwise detailed in the subdivision agreement.

6. That prior to the final approval of Phase 3, the Owner dedicate to the Municipality all applicable blocks and reserves for future access to the lands to the east of the subject lands.

7. That prior to the final approval of each phase, the associated the streets shall be named and the lots shall be addressed to the satisfaction of the Municipality in consultation with the County of Middlesex. This shall include permanent and temporary road names and municipal address signage during all stages of construction, and street signage which shall be required through the subdivision agreement.

8. That prior to final approval, the Owner convey up to 5% of the subject land to the Municipality for park purposes, this shall include Block 53 but shall not include Block 54. Alternatively, the Municipality may accept cash-in-lieu of parkland dedication of all or a portion of the conveyance pursuant to Section 42 of the Planning Act.

9. That the subdivision agreement for Phase 2 require the construction of a 1.8 metre wide asphalt walkway/trail in Block 53 to the satisfaction of the Municipality and that a connection to such a walkway/trail be provided from “Street A”.

10. That prior to final approval of each phase, the County is to be advised by the Municipality that appropriate zoning is in effect for the Plan of Subdivision.

11. That the Owner and the Municipality enter into a subdivision agreement (“Subdivision Agreement”) for each phase pursuant to Section 51 (26) of the Planning Act to be registered on title of the lands to which it applies prior to the Plan of Subdivision being registered. Further that the Subdivision Agreement shall include provisions that it will also be registered against the lands to which it applies once the plan of subdivision has been registered.

12. That each Subdivision Agreement applicable to an individual phase shall satisfy all requirements of the Municipality related to financial, legal, planning and engineering matters including but not limited to; grading and drainage, stormwater management pond, planting of trees, landscaping, provision of community mailboxes, fencing, buffering, street lighting and other amenities, the provision and installation of full municipal water and sanitary services, the installation of underground electrical services, and other matters which may be required by the Municipality respecting the development of the Plan of Subdivision, including the payment of Municipal Development Charges in accordance with the Municipality’s Development Charge By-Law.

13. If necessary, that prior to final approval of each phase the Owner shall enter into an agreement with Canada Post Corporation for the installation of community mailboxes. The subdivision agreement shall include requirements to notify all prospective lot purchasers of the mailbox(es) location.

14. That prior to final approval for each phase the Owner shall enter into an agreement with the appropriate service providers for the installation of underground communication / telecommunication utility services for these lands to enable, at a minimum, the effective delivery of the broadband internet services and communication / telecommunication services for 911 Emergency Services.

15. That the Subdivision Agreement shall ensure that the persons who first purchase the subdivided land after the final approval of the plan of subdivision are informed, at the time the land is transferred, of all the development charges related to the development, pursuant to Section 59(4) of the Development Charges Act.

16. That such easements as may be required for utility, servicing, or drainage purposes shall be granted to the appropriate authority, at the expense of the Owner.

17. That prior to final approval, arrangements shall be made to the satisfaction of the Municipality for the relocation of any utilities required for the development of the Plan, which relocation shall be undertaken and provided at the expense of the Owner.

18. That prior to final approval, a Licensed Archaeologist shall provide a letter to the Municipality and the County indicating that there are no concerns for impacts to archaeological sites on the subject lands. This is to be accompanied by a Ministry of Tourism, Culture and Sport letter indicating that the licensee has met the Terms and Conditions for Archaeological Licensing and that the report has been entered into the Ontario Public Register of Archaeological Reports.

19. That the south side of Oxbow Drive along the entire frontage of the subject lands shall be urbanized to the satisfaction of the Municipality and such costs shall be borne entirely by the development.

20. That prior to final approval of each phase, the Subdivision Agreement between the Municipality and the Owner provides for the following:

    a) municipal assumption and ownership of any facilities required for the retention and enhancement of stormwater quality will not occur until assumption of the final phase of the development; and

    b) the inclusion of any environmental protection measures recommended in the final storm water management plan that are not capable of being addressed under the Ontario Water Resources Act.

21. That an outlet agreement and easements with neighbouring properties are obtained, as required to implement the stormwater management plan, for external stormwater management outlets.

22. That prior to final approval of Phase 2 or Phase 3, whichever occurs first, an agreement and easement over the other lands owned by the applicant permits use of the remnant aggregate extraction pond to receive stormwater runoff.

23. As part of the works for Phase 2 and Phase 3, the developer includes traffic calming measures and/or devices, if required, to the satisfaction of the Municipality to aid in controlling vehicle speed on the streets proposed within the plan of subdivision.

24. That prior to final approval the developer provide the following relevant studies to the satisfaction of the Municipality:

    a) Hydrogeological study (including Chloride Impact Assessment)

    b) Geotechnical study

    c) Stormwater management report

    d) Servicing report

    e) Traffic impact study

25. That prior to final approval for any lots created and graded by engineered fill, the Owner shall provide documentation to the Municipality from a professional engineer licensed to practice in Ontario certifying that the fill areas have been compacted and completed under full time inspection to better or equal industry best practices and the affected lots are suitable and safe for residential development, to the satisfaction of the Municipality.

26. That the developer shall provide each prospective lot purchaser and new homeowner with information about the fill area and extent of the fill area by registering this information and a fill map on title to the satisfaction of the Municipality.

27. A Holding Symbol will be placed on Blocks 50, 51 and 52 to prevent premature development of the lands. The Holding symbol would remain until a subdivision agreement for Phase 3 is entered into the with Municipality. The subdivision agreement shall speak to future development of Blocks 50, 51 and 52.

28. That the Subdivision Agreement between the Owner and Municipality shall include a provision that the Owner convey, upon registration of the plan, Block 55 to either the Municipality for road allowance, or the adjacent owner and that the Block 55 be transferred to the adjacent owners and be merged in the exact same name and title.

29. The stormwater management plan will be completed to the satisfaction of the Upper Thames River Conservation Authority and the Municipality, and shall obtain the necessary approvals from the Ministry of the Environment, Conservation and Parks (MECP). Such report shall be prepared for the entire development and detail interim measures for the development of Phase 1.

30. The Hydrogeological study shall include a Chloride Impact Assessment and will be completed to the satisfaction of the Ministry of the Environment, Conservation and Parks (MECP) and the Municipality, and shall obtain the necessary approvals from the MECP.

31. That prior to final approval, the County is to be advised in writing by the Municipality of Middlesex Centre, how conditions 1 through 30 have been satisfied.

32. That prior to final approval, the County is to be advised in writing by the Upper Thames River Conservation Authority how condition 29 have been satisfied.

**NOTES TO DRAFT APPROVAL**

1. Draft approval for this plan of subdivision is for a period of three (3) years from the date of decision. Any request made by the Owner to the Approval Authority to extend the lapsing date must be made 60 days prior to the lapsing date and include a written confirmation from the municipality endorsing the extension.

2. It is the applicant's responsibility to fulfill the conditions of draft approval and to ensure that the required clearance letters are forwarded by the appropriate agencies to the approval authority, quoting the file number.

3. It is suggested that the applicant be aware of:

    a) subsection 144 (1) of The Land Titles Act, which requires all new plans be registered in a land titles system;

    b) subsection 144 (2) - allows certain exceptions.

4. Inauguration, or extension of a piped water supply, a communal sewage system or a storm water management system, is subject to the approval of the Ministry of Environment under Section 52 and Section 53 of the Ontario Water Resources Act.

5. The Ministry of Environment must be advised immediately should waste materials or other contaminants be discovered during the development of this plan of subdivision.

6. A copy of the subdivision agreement must be provided to the County of Middlesex (Planning Department) prior to final plan approval.

7. If the agency’s condition concerns a condition in the subdivision agreement, a copy of the agreement should be sent to them. This will expedite clearance of the final plan.

8. When the zoning by-law amendment required in Condition 5 is being prepared, reference to this

subdivision application file number should be included in the explanatory note. This will expedite the County of Middlesex and other agencies' consideration of the by-law.

9. Clearance is required from the following agencies:

   Municipality of Middlesex Centre | 10227 Ilderton Road, Coldstream N0M 2A0

   Upper Thames River Conservation Authority | 1424 Clarke Road, London, N5V 5B9

10. All measurements in subdivision final plans must be presented in metric units.

11. The final plan approved by the County of Middlesex must include the following paragraph on all copies (3 Mylars and 4 paper) for signature purposes:

    *"Approval Authority Certificate*
    *This Final Plan of Subdivision is approved by the County of Middlesex under Section 51(58) of the Planning Act, R.S.O. 1990, on this _______ day of .*
    *_____________, 201____ .*

    *________________________________*
    *Director of Planning"*

12. The final plan must be submitted digitally in AutoCAD (DWG) and Portable Document Format (PDF) with the appropriate citation from the Planning Act used. The AutoCAD (DWG) file must be consistent with the following standards:

    - Georeferenced to the NAD83 UTM Zone 17N coordinate system.
    - All classes of features must be separated into different layers.
    - Each layer should be given a descriptive name so that the class of feature it contains is recognizable.

13. The final plan approved by the County of Middlesex must be registered within 30 days or the County may withdraw its approval under Subsection 51(59) of the Planning Act.

14. All the above conditions shall apply to every Phase of development unless otherwise noted.

**Meeting Date:** **September 8, 2021**

**Submitted by:** **Marion-Frances Cabral**

**Report No:** **PLA-72-2021**

**Subject:** **Application for Draft Plan of Subdivision (39T-MC2004) and Zoning By-law Amendment (ZBA-24-2020); Filed by Kevin Muir (GSP Group) on behalf of 2270942 Ontario Ltd.**

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## Recommendation:

THAT Zoning By-law Amendment application (ZBA-24-2020), as amended, for 10125 Oxbow Drive filed by Kevin Muir on behalf of 2270942 Ontario Limited to rezone the subject land from ‘Extractive Industrial(M4)’ to ‘Urban Residential First Density with hold (UR1)(h-1)’, ‘Urban Residential First Density exception 41 (UR1-41)’, ‘Urban Residential First Density exception 42 with hold (UR1-42)(h-1)’, ‘Urban Residential First Density exception 43 with hold (UR1-43)(h-1)’, ‘Urban Residential Third Density exception 16 with hold (UR3-16)(h-1)’, and ‘Open Space (OS)’ be APPROVE;

AND THAT the County of Middlesex be advised that Middlesex Centre recommends draft plan approval for the land known legally as Concession 2 Part Lot 6, former Township of Lobo, Middlesex Centre, County File: 39T-MC2004, subject to the draft plan conditions appended to the Middlesex Centre report PLA-72-2021, and subject to a three (3) year lapse period.

## Purpose:

The purpose of this report is to provide Council with information for a draft plan of subdivision and zoning by-law amendment proposal for the property known municipally as 10125 Oxbow Drive and located south side of Oxbow Drive and east of Komoka Road in the village of Komoka. The land is legally described as Concession 2, Part Lot 6, geographic Township of Lobo, Municipality of Middlesex Centre.

A location map is included as Attachment 1.

## Background:

The subject property is located within the Komoka and Kilworth Settlement Area and has access onto Oxbow Drive. The property is east of the existing built up community of Komoka and is bound agricultural and residential uses to the north, the FireRock Golf

Club to the east, and Komoka Park, Komoka Community Centre and residential uses to the south. The subject property is irregularly shaped and is approximately 7.7 ha (19.03 ac) in area. Previously the lands were used as a gravel pit but are currently vacant and contains a ‘borrow pit’ that is regularly filled with water.

Prior to the current plan of subdivision and zoning by-law amendment applications, three (3) residential lots along Oxbow Drive were severed and rezoned from the subject lands in 2018 and 2019, respectively. For reference the consents files are B-15-18, B-16-18 and B-17-18, and the rezoning file is ZBA-06-2019.

The land is currently designated ‘Residential’ and has an Aggregate Overlay in the Komoka-Kilworth Urban Settlement Area & Secondary Plan. The property is zoned ‘Extractive Industrial (M4)’.

Pre-application for the development proposal was held in April 2018 and again in October 2019. A formal submission was made by the applicant and the application was deemed complete on September 25, 2020. Staff subsequently provided notice of applications to area residents and various agencies.

The plan of subdivision application proposes residential uses and stormwater management on 5.24 ha (12.95 ac) of the site which excludes the borrow pit due to development constraints. Since the public meeting in December 2020, the applicant revised the plan of subdivision related to technical comments regarding stormwater management and phasing of the development. However, the overall design features were generally maintained and include the following:

- 48 lots for single detached dwellings which is 2.73 ha (6.75 ac) in area. 10 lots are planned for Phase 1, 32 lots are planned for Phase 2, and 6 lots are planned for Phase 3.

- 1 block (Block 55) on Oxbow Drive and west of Street A that is 0.01 ha (0.02 ac) in area will be added to an existing residential lot to the west.

- 1 block (Block 49) for 8 street townhomes in Phase 3 which is 0.38 ha (0.0.94 ac) in area.

  The area of Block 49 increased in area to include lands to the north and east that will be conveyed and added to abutting land once development is considered on the neighbouring land. This could result in 3 additional residential lots fronting onto both Oxbow Drive and future Street B.

- 1 block for the stormwater management pond which is 0.47 ha (1.16 ac) in area. The area of the stormwater management pond increased as a result of the revised design of the system.

- A walkway/trail on the southern perimeter of the property and to be considered as part of the parkland dedication. The length of the trail was reduced to avoid a trail system to the rear of the stormwater management system and Lot 28, and better connect to the existing paths in the abutting park.

- Street A which connects to Oxbow Drive in two (2) locations – at Union Avenue and Oxbow Drive intersection, and across from the entrance to the Country Terrace home.
- Street B which runs parallel to Oxbow Drive. A turning circle (Block 50, 51 and 52) is proposed at the end of Street B and will be removed when development and the extension of Street B on lands to the east are planned. At such time, Blocks 50, 51 and 52 will be available for future residential development fronting onto Street B.
- The existing borrow pit to be retained by the owner and become a buildable lot for one single detached dwelling. This area is not part of the plan of subdivision but subject to the zoning by-law amendment application.

The revised plan of subdivision is included at Attachment 2.

In addition to the plan of subdivision, the applicant submitted a zoning by-law amendment to permit the residential development. The amendment would change the zoning on the land from ‘Extractive Industrial (M4)’ to:

- two (2) site specific ‘Urban Residential First Density exception x (UR1-x)’ zones to permit single detached dwellings along Oxbow Drive (Phase 1) and the interior of the plan of subdivision (Phase 2 and 3);
- a site specific ‘Urban Residential Third Density exception x (UR3-x)’ zone to permit the street townhouse dwellings on Street B (Phase 3);
- the ‘Open Space (OS)’ zone for the areas that contain the stormwater management pond and trail, and the retained lands not included within the plan of subdivision; and,
- the ‘Urban Residential First Density (UR1)’ and ‘Open Space (OS)’ zone for the retained lands not included within the plan of subdivision and where the existing borrow pit is located.

The applicant submitted the following reports as part of their submission:

- Planning Justification Report (Attachment 3)
- Final Servicing Report (Attachment 4)
- Transportation Impact Study (Attachment 5)
- Stormwater Management Report (Attachment 6)

- Stage 1 and 2 Archaeological Assessment (Attachment 7)
- Proposed Draft Plan Conditions (Attachment 8)

**Policy Regulation:**

The Middlesex County Official Plan identifies Komoka as a settlement area and defers to municipal official plans to delineate the boundaries of the settlement area. The subject property is within the Komoka Settlement Area and is designated as 'Residential' and has an Aggregate Overlay within Middlesex Centre's Official Plan. The subject property is currently zoned 'Extractive Industrial (M4)' within the Middlesex Centre's Comprehensive Zoning By-law.

As such, the policies and provisions below are applicable to the lands.

Provincial Policy Statement, 2020:

The Planning Act states that all decisions made by planning authorities/municipalities "shall be consistent with the policy statements issued" under subsection 3. The Provincial Policy Statement, 2020 (PPS) document is comprised of several policy statements and those that are applicable to the proposed development are noted below:

Generally, the PPS promotes healthy, liveable and safe communities by supporting efficient land use patterns that facilitate economic growth, create liveable communities, and protect the environment and public health and safety.

Section 1.0 – Building Strong Healthy Communities establishes policies that support long-term prosperity, environmental health and social well-being within communities.

Section 1.1 – Managing and Directing Land Use to Achieve Efficient and Resilient Development and Land Use Patterns identifies that healthy communities are sustained by accommodating an appropriate range and mix of uses, avoiding development patterns that cause environmental concerns, and promoting cost-effective development patterns that optimize the use of planned and future infrastructure.

Section 1.1.3 – Settlement Areas establishes that settlement areas can vary in size, population, and diversity and intensity of land uses. The PPS directs growth and development to settlement areas where new development varies in densities and land uses, and there are opportunities for intensification and redevelopment. New development patterns are based on the efficient use of land that minimize negative impacts to the environment, support active transportation and are appropriate for the infrastructure and public service facilities.

Sections 1.1.3.4 and 1.1.3.6 promote intensification, compact development, varying uses and densities where it avoids or mitigates risks to public health and safety and is adjacent to the existing built-up area. Section 1.1.3.5 also allows municipalities to establish a minimum target for intensification within built-up areas subject to local conditions.

Section 1.4 - Housing speaks to the provision of housing within a municipality. The PPS promotes an appropriate range and mix of housing types and densities and directs development of new housing towards areas where there is an appropriate level of infrastructure. Municipalities are to provide opportunities for all forms of housing and intensification to meet the social, health and well-being needs of the current and future community.

In support of healthy and active communities section 1.5 – Public Spaces, Recreation, Trails and Open Space promotes planning public street networks that foster social interaction and active transportation. Additionally, it recognizes the need for a full range of publicly-accessible recreational space such as trails and parklands.

Sections 1.6 – Infrastructure and Public Service Facilities directs that infrastructure and be provided in an efficient manner that also prepares for the impacts of a changing climate. Section 1.6.2 directs municipalities to promote green infrastructure to complement existing infrastructure such as permeable surfaces, green roofs, and street trees.

Section 1.6.6 – Sewage, Water and Stormwater directs future growth and development to efficiently use and optimize existing services such as municipal sewage and water services, when available. Municipal sewage and water services are the preferred form of servicing for settlement areas.

Section 1.6.6.7 promotes planning for stormwater management that minimizes or prevents an increase in negative impacts on the environment and water system; does not increase risks to human health and safety and property damage; and uses best practices, vegetation, and pervious surfaces as part of an effective stormwater management system.

Section 1.6.7 – Transportation Systems directs transportation and land use coordination to be considered at all stages of the planning process. Transportation networks should be safe, energy efficient and facilitate the movement of people and goods. Efficient development patterns, and a mix of uses and densities should also be promoted to minimize the number of vehicle trips and support active transportation.

Section 2.5 – Mineral Aggregate Resources states that mineral aggregate resources shall be protected for long-term use and shall be identified. Further direction directs that resources as is realistically possible shall be made available as close to markets as possible. If known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if the resource use would not be feasible; or the proposed land use or development serves a greater long-term public interest; and issues of public health, public safety and environmental impact are addressed.

Middlesex County's Official Plan:

The County of Middlesex Official Plan (County Plan) identifies the subject property as within the Komoka 'Settlement Area'.

Section 2.2.3 – Aggregate Resources recognizes the need to balance competing priorities for the protection of aggregate resources for future extraction and the need to protect agricultural land, the natural system and other sensitive land uses. In areas of significant aggregate resources, uses which do not preclude future resource extraction may be permitted in accordance with the underlying land use designation. All uses which would preclude resource extraction shall be discouraged until such time as the resource has been substantially depleted.

Where supporting documentation is provided that demonstrates that the aggregate resource is of secondary quality and extraction is neither practical nor economically feasible, the subject lands may be used for a land use other than agriculture provided such land use conforms with the local official plan.

Section 2.3.8 – Policy Framework-Settlement Areas of the County Plan recognizes that Settlement Areas will be the focus for future growth including residential uses. These areas are intended to have a wide range of land uses and full municipal servicing in conjunction with 2.4.5 of the County Plan. Additionally, section 2.3.7 encourages a wide variety of housing types, sizes and tenure to meet market requirements and demand for current and future residents.

Section 3.2 – Detailed Land Use Policies-Settlement Areas provides additional development policies for lands within Settlement Areas. The County Plan further supports that Settlement Areas are developed in a manner that is phased and compact, and preserves the historic character of Settlement Areas and complements the positive elements of the existing built-form.

With regard to municipal sanitary sewers and water services, section 2.4.5 – Sanitary Sewers and Water of the County Plan promotes efficient and environmentally responsible development that can be supported by full municipal systems servicing.

Middlesex Centre's Official Plan:

The Middlesex Centre Official Plan (Official Plan) designates the subject lands as 'Residential' within the Komoka Settlement Area on Schedule A-2: Komoka-Kilworth Urban Settlement Area & Secondary Plan and contains an Aggregate Overlay on the southwest portion of the lands. Additionally, the official plan schedule identifies a stormwater management facility on the southwestern portion of the lands, and Hazards Lands and a Community Gateway on the northwest portion of the land.

Section 4.2 – Areas of Aggregate Resource Deposits provide policy direction for aggregate resource areas that have been shown as a policy overlay on Schedule A-2 and for new or expanding operations. For lands that are within or adjacent to resource area delineations, the uses permitted are those of the designations underlying the resource area so long as the use would not preclude or hinder extraction. Where extraction may be hindered or precluded, development may occur only if resource use would not be feasible; or the proposed land uses or development serves a greater long term public interest; and issues of public health, safety and environmental impact are addressed.

Section 4.6 – Rehabilitation of Aggregate Resource Sites direct that extractive sites be progressively rehabilitated to a land use corresponding with the land use designation established beneath the Aggregate Resource Area overlay. Should an applicant propose an afteruse not permitted within the underlying designation, an Official Plan Amendment to change the underlying designation would be required prior to establishment of the afteruse.

Section 5.2 – Residential Areas pertain to lands designated 'Residential' within settlement areas like the Komoka-Kilworth area. The 'Residential' designation permits a range of housing, institutional uses, municipal uses, parks or open space and group homes. The Municipality is to provide and encourage a wide variety of housing types, sizes and tenures to meet demographic and market requirements. The Municipality shall provide opportunities to increase the supply of housing through intensification while considering issues of municipal servicing capacity, transportation issues and potential environmental considerations. Specifically, the Municipality shall require that 15 percent of all development occur by way of intensification.

Residential development should also reflect a high quality of residential and neighbourhood design and have regard for the Municipality's Site Plan Manual and Urban Design Guidelines. This includes promoting a development that is designed to be sustainable and support public transit and oriented to pedestrians.

The Municipality shall also encourage housing accessible to lower and moderate income households. In this regard the County of Middlesex through its Official Plan will require that 20 percent of all housing be affordable.

Further, on Schedule A-2 identifies Hazard Lands on the subject land. This can include flood plain, flood prone areas, or slope hazards as mapped and/or regulated by a conservation authority. Additional study may be required to demonstrate that development or site alteration will not increase risk to life and property, and there will be no impact on flooding, slope stability, upstream or downstream properties, aggravation of existing natural hazard processes, or natural features or functions.

Section 5.2.3 – Policies for Multiple Dwellings in Residential Areas provides direction when considering multiple dwellings, including four plexes, townhouses and low/medium rise apartments. Locations should be proximate to adequate open space or park areas, schools, or Village Centre areas, like Komoka, where possible. Densities proposed should be compatible with adjacent densities when proposed adjacent to or within existing residential areas. Apartment dwelling should be located in proximity to a major roadway, or roadway suitable for carrying higher than average volume of traffic. The excessive clustering of multiple dwellings shall be avoided, and a general integration and distribution of such uses at appropriate locations within neighbourhoods or settlements is encourages. The siting of multiple dwellings adjacent to or in proximity to Village Centres is encouraged. Lastly, townhouses and apartments shall be subject to the site plan approval requirements of Section 41 of the *Planning Act* and Section 10.5 of the Official Plan, and have regard for the site plan manual and urban design guidelines.

Section 5.7.4 – Komoka-Kilworth Residential Area Policies summarized below apply to lands designated 'Residential' and 'Medium Density Residential' in Schedule A-2 of the Official Plan.

The types of housing, density of development and targeted mix within the Residential and Medium Density Residential designations on Schedule A-2 are as follows:

| **Use** | **Housing Mix Targets** | **Net Density (units per ha)** |
|---|---|---|
| Low density residential (e.g. singles, semis) | 60% | Less than 20 |
| Medium density residential (e.g. townhouses) | 40% | 20 to 50 |

The net density refers to the land area to be used for housing as well as the abutting local streets, but does not include major streets and other residentially associated land uses. Notwithstanding the housing mix targets and net density provisions, multiple dwellings shall be permitted in the Residential designation in accordance with Section 5.2.3 – Policies for Multiple Unit Dwellings in Residential Areas.

Development proposals within areas designated as 'Medium Density Residential' shall provide for a diverse mix of multi-unit housing forms and choices to accommodate the needs and lifestyles of people at different stages throughout their life.

Further, all residential development shall ensure appropriate orientation and massing of residential buildings to provide adequate private and public open spaces and to facilitate the penetration of sunlight into these spaces.

In addition to compliance with the urban design guidelines, private garages for residential development shall not project into the front yard than the habitable portion of the building or porch on the main floor in order to limit visual and streetscape impacts of garages.

Lastly, entrance features to new residential neighbourhood development shall be encouraged where features are landscape related and require minimal maintenance.

Section 5.7.11 – Komoka-Kilworth Servicing Policies identify that all land use and development proposals require full municipal services. This includes sanitary sewage collection and treatment, stormwater management and water distribution.

Section 6.3 – Design Policies-Site Plans and Infill Developments provide additional direction to guide infill development to ensure there is compatibility with existing residences and neighbourhoods. High quality site design and architectural design is encouraged for new medium density residential development. Setbacks, massing, location of parking, architecture and other design elements will be carefully reviewed to ensure new development is in keeping with the character of the neighbourhood.

Section 8.4 – Parks and Recreation Policies requires the municipality to receive 5% of lands to be developed or redeveloped for residential purposes be conveyed for public park or recreational purposes. Alternatively, at the Municipality's discretion, a parkland dedication may be required at a rate of one hectare for each 300 dwelling units proposed in the context of a plan of subdivision application. In the case of such parkland dedications, lands to be conveyed shall be of adequate size, dimension, drainage and grading for their intended recreational use, and will be of an appropriate size and shape to meet the needs and goals of the Municipality.

Stormwater detention areas and drains in this Plan shall not be accepted in fulfilment of this requirement, however, they may be accepted as an adjunct to a functional park area.

Connecting walkways and pedestrian grade separations, sidewalks and protective buffer areas between conflicting land uses shall not be considered as a portion of a parkland dedication.

Council may, at its discretion, accept payments of cash-in-lieu of parkland dedication in cases where park and recreational facility sites in the vicinity of the lands to be developed are adequate for present and future needs, or where parklands of adequate size could not be achieved, even in combination with adjoining lands. Cash-in-lieu of parkland payments shall be placed in a separate account and used for the acquisition or development of parkland within the Municipality.

Section 9.3 – Municipal Infrastructure and Services Policies identify that primary municipal services (water supply, sewage disposal and stormwater management) are present in Komoka. It is the policy of the Official Plan that future development in settlement areas proceed on the basis of full municipal services which is consistent with the Provincial Policy Statement, 2020 and County Official Plan policies for servicing.

Section 9.4 – Municipal Transportation Structure establishes policies for the road network within the Municipality. Policies within this section address appropriate setbacks and location of driveway accesses to minimum visual traffic hazards and provide opportunities for roadway widening of rights-of-way extensions.

Middlesex Centre Zoning By-law:

The subject land is zoned ‘Extractive Industrial (M4)’ within Middlesex Centre’s Comprehensive Zoning By-law.

The application to amend the zoning by-law creates several new site specific zones for the lots and blocks, and are described below. A rezoning map provided by the applicant is also shown in Attachment 3.

- Phase 1: the proposed single detached lots fronting on Oxbow Drive to a Site-specific Urban Residential First Density (UR1-42) zone., with the site-specific regulations permitting a reduced minimum lot area, reduced minimum lot frontage for lots fronting on Oxbow Drive, reduced minimum front yard setback, and increased maximum lot coverage for main buildings and accessory buildings;

  A summary of the site-specific request is in the table below:

| | **Proposed UR1-42 zone (Phase 1)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Home Occupation<br>Single Detached Dwelling |
| **Minimum Lot  Area** | 380 m$^2$ (4, 090 ft$^2$) |
| **Minimum Lot Frontage** | 12 m (39.4 ft) |
| **Minimum Front Yard Setback** | 8 m (26.3 ft) |
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line) |
| **Maximum Lot Coverage** | 46% for the main use<br>49% for all buildings including accessory buildings subjection to |

| | |
|---|---|
| | Section 4.1 (a) of the zoning by-law |

- Phase 2 and Phase 3: the remainder of proposed single detached lots internal to the subdivision to a site-specific Urban Residential First Density (UR1-43) zone, with the site-specific regulations permitting a reduced minimum lot area, reduced minimum lot frontage for lots fronting on Oxbow Drive, reduced minimum front yard setback, and increased maximum lot coverage for main buildings and accessory buildings;

  A summary of the site-specific request is in the table below:

| | **Proposed UR1-43 zone (Phase 2 and Phase 3)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Home Occupation<br>Single Detached Dwelling |
| **Minimum Lot  Area** | 380 m$^2$ (4, 090 ft$^2$) |
| **Minimum Lot Frontage** | 12 m (39.4 ft) |
| **Minimum Front Yard Setback** | 4.5 m (14.8 ft) to porch or habitable portion<br>6.0 m (19.7 ft) to attached garage |
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line) |
| **Maximum Lot Coverage** | 48% for the main use<br>51% for all buildings including accessory |

| | **Proposed UR1-43 zone (Phase 2 and Phase 3)** |
|---|---|
| | buildings subjection to Section 4.1 (a) of the zoning by-law |

- Phase 3: the proposed townhouses block rezoned to a site-specific Urban Residential Third Density (UR3-16) zone, the regulation permitting a reduced minimum lot depth and increased maximum lot coverage for main buildings and accessory buildings.

  A summary of the site-specific request is in the table below:

| | **Proposed UR3-16 zone (Phase 3)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Apartment Dwelling<br>Multiple Unit Dwelling<br>Street Townhouse Dwelling<br>Townhouse Dwelling |
| **Minimum Lot  Depth** | 29 m (95.1 ft) |
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line)<br>No side yard setback required between common walls dividing dwelling units |
| **Maximum Density** | 35 units per hectare |

|  | **Proposed UR3-16 zone (Phase 3)** |
|---|---|
| **Maximum Lot Coverage** | 55% for the main use<br>58% for all buildings including accessory buildings subjection to Section 4.1 (a) of the zoning by-law |

- The remnant parcel containing the borrow pit and retained by the Owner, and not subject to the Draft Plan of Subdivision, rezoned to the Open Space (OS) and Urban Residential First Density (UR1) zones.

- The trail and stormwater management pond area rezoned to the Open Space (OS) zone.

**Consultation:**

Notice of the application has been circulated to agencies, as well as property owners in accordance with the *Planning Act* and Ontario Regulation 544/06.

**Public Comments:**

Prior to the public meeting in December 2020 staff received the following comments from area residents:

- Concern about the additional stormwater runoff resulting from this subdivision.

- Is there potential for lawn chemicals, road salt, etc. from these subdivisions finding its way into the ground water in the areas especially where residents are on well systems? Chemicals may also find their way into the Oxbow creek drainage.

Further, at the public meeting the following comments were received:

- Any fill and grading of the lands needs to be stable as there is a significant grade drop west of Union Avenue

- The geotechnical report raises some flags given the slope of the lands

- Given the amount of engineering and fill required for the lands, the lots may be expensive and may not meet the Official Plan policies for affordable/attainable housing and need.

**Agency Comments:**

At the time of writing the subject report the following comments were received:

The Municipality's Chief Building Official has reviewed the applications and has concerns of the settlement of soil within the lots which used to be a pond. It's recommended that a Hold symbol be applied to lots that were formerly a pond, in whole or in part, until a geotechnical investigation shows that the lands are suitable and safe for development.

The Municipality's Public Works and Engineering Department did not provide comments at the time of the public meeting in December 2020. However, comments were provided later related to the detailed design of the site.

The Municipality's Director of Community Services reviewed the application and note the trail provided on the plan of subdivision. During preconsultation in 2019 the conceptual plan shows a trail extending the entire southern boundary connecting the Komoka Park to the abutting property to the east. The trail shown on the 2019 conceptual plan is preferred in consideration of future development to the east of the subject lands. Further, there is a significant elevation change from Oxbow Drive to the water tower area. A connection point from the subject lands to the park should be considered.

Bell Canada recommends the following conditions of Draft Plan Approval:

"The Owner acknowledges and agrees to convey any easement(s) as deemed necessary by Bell Canada to service this new development. The Owner further agrees and acknowledges to convey such easements at no cost to Bell Canada.

The Owner agrees that should any conflict arise with existing Bell Canada facilities or easements within the subject area, the Owner shall be responsible for the relocation of any such facilities or easements at their own cost."

Canada Post reviewed the proposal and advised the applicant to consult with Canada Post to determine a suitable permanent location for a community mailbox and that the applicant agrees to provide a walkway, curb and base pad for the community mailbox. Canada Post requests to be notified of any changes or approval to the plan of condominium.

Conseil Scolaire Viamonde has not comment regarding the applications.

County of Middlesex – Emergency Services provided comments related to the proposed naming and addressing of the subdivision, location of fire hydrants, and visibility of addressing signage. Detailed comments have been provided to the proponent.

Enbridge Gas reviewed the proposal and requests the following condition of Draft Plan Approval:

"That the Owner/Developer provide to Union Gas the necessary easements and/or agreements required by Union Gas for the provision of gas services for the project, in a form satisfactory to Enbridge Gas Inc."

Hydro One has no comments or concerns with the applications at this time.

Rogers has no comments or concerns with the applications at this time.

The Thames Valley District School Board have sated they have no comments or concerns with the applications.

The Upper Thames Region Conservation Authority (UTRCA) has no objections to the applications and recommend the following condition of Draft Plan Approval:

"That the owner submit for review and approval a Stormwater Management Plan, and Sediment and Erosion Control Plan and Final Detailed Servicing and Grading Plans prepared to the satisfaction of the Upper Thames River Conversation Authority and the Municipality of Middlesex Centre."

**Analysis:**

The plan of subdivision is generally supported by the PPS and the County Official Plan. To consider the appropriate of the proposed plan of subdivision it must conform to the policies of the Middlesex Centre Official Plan:

a) **Plans of subdivision will not be required where three or fewer new lots are proposed to be created or where circumstances exist where a plan of subdivision is not considered by the Municipality to be necessary. Where more than three new lots are to be created, the Municipality may exercise flexibility in determining whether a plan of subdivision process is required. Notwithstanding the above, in all cases where the creation or extension of municipal streets and/or services is proposed, a plan of subdivision process will be required.**

   A total of 48 lots for single detached dwellings, 1 block for 8 townhouse dwellings, 3 blocks for future residential use, a stormwater management pond, a trail and municipal roads are proposed. A plan of subdivision is an appropriate method to subdivide the land, and address the creation of open space and parkland, trails, and extension of municipal roads.

b) **When considering plans of subdivision applications, the review is to consider whether the proposed development is premature. One key consideration of this review relates to the availability of appropriate services and capacity. Other relevant factors may also be considered.**

   Full municipal services are provided within the community of Komoka. Municipal staff have advised that there is sufficient servicing capacity to accommodate the proposed plan of subdivision.

c) **The review of plans of subdivision within the Municipality will be based in part on consideration of design policies included in Section 6.0 of this Plan and the Municipality's Urban Design Guidelines.**

In conformity with the Official Plan and Secondary Plan for the Komoka-Kilworth area, the development of single detached dwellings and townhouse dwellings will need to consider the municipality's Urban Design Guidelines. Additionally, private garages for new residential development shall not be located closer to the street than the habitable portion or porch on the main floor of the building to limit the visual and streetscape impacts of garages and encourage a positive street frontage oriented to pedestrians.

Further review of the development of blocks for medium density development will consider the urban design guidelines to ensure the development is appropriate and does not conflict with the surrounding low-density development. Additionally, review by the public and agencies are reflected into the design of the plan of subdivision and lot fabric that better integrates the plan of subdivision into the existing community and supports connectivity with future development surrounding the subject lands.

**d) Where possible, plans of subdivision within the Municipality will incorporate a mixture of housing types and levels of affordability in keeping with policies included in Residential policies included in Section 5.2 of this Plan.**

A majority of the developable lands are for single detached dwelling. However, the applicant has requested to rezone Block 49 to permit street townhouse dwellings to provide a mixture of housing options for current and future residents.

**e) All lots within a proposed plan of subdivision must have frontage on a public road which is or will be opened and maintained on a year round basis, and constructed to an acceptable Municipal standard.**

Lots 1 to 48, and Block 49 will have direct frontage onto Oxbow Drive or proposed Streets A and B which will be public right-of-ways. Future development on blocks 50, 51 and portions of Block 49 are proposed to have frontage onto Oxbow Drive or Street B when the lands have direct access to the public rights-of-way.

**f) Plans of subdivision that respect natural contours and topography will be encouraged. All unique natural features and assets, as well as heritage features, should be preserved and integrated into the subdivision design.**

The plan of subdivision does not consider development in the location of the existing borrow put.

Engineered fill is proposed to grade the lands appropriately to accommodate new residential development. Through the conditions of draft plan approval, final approval of the plan of subdivision will be given when the Owner provides the Municipality with documentation from a qualified professional engineer certifying that the fill areas have been compacted and completed under inspection, and that the lots are suitable and safe for residential development. Additionally, the developer will need to provide each prospective lot buyer and homeowner with information and extend of the fill area, and the fill map will be registered on title.

There are no natural heritage features on the subject lands.

g) **For large plans of subdivision, consideration of appropriate staging or phasing will be included.**

The proposed plan of subdivision is proposed to have three phases of development. Phase 1 will be the creation of residential lots along Oxbow Drive. Phase 2 will be the creation of residential lots and blocks for stormwater management and a trail along proposed Streets A and B. Phase 3 will be the creation of residential lots and blocks along Street B. Further subdivision of blocks in Phase 3 will create lots along Street B and Oxbow Drive when lands have direct access to the public right-of-way.

h) **It is the policy of this Plan that all new plans of subdivision be subject to a subdivision agreement between the Municipality and the owner / developer. This agreement shall address various matters pertaining to the plan of subdivision, as determined by the Municipality.**

The applicant will be required to enter into a subdivision agreement with the municipality prior to final plan approval each phase of the development. Each phase may result in separate or combined agreements. The subdivision agreement will need to address all draft plan conditions seen in Attachment 8.

i) **Park land dedication provided to the Municipality in keeping with Section 9.5 of this Plan, must be considered suitable for park land purposes and acceptable to the Municipality. Under no circumstances shall Municipal Council be obligated to accept park land which is being offered by an applicant for a proposed plan of subdivision. Park land dedications shall be reviewed in the context of public realm policies included in Section 6.0 of this Plan.**

The applicant will convey up to 5% of the land included within the plan of subdivision. The conveyance includes Block 53 (walkway/trail) but does not include Block 54 (stormwater management pond). Additionally, the municipality can accept cash-in-lieu of all or a portion of the conveyance.

The walkway/trail will extend along the southern perimeter of the lands and is intended to connect to Komoka Park and eventually lands to the west.

j) **The extent to which the plan’s design optimizes the available supply, means of supplying, efficient use and conservation of energy.**

The proposed plan of subdivision optimizes existing infrastructure and developable land available while maintaining a consistent lot fabric with the surrounding community.

k) **The interrelationship between the design of the proposed plan of subdivision and site plan control matters relating to any development on the land, if the land is also located within a site plan control area.**

The plan of subdivision is applicable to a majority of the property and site plan control is not contemplated for future residential development. The plan of subdivision addresses a number of matters including the design of the subdivision, construction, the orderly development of lands, infrastructure and servicing, conformity with municipal standards and conveyance of land.

l) **That highways, including pedestrian pathways, bicycle pathways and public transit rights of way, be dedicated as the approval authority considers necessary.**

The proposed trail will be a public trail along the southern perimeter of the subject lands and connects the subdivision to the existing park to the south, and to future development to the east. Pedestrian pathways, sidewalks, and rights of ways are to be dedicated to the municipality. This includes Streets A and B on the proposed plan of subdivision.

Staff reviewed the proposed rezoning request and are generally satisfied with the proposed site-specific zones as they are generally consistent with low-density and medium-density development within the Kilworth and Komoka area. Staff recommend the following revisions to the requested zoning:

- The existing site-specific ‘Urban Residential First Density exception 41 (UR1-41)’ zone will apply to Block 55 to facilitate the merger with the lot to the west and be consistent with the existing zoning.

- The new site-specific ‘Urban Residential First Density exception 42 (UR1-42)’ zone will have: a revised minimum front yard setback of 8 m (26.2 ft) to the habitable portion of the dwelling and the garage will not extend into the front yard to avoid snout houses; a revised maximum lot coverage of 38% for the dwelling and 41% for all buildings.

- The new site-specific ‘Urban Residential First Density exception 43 (UR1-43)’ zone will have a revised maximum lot coverage of 43% for the dwelling and 46% for all buildings;

- The new site-specific ‘Urban Residential Third Density exception 16 (UR3-16)’ zone will: permit only street townhouse dwellings and accessory uses; and have a revised side yard setback between common walls.

The Ministry of the Environment, Conservation and Parks (MECP) has requested further study of chloride levels within the groundwater which can have multiple sources including storm runoff. A special draft plan condition is included to address chloride levels as part of the hydrogeological study and overall stormwater management plan.

A majority of the runoff from the lands is intended to be directed to groundwater. However, the remainder of the runoff that is not generated from roof areas will be directed to oil grit separators for treatment. The stormwater management facility will receive runoff generated from the controlled areas which represents a majority of the development. In the event of a 25-year storm, runoff flows will spill over into the adjacent borrow pit.

Street B is proposed to temporarily terminate as a turning circle on the eastern portion of the land in Phase 3. The turning circle is to be constructed to a permanent standard, however, the intention to is extend Street B east at the time of future development and convert the turning circle into lots for residential development. The details of turning circle will be addressed through the Phase 3 subdivision agreement.

Staff have also recommended a special condition to include traffic calming measures on Street A and/or Street B in recognition of the vehicle speeding in neighbourhood areas.

Given the above and review by the public, agencies and council, planning staff is satisfied that the subject applications are consistent with the PPS, 2020, and in conformity with both the County of Middlesex and Middlesex Centre Official Plans and comprehensive zoning by-law. As such, it is appropriate that Middlesex Centre recommend draft plan approval subject to the attached draft plan conditions and approval of the zoning by-law amendment, as amended.

This opinion is provided as a result of the public meeting and with the benefit of receiving comments from agencies or members of the public. Should new information arise regarding this proposal prior to or at the meeting, Council is advised to take such information into account when considering the application.

## Financial Implications:

None.

## Strategic Plan:

This matter aligns with following strategic priorities:

- Balanced Growth

## Attachments:

Attachment 1 – Location Map

Attachment 2 – Proposed Plan of Subdivision

Attachment 3 – Planning Justification Report

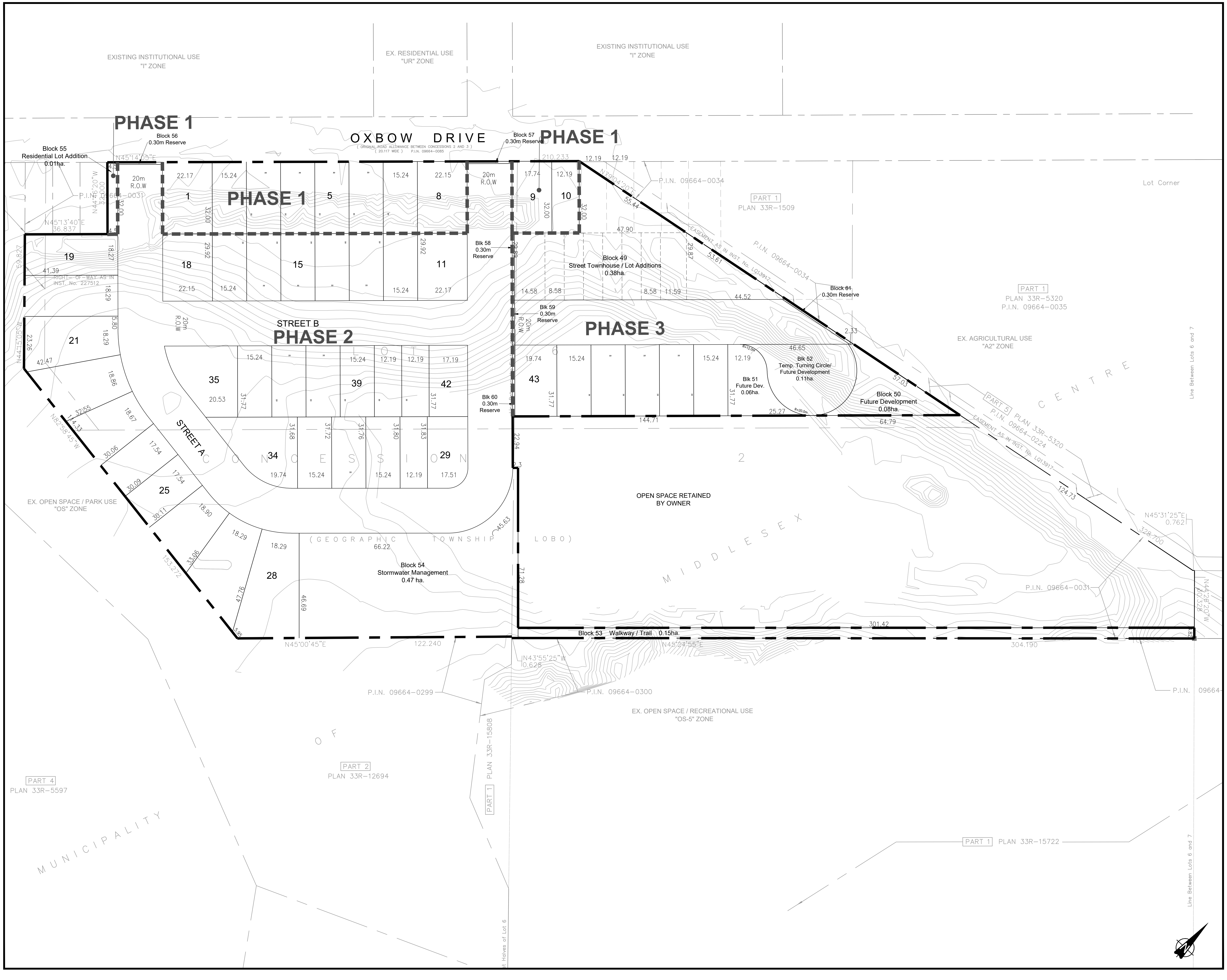
Attachment 4 – Final Servicing Report

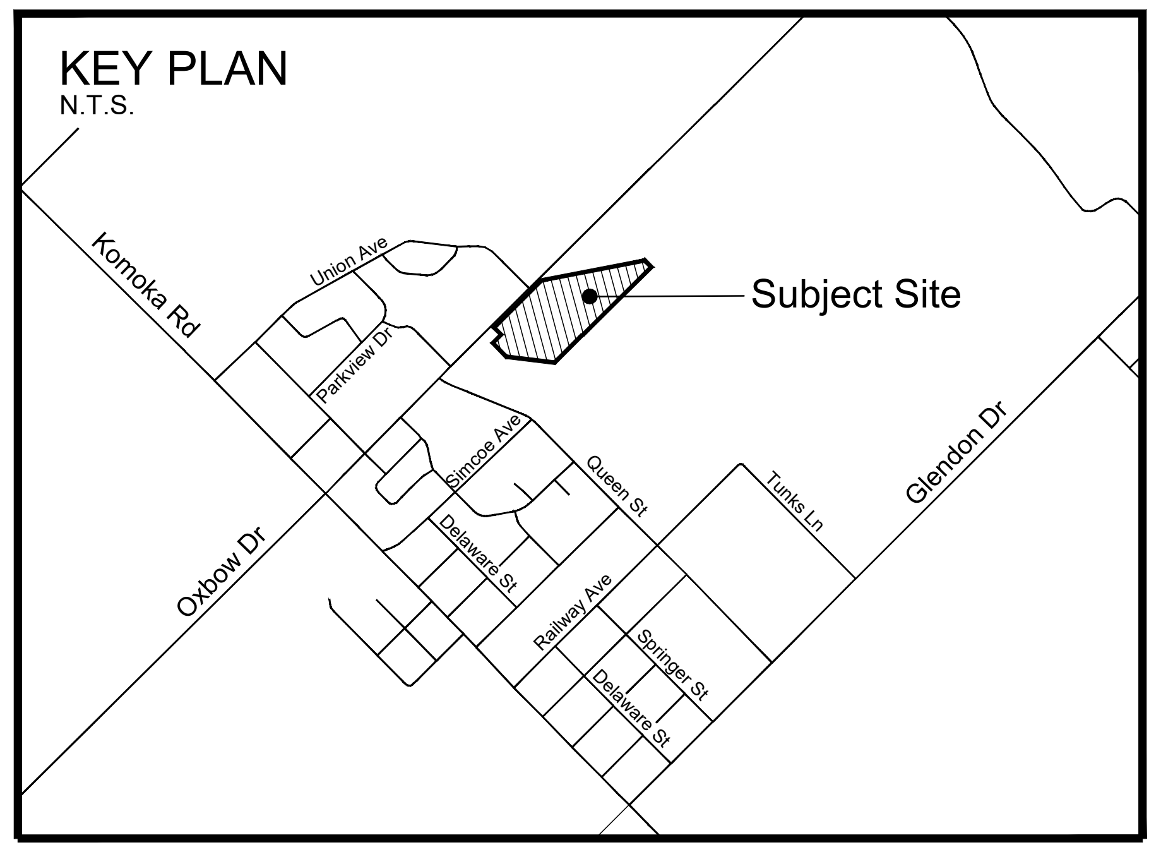
Attachment 5 – Transportation Impact Study

Attachment 6 – Stormwater Management Report

Attachment 7 - Stage 1 and 2 Archaeological Assessment

Attachment 8 – Proposed Draft Plan Conditions





# DRAFT PLAN OF SUBDIVISION

Part of Lot 6
Concession 2
(Geographic Township of Lobo)
Municipality of
Middlesex Centre

10125 Oxbow Drive

## LAND USE SCHEDULE

| PHASE 1 | LOTS/BLKS. | UNITS | AREA (ha.) |
|---|---|---|---|
| Single Detached Residential | 1-10 | 10 | 0.53 |
| Residential Lot Addition | 55 | | 0.01 |
| Total | | 10 | 0.54 |
| **PHASE 2** | LOTS/BLKS. | UNITS | AREA (ha.) |
| Single Detached Residential | 11-42 | 32 | 1.90 |
| Walkway / Trail | 53 | | 0.15 |
| Stormwater Management | 54 | | 0.47 |
| 0.3m Reserve | 56-57 | | 0.00 |
| Road | | | 1.12 |
| Total | | 32 | 3.64 |
| **PHASE 3** | LOTS/BLKS. | UNITS | AREA (ha.) |
| Single Detached Residential | 43-48 | 6 | 0.30 |
| Street Townhouse / Lot Addition | 49 | 8 | 0.38 |
| Future Development | 50-51 | | 0.14 |
| Temp. Turning Circle / Future Dev | 52 | | 0.11 |
| 0.3m Reserve | 58-61 | | 0.00 |
| Road | | | 0.28 |
| Total | | 14 | 1.21 |
| TOTAL | | 56 | 5.39 |

## ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and l ARE AS SHOWN ON THE DRAFT PLAN.

h) Municipal water supply
i) Brown silt
k) All sanitary and storm sewers as required

## OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO

OWNER DATE

## SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

SURVEYOR DATE

GSP group
PLANNING I URBAN DESIGN I LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS
June 2, 2021
July 6, 2021

| | | |
|---|---|---|
| Date: June 12, 2020 | Drawn By: MN | Dwg. File Name:dp18015f.dwg |
| Scale: 1: 750 metric | Project No.: 18015 | |

**Meeting Date:** **December 16, 2020**

**Submitted by:** **Marion-Frances Cabral, Planner**

**Report No:** **PLA-79-2020**

**Subject:** **Application for Draft Plan of Subdivision (39T-MC2004) and Zoning By-law Amendment (ZBA 24/20); Filed by Kevin Muir (GSP Group) on behalf of 2270942 Ontario Ltd.**

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## Recommendation:

THAT Report PLA-79-2020 be RECEIVED FOR INFORMATION.

## Purpose:

The purpose of this report is to provide Council with information for a draft plan of subdivision and zoning by-law amendment proposal for the property known municipally as 10125 Oxbow Drive and located south side of Oxbow Drive and east of Komoka Road in the village of Komoka. The land is legally described as Concession 2, Part Lot 6, geographic Township of Lobo, Municipality of Middlesex Centre.

A location map is included as Attachment 1.

## Background:

The subject property is located within the Komoka and Kilworth Settlement Area and has access onto Oxbow Drive. The property is east of the existing built up community of Komoka and is bound agricultural and residential uses to the north, the FireRock Golf Club to the east, and Komoka Park, Komoka Community Centre and residential uses to the south. The subject property is irregularly shaped and is approximately 7.7 ha (19.03 ac) in area. Previously the lands were used as a gravel pit but are currently vacant and contains a ‘borrow pit’ that is regularly filled with water.

Prior to the current plan of subdivision and zoning by-law amendment applications, three (3) residential lots along Oxbow Drive were severed and rezoned from the subject lands in 2018 and 2019, respectively. For reference the consents files are B-15-18, B-16-18 and B-17-18, and the rezoning file is ZBA-06-2019.

The land is currently designated ‘Residential’ and has an Aggregate Overlay in the Komoka-Kilworth Urban Settlement Area & Secondary Plan. The property is zoned ‘Extractive Industrial (M4)’.

Pre-application for the development proposal was held in April 2018 and again in October 2019. A formal submission was made by the applicant and the application was deemed complete on September 25, 2020. Staff subsequently provided notice of applications to area residents and various agencies.

The plan of subdivision application proposes residential uses and stormwater management on 5.24 ha (12.95 ac) of the site which excludes the borrow pit due to development constraints. The design features of the plan include the following:

- 49 lots for single detached dwellings which is 2.76 ha (6.82 ac) in area.
- 1 lot for a single detached dwelling or open space which is 0.08 ha (0.20 ac) in area.
- 8 lots for street townhomes which is 0.23 ha (0.57 ac) in area.
- 1 block for the stormwater management pond which is 0.43 ha (1.06 ac) in area.
- A walkway/trail on the southern perimeter of the stormwater management pond and to be considered as part of the parkland dedication.
- Street A which connects to Oxbow Drive in two (2) locations – at Union Avenue and Oxbow Drive intersection, and across from the entrance to the Country Terrace home.
- Street B which runs parallel to Oxbow Drive.
- Borrow pit to be retained by the owner and become a buildable lot for a single detached dwelling. This area is not part of the plan of subdivision but subject to the zoning by-law amendment application.
- The plan is to be developed in four (4) phases.

The proposed plan of subdivision is included at Attachment 2.

In addition to the plan of subdivision, the applicant submitted a zoning by-law amendment to permit the residential development. The amendment would change the zoning on the land from ‘Extractive Industrial (M4)’ to:

- two (2) site specific ‘Urban Residential First Density exception x (UR1-x)’ zones to permit single detached dwellings along Oxbow Drive (area 1) and the interior of the plan of subdivision (area 2);
- a site specific ‘Urban Residential Third Density exception x (UR3-x)’ zone to

permit the townhouse dwellings (area 3);

- the ‘Open Space (OS)’ zone for the areas that contain the stormwater management pond and trail; and,
- the ‘Urban Residential First Density (UR1)’ zone for the lands where the existing borrow pit is located.

The proposed zone map is included as Attachment 3.

The applicant submitted the following reports as part of their submission:

- Planning Justification Report (Attachment 4)
- Final Servicing Report (Attachment 5)
- Transportation Impact Study (Attachment 6)
- Stormwater Management Report (Attachment 7)
- Stage 1 and 2 Archaeological Assessment (Attachment 8)

**Policy Regulation:**

The Middlesex County Official Plan identifies Komoka as a settlement area and defers to municipal official plans to delineate the boundaries of the settlement area. The subject property is within the Komoka Settlement Area and is designated as ‘Residential’ and has an Aggregate Overlay within Middlesex Centre’s Official Plan. The subject property is currently zoned ‘Extractive Industrial (M4)’ within the Middlesex Centre’s Comprehensive Zoning By-law.

As such, the policies and provisions below are applicable to the lands.

**Provincial Policy Statement, 2020:**

The Planning Act states that all decisions made by planning authorities/municipalities “shall be consistent with the policy statements issued” under subsection 3. The Provincial Policy Statement, 2020 (PPS) document is comprised of several policy statements and those that are applicable to the proposed development are noted below:

Generally, the PPS promotes healthy, liveable and safe communities by supporting efficient land use patterns that facilitate economic growth, create liveable communities, and protect the environment and public health and safety.

Section 1.0 – Building Strong Healthy Communities establishes policies that support long-term prosperity, environmental health and social well-being within communities.

Section 1.1 – Managing and Directing Land Use to Achieve Efficient and Resilient Development and Land Use Patterns identifies that healthy communities are sustained by accommodating an appropriate range and mix of uses, avoiding development patterns that cause environmental concerns, and promoting cost-effective development patterns that optimize the use of planned and future infrastructure.

Section 1.1.3 – Settlement Areas establishes that settlement areas can vary in size, population, and diversity and intensity of land uses. The PPS directs growth and development to settlement areas where new development varies in densities and land uses, and there are opportunities for intensification and redevelopment. New development patterns are based on the efficient use of land that minimize negative impacts to the environment, support active transportation and are appropriate for the infrastructure and public service facilities.

Sections 1.1.3.4 and 1.1.3.6 promote intensification, compact development, varying uses and densities where it avoids or mitigates risks to public health and safety and is adjacent to the existing built-up area. Section 1.1.3.5 also allows municipalities to establish a minimum target for intensification within built-up areas subject to local conditions.

Section 1.4 - Housing speaks to the provision of housing within a municipality. The PPS promotes an appropriate range and mix of housing types and densities and directs development of new housing towards areas where there is an appropriate level of infrastructure. Municipalities are to provide opportunities for all forms of housing and intensification to meet the social, health and well-being needs of the current and future community.

In support of healthy and active communities section 1.5 – Public Spaces, Recreation, Trails and Open Space promotes planning public street networks that foster social interaction and active transportation. Additionally, it recognizes the need for a full range of publicly-accessible recreational space such as trails and parklands.

Sections 1.6 – Infrastructure and Public Service Facilities directs that infrastructure and be provided in an efficient manner that also prepares for the impacts of a changing climate. Section 1.6.2 directs municipalities to promote green infrastructure to complement existing infrastructure such as permeable surfaces, green roofs, and street trees.

Section 1.6.6 – Sewage, Water and Stormwater directs future growth and development to efficiently use and optimize existing services such as municipal sewage and water services, when available. Municipal sewage and water services are the preferred form of servicing for settlement areas.

Section 1.6.6.7 promotes planning for stormwater management that minimizes or prevents an increase in negative impacts on the environment and water system; does not increase risks to human health and safety and property damage; and uses best practices, vegetation, and pervious surfaces as part of an effective stormwater management system.

Section 1.6.7 – Transportation Systems directs transportation and land use coordination to be considered at all stages of the planning process. Transportation networks should be safe, energy efficient and facilitate the movement of people and goods. Efficient development patterns, and a mix of uses and densities should also be promoted to minimize the number of vehicle trips and support active transportation.

Section 2.5 – Mineral Aggregate Resources states that mineral aggregate resources shall be protected for long-term use and shall be identified. Further direction directs that resources as is realistically possible shall be made available as close to markets as possible. If known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if the resource use would not be feasible; or the proposed land use or development serves a greater long-term public interest; and issues of public health, public safety and environmental impact are addressed.

## Middlesex County's Official Plan:

The County of Middlesex Official Plan (County Plan) identifies the subject property as within the Komoka 'Settlement Area'.

Section 2.2.3 – Aggregate Resources recognizes the need to balance competing priorities for the protection of aggregate resources for future extraction and the need to protect agricultural land, the natural system and other sensitive land uses. In areas of significant aggregate resources, uses which do not preclude future resource extraction may be permitted in accordance with the underlying land use designation. All uses which would preclude resource extraction shall be discouraged until such time as the resource has been substantially depleted.

Where supporting documentation is provided that demonstrates that the aggregate resource is of secondary quality and extraction is neither practical nor economically feasible, the subject lands may be used for a land use other than agriculture provided such land use conforms with the local official plan.

Section 2.3.8 – Policy Framework-Settlement Areas of the County Plan recognizes that Settlement Areas will be the focus for future growth including residential uses. These areas are intended to have a wide range of land uses and full municipal servicing in conjunction with 2.4.5 of the County Plan. Additionally, section 2.3.7 encourages a wide variety of housing types, sizes and tenure to meet market requirements and demand for current and future residents.

Section 3.2 – Detailed Land Use Policies-Settlement Areas provides additional development policies for lands within Settlement Areas. The County Plan further supports that Settlement Areas are developed in a manner that is phased and compact, and preserves the historic character of Settlement Areas and complements the positive elements of the existing built-form.

With regard to municipal sanitary sewers and water services, section 2.4.5 – Sanitary Sewers and Water of the County Plan promotes efficient and environmentally responsible development that can be supported by full municipal systems servicing.

## Middlesex Centre's Official Plan:

The Middlesex Centre Official Plan (Official Plan) designates the subject lands as 'Residential' within the Komoka Settlement Area on Schedule A-2: Komoka-Kilworth Urban Settlement Area & Secondary Plan and contains an Aggregate Overlay on the southwest portion of the lands. Additionally, the official plan schedule identifies a stormwater management facility on the southwestern portion of the lands, and Hazards Lands and a Community Gateway on the northwest portion of the land.

Section 4.2 – Areas of Aggregate Resource Deposits provide policy direction for aggregate resource areas that have been shown as a policy overlay on Schedule A-2 and for new or expanding operations. For lands that are within or adjacent to resource area delineations, the uses permitted are those of the designations underlying the resource area so long as the use would not preclude or hinder extraction. Where extraction may be hindered or precluded, development may occur only if resource use would not be feasible; or the proposed land uses or development serves a greater long term public interest; and issues of public health, safety and environmental impact are addressed.

Section 4.6 – Rehabilitation of Aggregate Resource Sites direct that extractive sites be progressively rehabilitated to a land use corresponding with the land use designation established beneath the Aggregate Resource Area overlay. Should an applicant propose an afteruse not permitted within the underlying designation, an Official Plan Amendment to change the underlying designation would be required prior to establishment of the afteruse.

Section 5.2 – Residential Areas pertain to lands designated 'Residential' within settlement areas like the Komoka-Kilworth area. The 'Residential' designation permits a range of housing, institutional uses, municipal uses, parks or open space and group homes. The Municipality is to provide and encourage a wide variety of housing types, sizes and tenures to meet demographic and market requirements. The Municipality shall provide opportunities to increase the supply of housing through intensification while considering issues of municipal servicing capacity, transportation issues and potential environmental considerations. Specifically, the Municipality shall require that 15 percent of all development occur by way of intensification.

Residential development should also reflect a high quality of residential and neighbourhood design and have regard for the Municipality's Site Plan Manual and Urban Design Guidelines. This includes promoting a development that is designed to be sustainable and support public transit and oriented to pedestrians.

The Municipality shall also encourage housing accessible to lower and moderate income households. In this regard the County of Middlesex through its Official Plan will require that 20 percent of all housing be affordable.

Further, on Schedule A-2 identifies Hazard Lands on the subject land. This can include flood plain, flood prone areas, or slope hazards as mapped and/or regulated by a conservation authority. Additional study may be required to demonstrate that development or site alteration will not increase risk to life and property, and there will be no impact on flooding, slope stability, upstream or downstream properties, aggravation of existing natural hazard processes, or natural features or functions.

Section 5.2.3 – Policies for Multiple Dwellings in Residential Areas provides direction when considering multiple dwellings, including four plexes, townhouses and low/medium rise apartments. Locations should be proximate to adequate open space or park areas, schools, or Village Centre areas, like Komoka, where possible. Densities proposed should be compatible with adjacent densities when proposed adjacent to or within existing residential areas. Apartment dwelling should be located in proximity to a major roadway, or roadway suitable for carrying higher than average volume of traffic. The excessive clustering of multiple dwellings shall be avoided, and a general integration and distribution of such uses at appropriate locations within neighbourhoods or settlements is encourages. The siting of multiple dwellings adjacent to or in proximity to Village Centres is encouraged. Lastly, townhouses and apartments shall be subject to the site plan approval requirements of Section 41 of the *Planning Act* and Section 10.5 of the Official Plan, and have regard for the site plan manual and urban design guidelines.

Section 5.7.4 – Komoka-Kilworth Residential Area Policies summarized below apply to lands designated ‘Residential’ and ‘Medium Density Residential’ in Schedule A-2 of the Official Plan.

The types of housing, density of development and targeted mix within the Residential and Medium Density Residential designations on Schedule A-2 are as follows:

| **Use** | **Housing Mix Targets** | **Net Density (units per ha)** |
|---|---|---|
| Low density residential (e.g. singles, semis) | 60% | Less than 20 |
| Medium density residential (e.g. townhouses) | 40% | 20 to 50 |

The net density refers to the land area to be used for housing as well as the abutting local streets, but does not include major streets and other residentially associated land uses. Notwithstanding the housing mix targets and net density provisions, multiple dwellings shall be permitted in the Residential designation in accordance with Section 5.2.3 – Policies for Multiple Unit Dwellings in Residential Areas.

Development proposals within areas designated as ‘Medium Density Residential’ shall provide for a diverse mix of multi-unit housing forms and choices to accommodate the needs and lifestyles of people at different stages throughout their life.

Further, all residential development shall ensure appropriate orientation and massing of residential buildings to provide adequate private and public open spaces and to facilitate the penetration of sunlight into these spaces.

In addition to compliance with the urban design guidelines, private garages for residential development shall not project into the front yard than the habitable portion of the building or porch on the main floor in order to limit visual and streetscape impacts of garages.

Lastly, entrance features to new residential neighbourhood development shall be encouraged where features are landscape related and require minimal maintenance.

Section 5.7.11 – Komoka-Kilworth Servicing Policies identify that all land use and development proposals require full municipal services. This includes sanitary sewage collection and treatment, stormwater management and water distribution.

Section 6.3 – Design Policies-Site Plans and Infill Developments provide additional direction to guide infill development to ensure there is compatibility with existing residences and neighbourhoods. High quality site design and architectural design is encouraged for new medium density residential development. Setbacks, massing, location of parking, architecture and other design elements will be carefully reviewed to ensure new development is in keeping with the character of the neighbourhood.

Section 8.4 – Parks and Recreation Policies requires the municipality to receive 5% of lands to be developed or redeveloped for residential purposes be conveyed for public park or recreational purposes. Alternatively, at the Municipality’s discretion, a parkland dedication may be required at a rate of one hectare for each 300 dwelling units proposed in the context of a plan of subdivision application. In the case of such parkland dedications, lands to be conveyed shall be of adequate size, dimension, drainage and grading for their intended recreational use, and will be of an appropriate size and shape to meet the needs and goals of the Municipality.

Stormwater detention areas and drains in this Plan shall not be accepted in fulfilment of this requirement, however, they may be accepted as an adjunct to a functional park area.

Connecting walkways and pedestrian grade separations, sidewalks and protective buffer areas between conflicting land uses shall not be considered as a portion of a parkland dedication.

Council may, at its discretion, accept payments of cash-in-lieu of parkland dedication in cases where park and recreational facility sites in the vicinity of the lands to be developed are adequate for present and future needs, or where parklands of adequate size could not be achieved, even in combination with adjoining lands. Cash-in-lieu of parkland payments shall be placed in a separate account and used for the acquisition or development of parkland within the Municipality.

Section 9.3 – Municipal Infrastructure and Services Policies identify that primary municipal services (water supply, sewage disposal and stormwater management) are present in Komoka. It is the policy of the Official Plan that future development in settlement areas proceed on the basis of full municipal services which is consistent with the Provincial Policy Statement, 2020 and County Official Plan policies for servicing.

Section 9.4 – Municipal Transportation Structure establishes policies for the road network within the Municipality. Policies within this section address appropriate setbacks and location of driveway accesses to minimum visual traffic hazards and provide opportunities for roadway widening of rights-of-way extensions.

## Middlesex Centre Zoning By-law:

The subject land is zoned 'Extractive Industrial (M4)' within Middlesex Centre's Comprehensive Zoning By-law.

The application to amend the zoning by-law creates several new site specific zones for the lots and blocks, and are described below. A rezoning map provided by the applicant is also shown in Attachment 3.

- Area 1: the proposed single detached lots fronting on Oxbow Drive to a Site-specific "Urban Residential First Density (UR1-X)" zone, with the site-specific regulations permitting a reduced minimum lot area, reduced minimum lot frontage for lots fronting on Oxbow Drive, reduced minimum front yard setback, and increased maximum lot coverage for main buildings and accessory buildings;

  A summary of the site-specific request is in the table below:

| | **Proposed UR1-x zone (area 1)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Home Occupation<br>Single Detached Dwelling |
| **Minimum Lot  Area** | 380 m$^2$ (4, 090 ft$^2$) |
| **Minimum Lot Frontage** | 12 m (39.4 ft) |
| **Minimum Front Yard Setback** | 8 m (26.3 ft) |

| | **Proposed UR1-x zone (area 1)** |
|---|---|
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line) |
| **Maximum Lot Coverage** | 46% for the main use<br>49% for all buildings including accessory buildings subjection to Section 4.1 (a) of the zoning by-law |

- Area 2: the remainder of proposed single detached lots internal to the subdivision to a site-specific “Urban Residential First Density (UR1-X)” zone, with the site-specific regulations permitting a reduced minimum lot area, reduced minimum lot frontage for lots fronting on Oxbow Drive, reduced minimum front yard setback, and increased maximum lot coverage for main buildings and accessory buildings;

  A summary of the site-specific request is in the table below:

| | **Proposed UR1-x zone (area 2)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Home Occupation<br>Single Detached Dwelling |
| **Minimum Lot  Area** | 380 $m^2$ (4, 090 $ft^2$) |
| **Minimum Lot Frontage** | 12 m (39.4 ft) |

| | **Proposed UR1-x zone (area 2)** |
|---|---|
| **Minimum Front Yard Setback** | 4.5 m (14.8 ft) to porch or habitable portion<br>6.0 m (19.7 ft) to attached garage |
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line) |
| **Maximum Lot Coverage** | 48% for the main use<br>51% for all buildings including accessory buildings subjection to Section 4.1 (a) of the zoning by-law |

- Area 3: the proposed townhouses block rezoned to a site-specific “Urban Residential Third Density (UR3-X)” zone, the regulation permitting a reduced minimum lot depth and increased maximum lot coverage for main buildings and accessory buildings.

  A summary of the site-specific request is in the table below:

| | **Proposed UR3-x zone (area 3)** |
|---|---|
| **Permitted Uses** | Accessory Use<br>Apartment Dwelling |

|  | **Proposed UR3-x zone (area 3)** |
|---|---|
|  | Multiple Unit Dwelling<br>Street Townhouse Dwelling<br>Townhouse Dwelling |
| **Minimum Lot Depth** | 29 m (95.1 ft) |
| **Minimum Side Yard Setback** | 1.2 m (3.9 ft.) on an interior lot line<br>2.5 m (8.2 ft.) to habitable portion abutting a public street (exterior lot line)<br>6.0 m (19.7 ft.) to attached garage abutting a public street (exterior lot line)<br>No side yard setback required between common walls dividing dwelling units |
| **Maximum Density** | 35 units per hectare |
| **Maximum Lot Coverage** | 55% for the main use<br>58% for all buildings including accessory buildings subjection to Section 4.1 (a) of the zoning by-law |

- Area 4: the remnant parcel containing the borrow pit and retained by the Owner, and not subject to the Draft Plan of Subdivision, rezoned to the “Urban Residential First Density (UR1)” zone.

- Area 5: the trail and stormwater management pond area rezoned to the “Open Space (OS)” zone.

**Consultation:**

Notice of the application has been circulated to agencies, as well as property owners in accordance with the *Planning Act* and Ontario Regulation 544/06.

**Public Comments:**

At the time of writing this report staff received the following comments from area residents:

- Concern about the additional stormwater runoff resulting from this subdivision.
- Is there potential for lawn chemicals, road salt, etc. from these subdivisions finding its way into the ground water in the areas especially where residents are on well systems? Chemicals may also find their way into the Oxbow creek drainage.

**Agency Comments:**

At the time of writing the subject report the following comments were received:

The Municipality's Chief Building Official has reviewed the applications and has concerns of the settlement of soil within the lots which used to be a pond. Its recommended that a Hold symbol be applied to lots that were formerly a pond, in whole or in part, until a geotechnical investigation shows that the lands are suitable and safe for development.

The Municipality's Public Works and Engineering Department has not provided comments at the time of writing this report. However, they are reviewing the submitted materials and will provide comments.

The Municipality's Director of Community Services reviewed the application and note the trail provided on the plan of subdivision. During preconsultation in 2019 the conceptual plan shows a trail extending the entire southern boundary connecting the Komoka Park to the abutting property to the east. The trail shown on the 2019 conceptual plan is preferred in consideration of future development to the east of the subject lands. Further, there is a significant elevation change from Oxbow Drive to the water tower area. A connection point from the subject lands to the park should be considered.

The Upper Thames Region Conservation Authority (UTRCA) has not provided comments at the time of writing this report.

Canada Post reviewed the proposal and advised the applicant to consult with Canada Post to determine a suitable permanent location for a community mailbox and that the applicant agrees to provide a walkway, curb and base pad for the community mailbox. Canada Post requests to be notified of any changes or approval to the plan of condominium.

**Financial Implications:**

None.

**Strategic Plan:**

This matter aligns with following strategic priorities:

- 1a. Planning & Positioning: Diversifying future residential development.
- 1c. Planning & Positioning: Realizing development potential.
- 3c. Quality of Life: Meeting the needs of both current and future citizens.

**Attachments:**

Attachment 1 – Location Map

Attachment 2 – Proposed Plan of Subdivision

Attachment 3 – Proposed Rezoning Map

Attachment 4 – Planning Justification Report

Attachment 5 – Final Servicing Report

Attachment 6 – Transportation Impact Study

Attachment 7 – Stormwater Management Report

Attachment 8 - Stage 1 and 2 Archaeological Assessment

# LOCATION MAP

Description:
PROPOSED PLAN OF SUBDIVISION
CUDNEY BLUE
MUNICIPALITY OF MIDDLESEX CENTRE

File Number:
39T-MC2004

Prepared by: Planning Department
The County of Middlesex, September 28, 2020.

## LEGEND

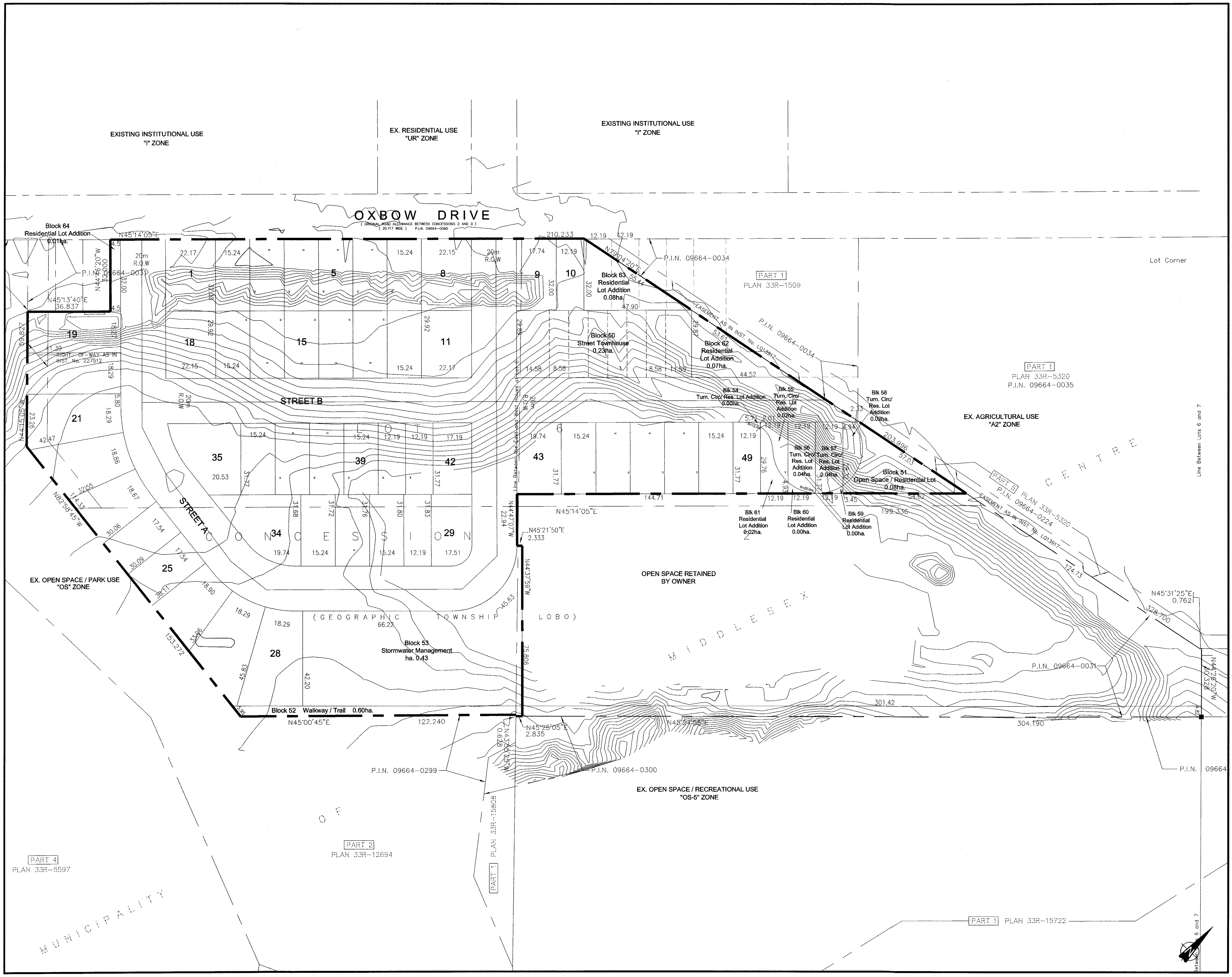
☐ SUBJECT LANDS

N

1:4,000

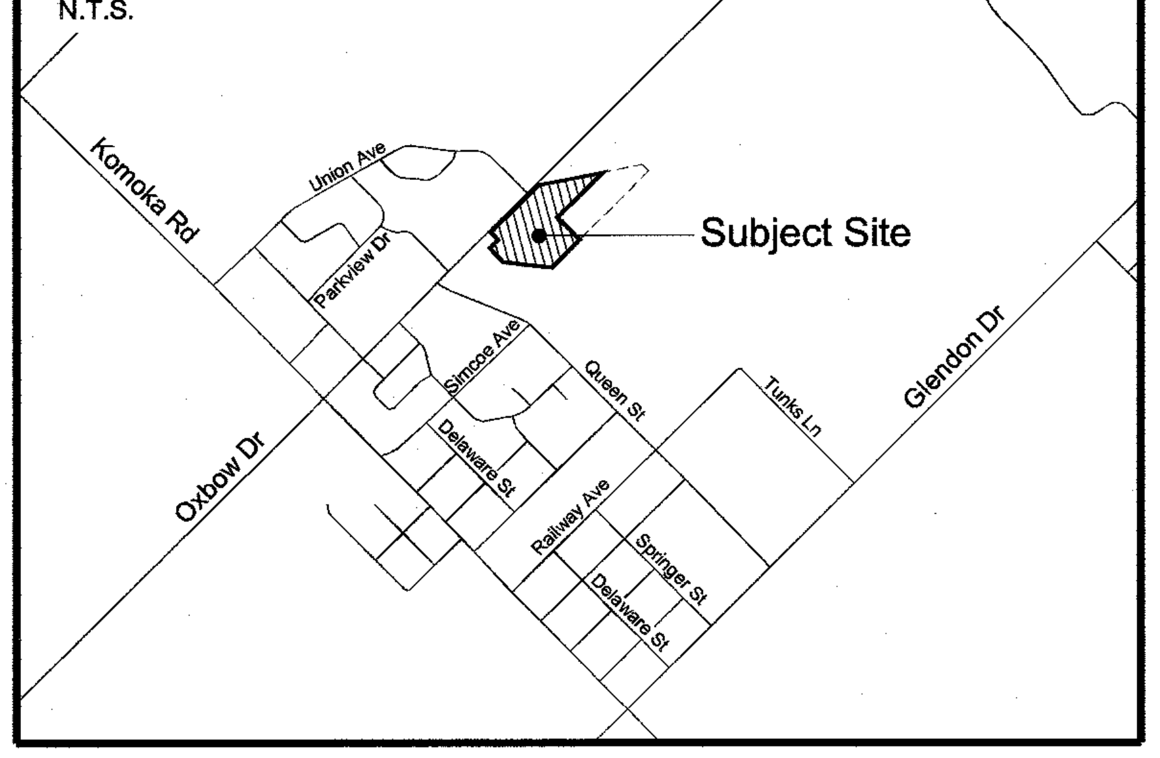
0 100 200

Meters



## KEY PLAN

N.T.S.



# DRAFT PLAN OF SUBDIVISION

Part of Lot 6
Concession 2
(Geographic Township of Lobo)
Municipality of
Middlesex Centre

## 10125 Oxbow Drive

## LAND USE SCHEDULE

| DESCRIPTION | LOTS/BLKS. | UNITS | AREA (ha.) |
|---|---|---|---|
| Single Detached Residential | 1-49 | 49 | 2.76 |
| Medium Density Residential | 50 | 8 | 0.23 |
| Open Space / Residential | 51 | 1 | 0.08 |
| 6.0m Walkway / Trail | 52 | | 0.06 |
| Stormwater Management | 53 | | 0.43 |
| Turning Circle / Res. Lot Addition | 54-58 | | 0.12 |
| Residential Lot Addition | 59-64 | | 0.18 |
| Road | | | 1.38 |
| Total | | 58 | 5.24 |

## ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
i)
k) All sanitary and storm sewers as required

## OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO

Heather Johnston-Inglis
OWNER

Aug 13/20
DATE

## SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

P. R. Levac
P.R. LEVAC, OLS

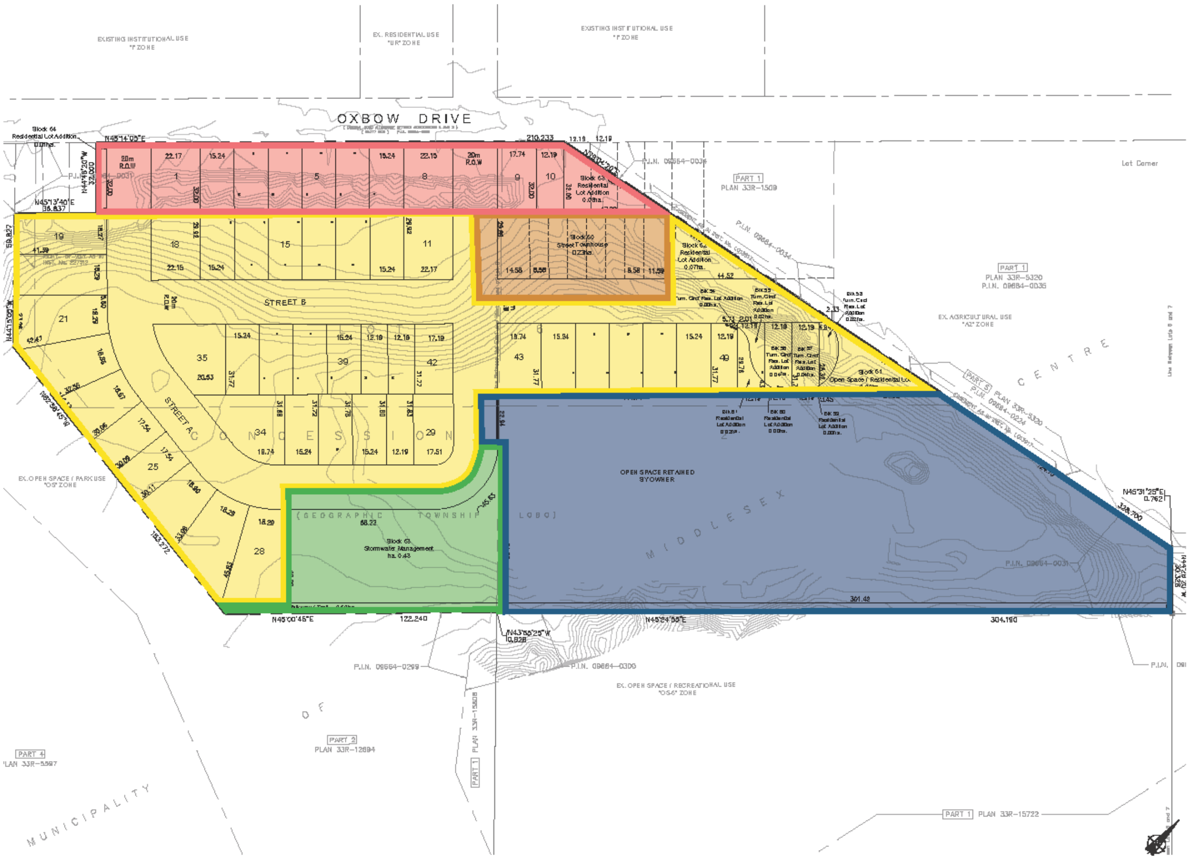
Aug 12/20
DATE

GSP group
PLANNING | URBAN DESIGN | LANDSCAPE ARCHITECTURE
gspgroup.ca

REVISIONS

| | | |
|---|---|---|
| Date: AUG. 10, 2020 | Drawn By: MN | Dwg. File Name:43705-104-DRAFT PLAN.dwg |
| Scale: 1: 750 metric | Project No.: 18015 | |

## Proposed Zoning Map for Files 39T-MC2004 and ZBA-24-2020



🟥 From Extractive Industrial ‘M4’ Zone to Urban Residential ‘UR1-#’ Zone

🟨 From Extractive Industrial ‘M4’ Zone to Urban Residential ‘UR1-#’ Zone

🟧 From Extractive Industrial ‘M4’ Zone to Urban Residential ‘UR3-#’ Zone

🟦 From Extractive Industrial ‘M4’ Zone to Urban Residential ‘UR1’ Zone

🟩 From Extractive Industrial ‘M4’ Zone to Open Space ‘OS’ Zone

GSP group

Figure 8

Proposed Zoning
Source: GSP Group (June 2020)

# Inglis Subdivision

## Preliminary
## Stormwater Management Report

**Project Location:**
10125 Oxbow Drive, Komoka, ON

**Prepared for:**
Heather Johnston-Inglis
P.O. Box 63, Formosa, ON

**Prepared by:**
MTE Consultants
123 St. George Street
London, ON  N6A 3A1

June 12, 2020

**MTE File No.:** 43705-104

*Engineers, Scientists, Surveyors.*

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## Appendices

Appendix ‘A’ Sanitary Capacity Analysis
Appendix ‘B’ Water Distribution Modelling Information

# 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Ms. Inglis (Client) to complete the servicing report for the Inglis Subdivision to be constructed at 10125 Oxbow Drive in the Community of Komoka, Municipality of Middlesex Centre.

The site is approximately located at the intersection of Oxbow Drrive and Union Avenue. The property is bounded to the north by Oxbow Drive, to the south and west by municipally owned properties (Park, water tower) and golf course, and to the east by residential properties. For the exact location of the site, refer to Figure 1.

The Inglis property is being considered along with two other residential properties (10147 & 10171 Oxbow Drive) currently under separate ownership. Together these parcels are approximately 10.4ha in area inclusive of a portion of Oxbow drive across the frontage of the properties and the existing borrow pit. This report addresses the municipal servicing of the proposed subdivision. The site grading, servicing and stormwater management details for the site are illustrated on the figures provided.

# 2.0 Sanitary Servicing

Effluent from the proposed subdivision is intended to be directed through the Municipally Owned parklands to the south to an existing 200mm sanitary sewer on Queen Street. Lots fronting onto Oxbow Drive will require a new sanitary sewer to be constructed in the Oxbow R.O.W. to pick up effluent from these lots. The new sewer can direct flows from these lots to the internal sewers which will direct the flows to Queen Street.

The proposed draft plan for the Inglis property indicates 4.81 ha of residential development area with 49 single family lots, 8 townhouse units, and 0.23ha of future residential lands. The external properties are approximately 2.52 ha. Allowing for the Municipality’s estimate for low density development, the external and future residential areas will allow for the construction of approximately (2.52ha + 0.23ha) x 30 u/ha = 83 additional units.

Allowing for a population of 3 persons/unit, a total population of 420 persons is expected for the subdivision. Allowing for an average daily consumption of 350 L/day (0.004 L/s), factoring in the Municipality’s specified peaking factor (0.8 x Harmon = 3.21), and adding the Municipality’s infiltration allowance (0.1 L/s/ha x 7.3ha = 0.73 L/s) the peak expected flow rate from the site is approximately 420 x 0.004 x 3.21 + 0.73 = 6.26 L/s.

Based on the sanitary drainage plan for the neighbouring Fieldstone Subdivision (Prepared by Development Engineering, Dated March-2017) the sanitary sewer on Queen street currently collects effluent from approximately 25 units and directs flows south. Based on the layout of the existing sanitary MH’s it is assumed the sanitary sewers from the proposed subdivision will connect into MH117 as labelled on the sanitary drainage plan. MTE has completed a sanitary capacity analysis from the proposed connection location down to the 250mm sanitary sewer on Huron Avenue. The analysis shows that all sewer runs have adequate capacity to convey effluent from the proposed site. The capacity analysis prepared by MTE is included in Appendix ‘A’. Proposed Sanitary routing is illustrated on Figure 2.

MTE

Engineers, Scientists, Surveyors

Division

Project Number:
43705-104

Project Name:
OXBOW DRIVE
SUBDIVISION

Drawing Title:
SITE LOCATION

Scale:
1:2000

Part of Dwg:

Date:
05/22/2020

Revision #:

Issued For:

Drawing Number:
FIG.1

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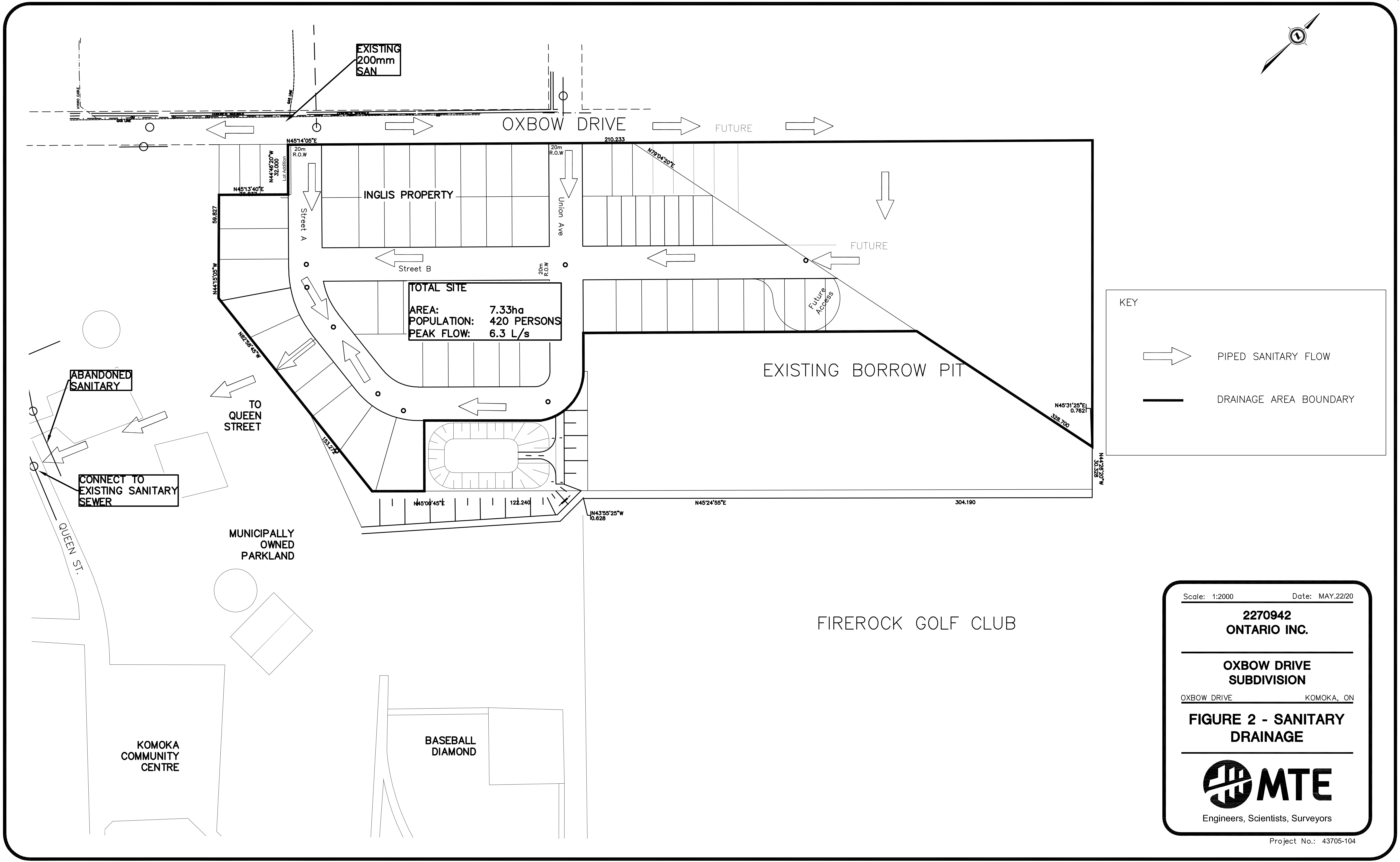
date — time — CADTAG



Scale: 1:2000 Date: MAY.22/20

**2270942 ONTARIO INC.**

**OXBOW DRIVE SUBDIVISION**

OXBOW DRIVE KOMOKA, ON

## FIGURE 2 - SANITARY DRAINAGE

MTE
Engineers, Scientists, Surveyors

Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705–104–FIGURES.dwg

# 3.0 Water Distribution

Water supply for the proposed subdivision will be provided by:

- Two (2) connections to the existing 150mm watermain on Oxbow Drive; and
- One (1) future connection to future extension of 150mm watermain along Oxbow drive to service future development to the east.

It is anticipated that two connections to the 150mm main on Oxbow will be completed as part of the development of the Inglis property and another completed upon development of the external properties. Proposed water distribution network is illustrated in Figure 3.

## 3.1 Water distribution Modelling

The proposed and future development conditions were modelled using WaterCAD to determine the expected pressures and available flow rates within the proposed subdivision. The site was modelled as a network of nodes connected by pipes. Demands were applied at the nodes based on the proposed and assumed future lotting, estimated population and consumtion rates, and the max day and peak hour demand factors as specified in the Municipality’s design guidelines. Physical properties were assigned to the pipes as per Municipal criteria.

Supply for the subdivision was modelled as a reservoir with a fixed elevation connected to the existing 150mm watermain on Oxbow drive at the approximate location of the Municipal water tower and the intersection of Oxbow Drive and Union Avenue. The elevation of the reservoir was calculated to be 284.60 masl based on the results of a hydrant flow test located in the subdivision north of Oxbow Drive. The flow test was completed in 2015 at Municipal Hydrant KO-94 and showed a static pressure of 50.3 psi which equates to roughly 35.4m of pressure head. Based on the Plan Profile drawing of Oakcrest rive (on which hydrant KO-94 is located) the approximate surface elevation in the location of the hydrant is 249.20. Thus, the reservoir elevation was set at 284.60 masl. A sketch of the model network along with a summary of the demands and physical properties applied within the model are included in Appendix ‘B’.

## 3.2 Results

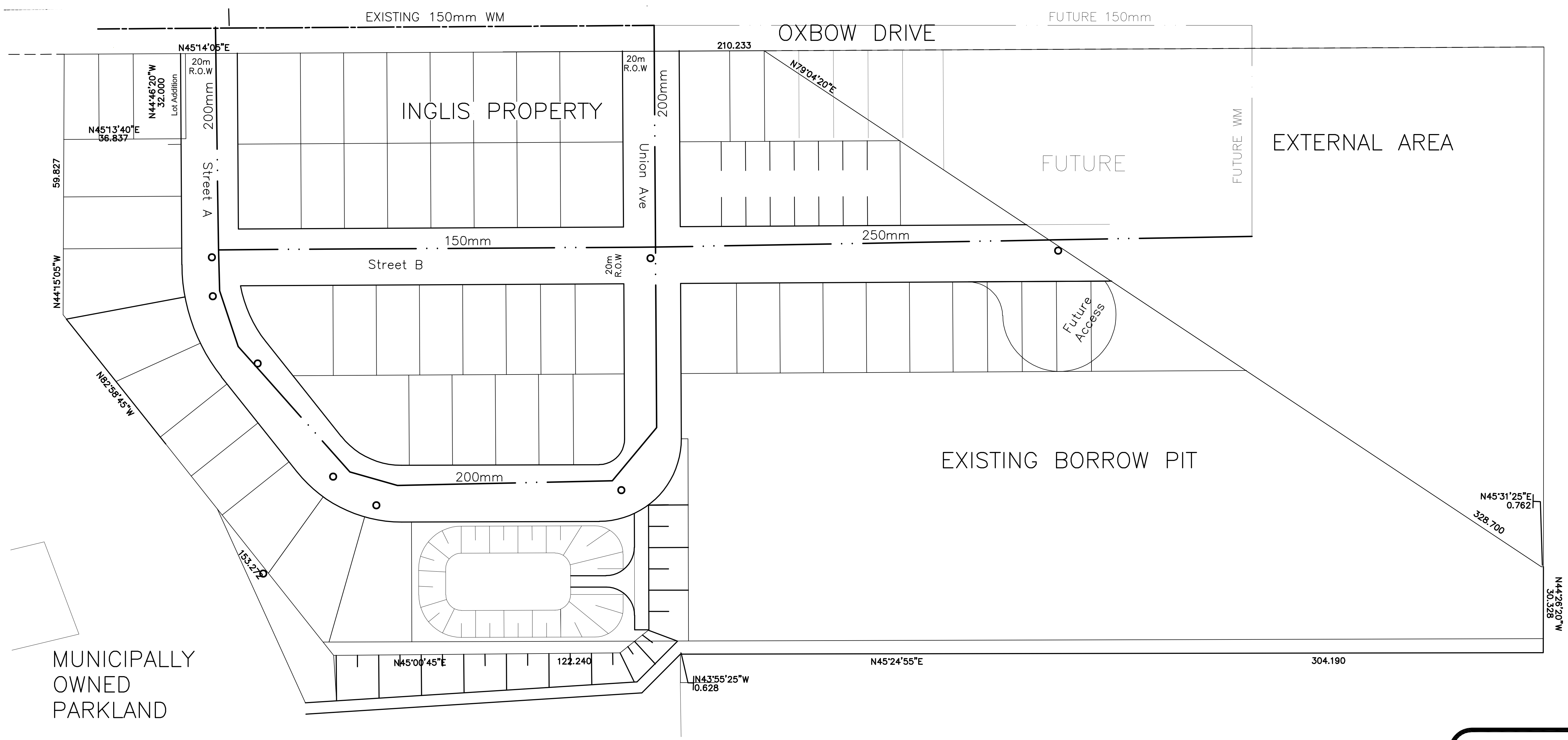
### 3.2.1 Pressure

Pressures within the system are expected to remain between 307 and 354 kPa during all domestic demand scenarios under proposed and future conditions. This is within the Municipality’s preferred operating range of 275-550 kPa.

### 3.2.2 Velocity

Maximum velocity within the proposed system during domestic demand scenarios is approximately 0.07 and 0.12 m/s for the proposed and future conditions respectively.

Maximum velocity during fire flow scenarios was checked by applying a fire demand of 100 L/s at nodes J-3, J-5, J-8, J-9, and J-20. The maximum velocity in the system was found to be 2.2 and 2.0 m/s during the proposed and future conditions respectively.



## LEGEND

— · — · — EXISTING WATER MAIN

——— PROP. WATER MAIN

Scale: 1:1500 Date: MAY.22/20

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**OXBOW DRIVE**
**SUBDIVISION**

OXBOW DRIVE KOMOKA, ON

## FIGURE 3 -
## WATER DISTIBUTION

MTE

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Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg

### 3.2.3 Fire Flow

The fire flow analysis feature within the WaterCAD program was used to determine the available fire flow at all locations within the system. The model was run with constraints specifying a maximum allowable velocity of 2.4 m/s and minimum allowable system pressure of 140 kPa. Minimum available fire flow rate was determined to be 109 and 114 L/s during the proposed and future development scenarios.

### 3.2.4 Age

An age analysis was run assuming average day demands to determine the maximum age within the system under the proposed development conditions. Both scenarios were run assuming full buildout conditions. The maximum age in the system was modelled to be roughly 35.1 hrs. and 19.7 hrs. under the proposed and future development conditions respectively.

Modelling parameters and results are summarized in Appendix ‘B’ below.

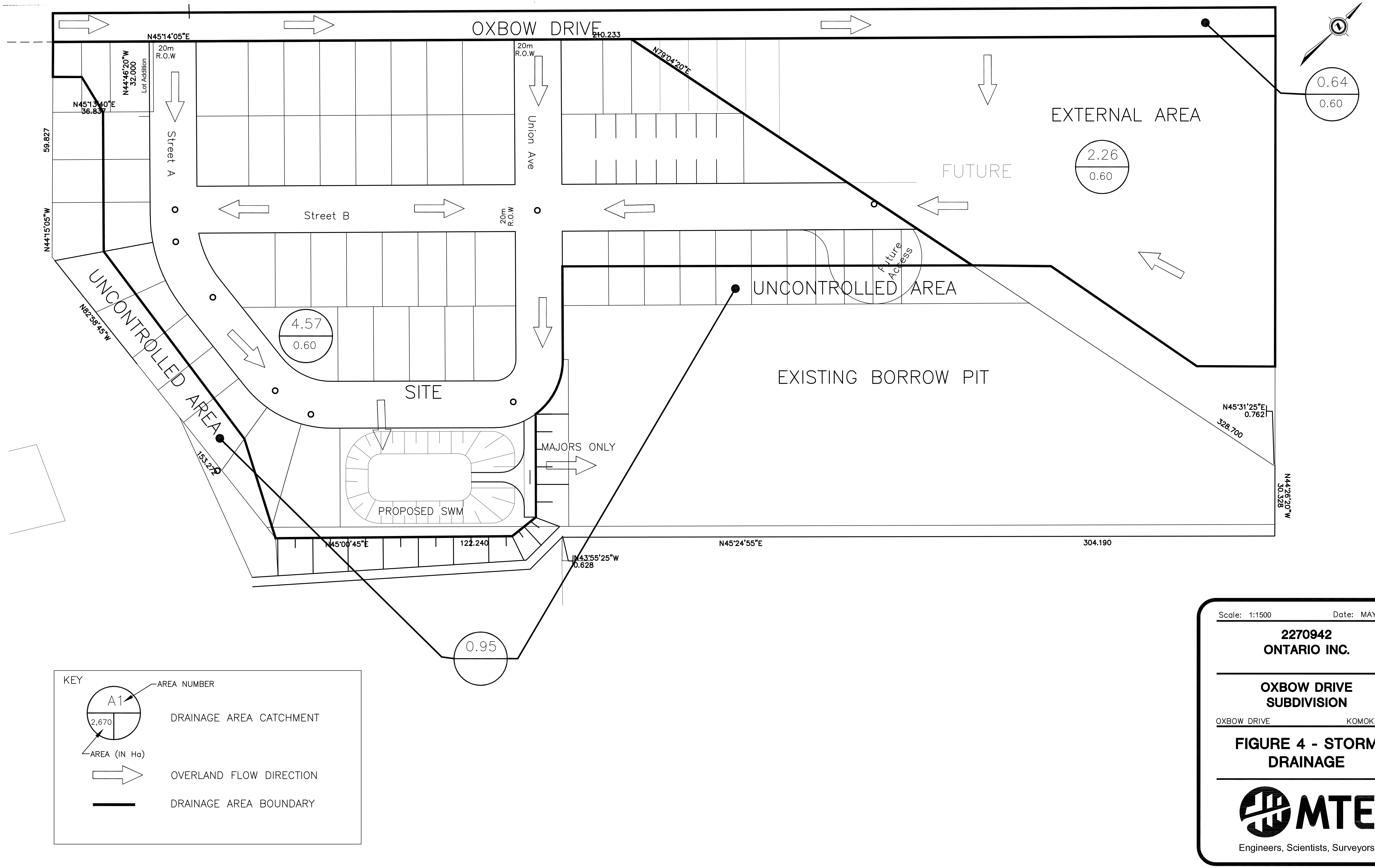
## 4.0 Stormwater Management

Under existing conditions the majority of the proposed subdivision lands drain to an existing borrow pit located on the Inglis property. The borrow pit has no outlet and drains via infiltration to the local shallow groundwater.

A geotechnical investigation for the Inglis property showed that the site has a thick layer of fill material over the northern portion of the site but the underlying native soils are sandy in nature with high conductivity.

It is proposed that lot-level Infiltration measures be employed wherever possible across the site and that all minor system runoff (≤ 5 yr) be infiltrated in an end-of-pipe SWM facility. Major system runoff will be released to the borrow pit in a controlled manner to prevent erosion or scour within the pit.

For further SWM details, refer to the preliminary SWM report for the site prepared by MTE. Proposed drainage patterns are illustrated in Figure 4.



Scale: 1:1500 Date: MAY.22/20

**2270942**
**ONTARIO INC.**

**OXBOW DRIVE**
**SUBDIVISION**

OXBOW DRIVE KOMOKA, ON

## FIGURE 4 - STORM DRAINAGE

MTE

Engineers, Scientists, Surveyors

Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg

# 5.0 Conclusions

Based on the foregoing analysis, it is concluded that:

i. The proposed subdivision may be adequately serviced through the installation of gravity sanitary sewers, connection to the existing municipal water distribution network, and the establishment of lot-level and end-of-pipe SWM infrastructure;

ii. A sanitary outlet can be provided for the subdivision through the existing municipally owned lands to the south and connecting into the existing sanitary sewer on Queen Street.

iii. Water servicing can be supplied by connections to the existing mains on Oxbow Drive and Queen Street. Connection to the Queen Street main may be provided through the municipally owned land to the south.

iv. Stormwater management for the site may be accommodated through the implementation of lot-level and end-of-pipe infiltration measures with major flows being directed to the borrow pit.

v. Availability of utilities will need to be confirmed with the appropriate providers.

All of which is respectfully submitted,

**MTE Consultants Inc.**

**Josh Monster**
Design Engineer
519-204-6510 ext. 2202
jmonster@mte85.com

JJM:jjm

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# Appendix A

# Sanitary Capacity Analysis

MTE

# SANITARY SEWER DESIGN SHEET

## MUNICIPALITY OF MIDLESEX CENTRE

## CITY ENGINEER'S DEPARTMENT

DATE : **October 2019**
DESIGNED BY : **JJM**
CHECKED BY :
FILE No : **43705-104**
SHEET : **1of1**

***RESIDENTIAL POPULATION DENSITIES***

*THE FOLLOWING POPULATION ALLOWANCES WILL APPLY WHEN DESIGNING SANITARY SEWERS:*

***(A) HECTARE BASIS***

*LOW DENSITY (SINGLE FAMILY/SEMI-DETACHED) = 30 UNITS/HA @ 3 PEOPLE/UNIT*
*MEDIUM DENSITY (TOWNHOUSES) = 75 UNITS/HA @ 2.4 PEOPLE/UNIT*
*HIGH DENSITY (APARTMENTS) = 150-300 UNITS/HA @ 1.6 PEOPLE/UNIT*
*COMMERCIAL / INSTITUTIONAL / CHURCH = 100 PEOPLE/HA*
*ELEMENTARY SCHOOL = 400 PEOPLE*
*SECONDARY SCHOOL = 1500 PEOPLE*

***(B) LOT BASIS***

*SINGLE FAMILY = 3 PEOPLE*
*DUPLEX / SEMI = 6 PEOPLE*

*PROJECT NAME : Inglis Subdivision - Sanitary Capacity Analysis*

**DESIGN CRITERIA**

*SEWAGE = 350 L/DAY/CAP = 0.00405 x 1.1 l/s/person*
*INFILTRATION = 8640 L/HA/DAY = infilt. of 0.100 l/s/ha*
*PEAKING FACTOR = HARMON FORMULA* $M = 0.8 * [ 1 + \frac{14}{4 + P^{0.5}} ]$

| LOCATION | | | | AREA (HECTARES) | | | POPULATION | | | | | SEWAGE FLOW | | | | SEWER DESIGN | | | | | Source of Information | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AREA No. | STREET | FROM M.H. | TO M.H. | NET OR GROSS | DELTA AREA ha | TOTAL AREA ha | PER ha | PER LOT | No. OF LOTS | DELTA POP. | TOTAL POP. | M Min.2.0 | SEWAGE l/s | INFILT. l/s | TOTAL l/s | DIA. mm | SLOPE % | n | VELOCITY m / s | CAP. l / s | Dwg # | Prepared By | Dated |
| | **Proposed Site** | | 118 | | 7.30 | 7.30 | | 2.4 | 8 | 20.00 | 20 | 3.50 | 0.31 | 0.73 | **1.04** | | | | | | | | |
| | | | | | 0.00 | 7.30 | | 3 | 132 | 396.00 | 416 | 3.21 | 5.95 | 0.73 | **6.68** | | | | | | | | |
| | Existing | 119 | 118 | | 0.68 | 0.68 | | 4 | 6 | 24.00 | 24 | 3.50 | 0.37 | 0.07 | **0.44** | | | | | | Project: Fieldstone Estates Phases 4 & 5 | | |
| | Queen Street | 118 | 117 | | 0.71 | 8.69 | | 4 | 6 | 24.00 | 464 | 3.19 | 6.60 | 0.87 | **7.47** | 200 | 0.49 | 0.013 | 0.73 | 22.96 | Sanitary Area Plan | ENG PLUS | Nov. 23, 2009 |
| | | 117 | Ex. 44 | | 1.58 | 10.27 | | 4 | 11 | 44.00 | 508 | 3.18 | 7.19 | 1.03 | **8.22** | 200 | 0.61 | 0.013 | 0.82 | 25.62 | Design Sheets | ENG PLUS | Nov. 23, 2009 |
| | Simcoe Avenue | Ex. 44 | Ex. 43 | | 0.69 | 10.96 | | 3 | 6 | 18.00 | 526 | 3.17 | 7.43 | 1.10 | **8.53** | 200 | 3.35 | 0.013 | 1.91 | 60.03 | Sanitary sewer slopes taken from Fieldstone Estates Project | | |
| | | Ex. 43 | Ex. 42 | | 1.05 | 12.01 | | 3 | 10 | 30.00 | 556 | 3.16 | 7.83 | 1.20 | **9.03** | 200 | 0.42 | 0.013 | 0.68 | 21.26 | Dwg 11 | MTE | 02/08/2017 |
| | | Ex. 42 | Ex. 41 | | 0.89 | 12.90 | | 3 | 8 | 24.00 | 580 | 3.15 | 8.15 | 1.29 | **9.44** | 200 | 0.42 | 0.013 | 0.68 | 21.26 | | | |
| | External 1 | | Ex. 41 | | | 5.85 | | 3 | 47 | | 141 | 3.36 | 2.11 | 0.59 | **2.70** | | | | | | External Area from Fieldstone Estates - Komoka Phase 2 | | |
| | | | | | | | | | | | | | | | | | | | | | P&P dgws | Eng Plus | June 27/11 |
| | | | | | | | | | | | | | | | | | | | | | Population from unit count based on aerial photography (Google) | | |
| | Simcoe Cres. | Ex. 41 | 46 | | 1.14 | 19.89 | | 3 | 4 | 12.00 | 733 | 3.10 | 10.14 | 1.99 | **12.13** | 200 | 0.36 | 0.013 | 0.63 | 19.68 | Unit Counts and Sewer Sizes & Slopes From | | |
| | | 46 | 47 | | 1.24 | 21.13 | | 3 | 4 | 12.00 | 745 | 3.10 | 10.30 | 2.11 | **12.41** | 200 | 0.30 | 0.013 | 0.57 | 17.97 | Sewage Works Project No 52-0030-01 | | |
| | | 47 | 48 | | 0.00 | 21.13 | | 3 | 2 | 6.00 | 751 | 3.10 | 10.39 | 2.11 | **12.50** | 200 | 0.30 | 0.013 | 0.57 | 17.97 | S 19 & S20 | Totten Sims Hubicki Associates | January 1995 |
| | | | | | | | | | | | | | | | | | | | | | Contributing Area Estimates from | | |
| | | | | | | | | | | | | | | | | | | | | | Village of Komoka Sanitary Sewer System Project | | |
| | | | | | | | | | | | | | | | | | | | | | Design sheets | Totten Sims Hubicki Associates | 24-Nov-94 |
| | External 2 | | 48 | | | 3.97 | | 3 | 21 | | 63 | 3.43 | 0.96 | 0.40 | **1.36** | | | | | | Population from unit count based on aerial photograph (Google) | | |
| | | | | | | | | | | | | | | | | | | | | | Area estimate from Village of Komoka Sanitary Sewer System Project | | |
| | | | | | | | | | | | | | | | | | | | | | Design sheets | Totten Sims Hubicki Associates | 24-Nov-94 |
| | | | | | | | | | | | | | | | | | | | | | Drainage pattern discerned from | | |
| | | | | | | | | | | | | | | | | | | | | | Sewage Works Project No 52-0030-01 | | |
| | | | | | | | | | | | | | | | | | | | | | S20 | Totten Sims Hubicki Associates | January 1995 |
| | Springer Street | 48 | 48A | | 0.00 | 25.10 | | 3 | | 0.00 | 814 | 3.09 | 11.20 | 2.51 | **13.71** | 250 | 0.38 | 0.013 | 0.75 | 36.66 | Sewage Works Project No 52-0030-01 | | |
| | | 48A | 69 | | 0.00 | 25.10 | | 3 | | 0.00 | 814 | 3.09 | 11.20 | 2.51 | **13.71** | 250 | 0.34 | 0.013 | 0.71 | 34.68 | S23 | Totten Sims Hubicki Associates | January 1995 |
| | External 3 | | 69 | | | 4.73 | | | | | 142 | 3.36 | 2.13 | 0.47 | **2.60** | | | | | | External Area and Population from | | |
| | | | | | | | | | | | | | | | | | | | | | Village of Komoka Sanitary Sewer System Project | | |
| | | | | | | | | | | | | | | | | | | | | | Design sheets | Totten Sims Hubicki Associates | 24-Nov-94 |
| | | 69 | 69A | | 0.58 | 30.41 | | 3 | 2 | 6.00 | 962 | 3.05 | 13.07 | 3.04 | **16.11** | 250 | 0.30 | 0.013 | 0.66 | 32.57 | Unit Count and Sewer Info from | | |
| | | 69A | 79 | | 0.58 | 30.99 | | 19 | 3 | 57.00 | 1019 | 3.03 | 13.77 | 3.10 | **16.87** | 250 | 0.30 | 0.013 | 0.66 | 32.57 | Sewage Works Project No 52-0030-01 | | |
| | | | | | | | | | | | | | | | | | | | | | S23 | Totten Sims Hubicki Associates | January 1995 |
| | | | | | | | | | | | | | | | | | | | | | Area Estimate from | | |
| | | | | | | | | | | | | | | | | | | | | | Village of Komoka Sanitary Sewer System Project | | |
| | | | | | | | | | | | | | | | | | | | | | Design sheets | Totten Sims Hubicki Associates | 24-Nov-94 |

# Appendix B

# Water Distribution Modelling Information

| | |
|---|---|
| **Project:** | Inglis Subdivision |
| **Project No:** | 43705-104 |
| **Location:** | Komoka, ON |
| **Date:** | 8-Jun-20 |
| **Designer:** | JJM |

**Criteria and Background**

| | | |
|---|---|---|
| Average Day Consumption: | 350 | L/day/cap |
| | 0.004 | L/s/cap |
| Max Day Peaking Factor: | 2.75 | |
| Peak Hour Peaking Factor: | 4.13 | |

**Boundary Condition**

| | | |
|---|---|---|
| Local Hydrant: | KO-94 (Test Completed May, 2015) | |
| Elevation: | 249.20 | masl |
| Static Pressure: | 50.3 | psi |
| | 35.4 | m $H_2O$ |
| HGL Elevation: | 284.6 | masl |

**# Lots**

| | |
|---|---|
| Proposed: | 59 |
| Future (assumed): | 83 |
| Population: | 422 |

**Pressure Requirements (kPa)**

| | | |
|---|---|---|
| Avg. Day: | 275 | (minimum) |
| Max Day: | 275 | (minimum) |
| Peak Hour: | N/A | |
| Max Day + Fire: | 140 | (minimum) |
| Max Allowable: | 550 | (maximum) |

**Demands**

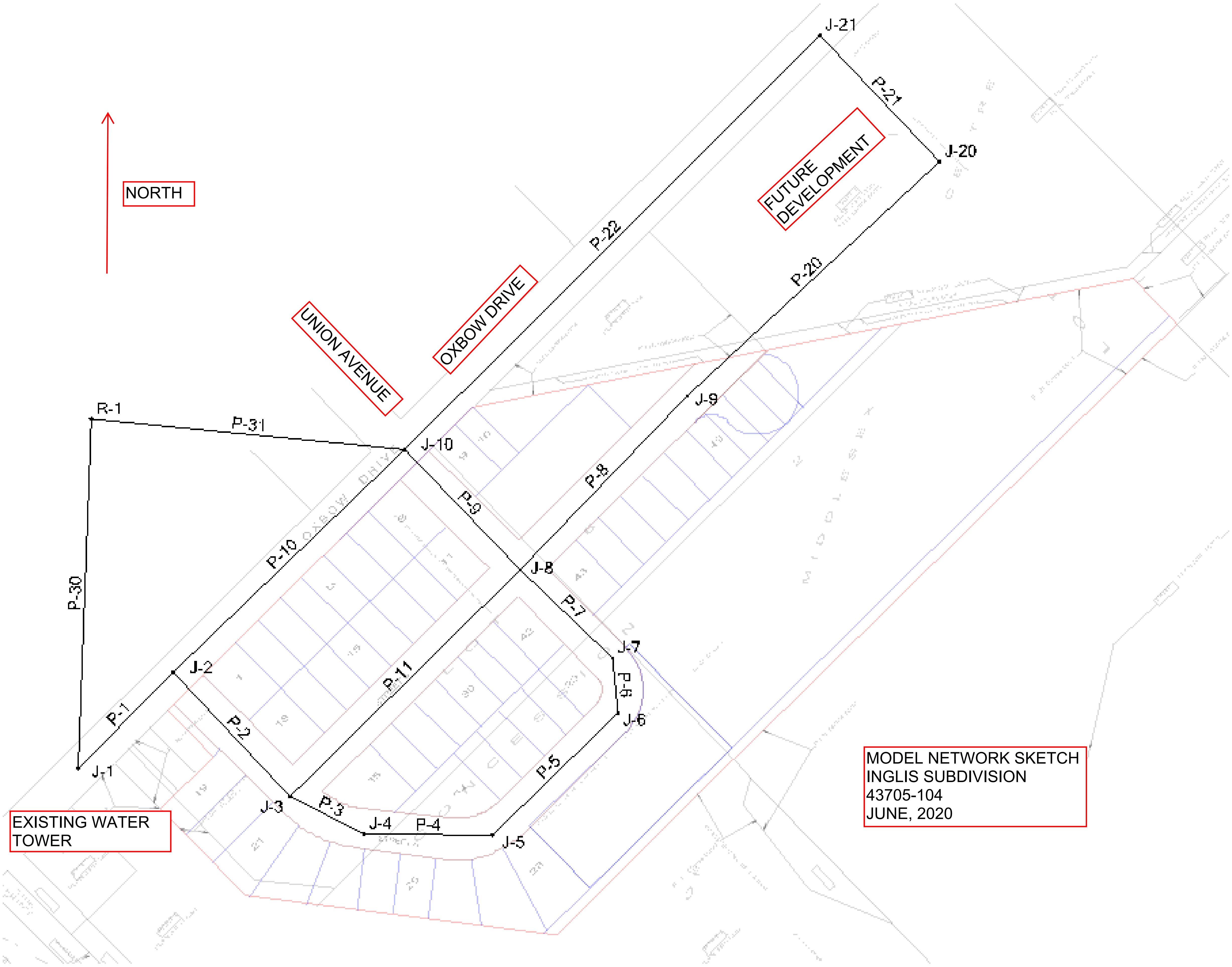
| Node | Units | # Units | ppu | Total Population | Demands (L/s) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Avg Day | Max Day | Peak Hour |
| J-2 | 1-4 | 4 | 3 | 12 | 0.049 | 0.134 | 0.201 |
| J-3 | 15-18, 19-22, 35-38 | 12 | 3 | 36 | 0.146 | 0.401 | 0.602 |
| J-4 | 22-25 | 4 | 3 | 12 | 0.049 | 0.134 | 0.201 |
| J-5 | 26-28, 32-34 | 7 | 3 | 21 | 0.085 | 0.234 | 0.351 |
| J-6 | 29-31 | 3 | 3 | 9 | 0.036 | 0.100 | 0.151 |
| J-7 | - | | | | | | |
| J-8 | 11-14, 39-45, | 11 | 3 | | | | |
| | BLK 50 | 8 | 2.4 | 52 | 0.211 | 0.582 | 0.873 |
| J-9 | 46-49 | 4 | 3 | 12 | 0.049 | 0.134 | 0.201 |
| J-10 | 5-10 | 6 | 3 | 18 | 0.073 | 0.201 | 0.301 |
| J-11 | Future | 83 | 3 | 249 | 1.009 | 2.774 | 4.166 |

**Node Info and Results Summary**

| Node | Elevation | Proposed Conditions | | | | | Future Conditions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pressure (kPa) | | | Available Fire Flow | Max Age (hrs) | Pressure (kPa) | | | Available Fire Flow | Max Age (hrs) |
| | | Avg Day | Max Day | Peak Hour | | | Avg Day | Max Day | Peak Hour | | |
| J-1 | 253.20 | 307.3 | 307.3 | 307.3 | - | 1.4 | 307.3 | 307.3 | 307.3 | - | 0.7 |
| J-2 | 252.55 | 313.7 | 313.7 | 313.7 | - | 5.4 | 313.7 | 313.6 | 313.6 | - | 2.6 |
| J-3 | 249.60 | 342.5 | 342.5 | 342.5 | 139 | 11.7 | 342.5 | 342.5 | 342.4 | 143 | 4.2 |
| J-4 | 248.60 | 352.3 | 352.3 | 352.3 | 122 | 16.1 | 352.3 | 352.3 | 352.2 | 124 | 5.7 |
| J-5 | 248.50 | 353.3 | 353.3 | 353.3 | 128 | 28.2 | 353.3 | 353.3 | 353.2 | 142 | 8.7 |
| J-6 | 249.70 | 341.6 | 341.6 | 341.5 | 119 | 11.0 | 341.6 | 341.5 | 341.5 | 124 | 16.1 |
| J-7 | 249.20 | 346.5 | 346.4 | 346.4 | 114 | 8.4 | 346.4 | 346.4 | 346.3 | 114 | 19.7 |
| J-8 | 249.30 | 345.5 | 345.5 | 345.5 | 109 | 2.3 | 345.5 | 345.4 | 345.4 | 120 | 3.7 |
| J-9 | 249.90 | 339.6 | 339.6 | 339.6 | 109 | 35.1 | 339.6 | 339.5 | 339.4 | 127 | 5.6 |
| J-10 | 251.20 | 326.9 | 326.9 | 326.9 | - | 0.4 | 326.9 | 326.9 | 326.9 | - | 0.2 |
| J-20 | 250.75 | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | 331.3 | 331.2 | 331.1 | 134 | 8.4 |
| J-21 | 249.00 | *(N/A)* | *(N/A)* | *(N/A)* | - | *(N/A)* | 348.4 | 348.3 | 348.2 | - | 6.0 |

**Pipe Info and Result Summary**

| Pipe | Hazen-Williams 'C' Value | Size | Length | Proposed Conditions | | | | | Future Conditions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Velocity (m/s) | | | | | Velocity (m/s) | | | | | |
| | | | | Peak Hour | J-3 | J-5 | J-8 | J-9 | Peak Hour | J-3 | J-5 | J-8 | J-9 | J-20 |
| P-1 | 100 | 150 | 66 | 0.04 | 1.73 | 1.48 | 1.13 | 1.13 | 0.07 | 1.69 | 1.42 | 1.04 | 0.99 | 0.94 |
| P-2 | 110 | 200 | 83 | 0.06 | 1.58 | 1.35 | 1.03 | 1.03 | 0.06 | 1.54 | 1.29 | 0.94 | 0.9 | 0.85 |
| P-3 | 110 | 200 | 41 | 0.02 | 1.02 | 1.68 | 0.65 | 0.65 | 0.03 | 1.04 | 1.66 | 0.59 | 0.57 | 0.54 |
| P-4 | 110 | 200 | 63 | 0.01 | 1.02 | 1.68 | 0.65 | 0.65 | 0.02 | 1.05 | 1.65 | 0.59 | 0.56 | 0.53 |
| P-5 | 110 | 200 | 86 | 0.01 | 1.03 | 1.51 | 0.64 | 0.64 | 0.01 | 1.05 | 1.54 | 0.58 | 0.55 | 0.52 |
| P-6 | 110 | 200 | 27 | 0.02 | 1.03 | 1.52 | 0.64 | 0.64 | 0.01 | 1.06 | 1.54 | 0.58 | 0.55 | 0.52 |
| P-7 | 110 | 200 | 63 | 0.02 | 1.03 | 1.52 | 0.64 | 0.64 | 0.01 | 1.06 | 1.54 | 0.58 | 0.55 | 0.52 |
| P-8 | 110 | 250 | 118 | 0.01 | 0.00 | 0.00 | 0.00 | 2.04 | 0.07 | 0.12 | 0.14 | 0.18 | 1.77 | 1.68 |
| P-9 | 110 | 200 | 82 | 0.07 | 1.65 | 1.89 | 2.2 | 2.2 | 0.12 | 1.5 | 1.71 | 2.01 | 1.91 | 1.81 |
| P-10 | 100 | 150 | 157 | 0.03 | 1.09 | 0.93 | 0.71 | 0.71 | 0.05 | 1.06 | 0.89 | 0.65 | 0.62 | 0.59 |
| P-11 | 100 | 150 | 158 | 0.00 | 1.06 | 0.62 | 0.66 | 0.66 | 0.02 | 1.08 | 0.67 | 0.6 | 0.57 | 0.54 |
| P-20 | 110 | 250 | 168 | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | 0.06 | 0.12 | 0.15 | 0.18 | 0.27 | 1.68 |
| P-21 | 100 | 150 | 85 | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | 0.06 | 0.49 | 0.56 | 0.66 | 0.91 | 1.16 |
| P-22 | 100 | 150 | 287 | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | *(N/A)* | 0.06 | 0.49 | 0.56 | 0.66 | 0.91 | 1.16 |



MODEL NETWORK SKETCH
INGLIS SUBDIVISION
43705-104
JUNE, 2020

# Appendix C

# Geotechnical Report

# 10125 Oxbow Drive Development

## Geotechnical Investigation

**Project Location:**
10125 Oxbow Drive
Komoka, ON

**Prepared for:**
2270942 Ontario Ltd.
P.O. Box 63
Formosa, ON N0G 1W0

**Prepared by:**
MTE Consultants
123 St. George Street
London, ON N6A 3A1

April 2, 2020

**MTE File No.:** 43705-301

*Engineers, Scientists, Surveyors.*

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# 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Ms. Heather Johnson-Inglis to conduct a geotechnical investigation for a proposed development at 10125 Oxbow Drive, Komoka Ontario, as shown on **Figure 1 in Appendix A**. The 7.7 hectare site is currently vacant and was a previous aggregate extraction pit.

The site is bordered to the north by Oxbow Drive and a retirement facility; to the east by residential buildings; to the west by a park and Municipality lands and to the south by a golf course. The ground surface generally slopes from north to south from approximate Elevation 251.5 to 245.5 metres (m).

A previous report was completed by LVM entitled "Planned Residential Subdivision, 10125 Oxbow Drive, Komoka, Ontario" dated May 20, 2015. The previous boreholes from LVM have been incorporated into this report. Geodetic elevations have been added to the LVM borehole logs based on the site benchmark used in the previous investigation. The borehole logs from the previous report are provided in Appendix B.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

# 2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out between December 10 and 19, 2019 and involved the drilling of eight boreholes (Boreholes MW101-19 to BH108-19) to depths ranging from 5.0 to 11.3 m. The locations of the boreholes are shown on the Site Plan, **Figure 2 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a D50 track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by London Soil Test Ltd.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B**.

Upon completion of drilling, monitoring wells were installed in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19. The remaining boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

Five 50 mm diameter monitoring wells were installed in Boreholes MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 to allow measurement of stabilized groundwater levels and groundwater sampling and testing, if required. The installations comprised 1.5 m filtered screen and bentonite seals above the screen. Stabilized water level measurements were taken by MTE on January 7 and February 4, 2020. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT tests; documented the soil stratigraphies; monitored the groundwater conditions; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations were surveyed by MTE OLS Ltd. and referenced to geodetic datum.

All of the soil samples collected were submitted for moisture content testing and six soil samples were submitted for particle size distribution analyses. The results of the laboratory tests are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

# 3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include topsoil/fill materials overlying granular deposits and silt.

## 3.1 Topsoil

Topsoil/Surficial organic fill was encountered surficially in all of the boreholes and was 80 to 915 mm thick (average thickness = 430 mm). The topsoil typically comprises dark brown silty to sandy topsoil. A layer of buried topsoil was encountered MW108-19 at a depth of 1.1 m and was 30 mm thick. Topsoil was determined through visual observation and no nutrient testing for applicable plant growth was performed as part of the scope of work for this project.

## 3.2 Fill Material

Variable fill material was encountered beneath topsoil in Boreholes MW101-19, BH102-19, MW104-19, BH105-19, BH106-19 and MW108-19. The fill materials ranged in thickness from 40 mm to 9.3 m and extended to depths of 0.1 to 9.4 m. The fill was deepest at the northern part of the site near Oxbow Drive. The fill typically ranges in composition from sand to silty sand to sand and gravel with rootlets. SPT N-values measured in the fill ranged from 5 to 19 blows per 300 mm penetration of the split spoon sampler indicating loose to compact conditions. Insitu moisture contents in the fill were 5 to 19% indicating moist to wet conditions.

Fill materials encountered in the LVM Boreholes BH01-15 to BH06-15 ranged in thickness from 0.7 to 8.5 m and extended to the termination depth of Borehole 04-15.

## 3.3 Granular Deposits

Granular soils were encountered beneath topsoil, fill materials or silts in all of the boreholes. The granular deposits were about 1.0 to 7.9 m. All boreholes were terminated in the granular soils except for MW104-19, BH106-19 and MW108-19. The granular soils typically range in composition from sand to silty sand to gravelly sand to sand and gravel. The results of six particle size distribution analyses conducted on the granular deposits are provided in **Appendix C** and summarized in the following table;

**Table 1 - Results of Granular Deposits Particle Size Distribution Analyses**

| Borehole Number | Sample Depth (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) |
|---|---|---|---|---|---|
| MW101-19 | 10.7 - 11.3 | 0 | 85 | 14 | 1 |
| MW103-19 | 7.6 - 8.2 | 53 | 40 | 6 | 1 |
| MW104-19 | 7.6 - 8.1 | 24 | 66 | 9 | 1 |
| BH106-19 | 3.8 – 4.3 | 0 | 73 | 26 | 1 |
| MW107-19 | 3.8 - 4.4 | 0 | 73 | 26 | 1 |
| MW108-19 | 1.5 - 2.0 | 3 | 87 | 9 | 1 |

SPT N-values measured in the granular soils range from 4 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating very loose to very dense conditions. Insitu moisture contents in the granular range from 2 to 20% indicating damp to wet conditions. Cobbles were encountered in MW103-19 and MW104-19 at depths of 5.3m and 4.4m, respectively, during drilling.

### 3.4 Silt and Clayey Silt Deposits

Silt to clayey silt was encountered beneath or interlayered in the granular soils in all of the boreholes except BH102-19, MW103-19 and MW107-19 and extends to the termination depth of MW104-19, BH106-19 and MW108-19. SPT N-values range from 26 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating compact to very dense conditions. Insitu moisture contents in the silt soils range from 8 to 21% indicating moist to wet conditions.

## 4.0 Groundwater Conditions

Groundwater observations were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Groundwater was noted within the granular deposits or fill materials in all boreholes at depths of 0.9 to 9.1 m below the ground surface.

Groundwater levels were measured in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 on January 7 and February 4, 2020 at depth of 0.5 to 8.8 m beneath the ground surface or Elevations 243.1 to 244.8 m. The results of the measured groundwater levels are summarized in the table below:

**Table 2 – Groundwater Measurements**

| Borehole | Ground Surface Elevation (mASL | Measured Groundwater Level January 7, 2020 | | Measured Groundwater Level February 4, 2020 | |
|---|---|---|---|---|---|
| | | Depth (m) | Elevation (m) | Depth (m) | Elevation (m) |
| MW101-19 | 251.9 | 8.79 | 243.11 | 8.33 | 243.57 |
| MW103-19 | 250.9 | 7.45 | 243.45 | 7.17 | 243.73 |
| MW104-19 | 250.2 | 6.29 | 243.91 | 6.01 | 244.19 |
| MW107-19 | 245.8 | 1.72 | 244.08 | 1.10 | 244.70 |
| MW108-19 | 245.3 | 0.85 | 244.45 | 0.54 | 244.76 |

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

# 5.0 Discussion and Recommendations

## 5.1 General

The project involves the design for a proposed development located at 10125 Oxbow Drive in Komoka, Ontario. Based on the detailed design information known at the time of preparing this report, a total of about 97 residential lots were proposed with a stormwater management dry pond to the west part of the property and a medium density block to the southeast corner.

The subsurface stratigraphy at the site generally comprises topsoil and/or fill materials overlying granular soils and silt deposits. Groundwater was measured within the granular deposits about 0.5 to 8.8 m below the ground surface or Elevations 243.1 to 244.8 m in MW101-19, MW103-19, MW104-19, MW107-9 and MW108-19 on January 7 and February 4, 2020.

Based on the results of this geotechnical investigation, the proposed development will be problematic due to the thickness of fill soils on site and the elevation difference across the site. The following subsections of this report contain geotechnical recommendations pertaining to development of the property; including, site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration. It is recommended that geotechnical consultant provide additional recommendations once the final grading, servicing and cut/fill plans are completed.

## 5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Prior to carrying out any cutting and engineering fill operations, the surficial topsoil and fill materials must be removed and stockpiled. The average topsoil and fill thickness for the north part of the site (BH102-19 and LVM Boreholes BH01-15 to BH05-15) was approximately 7.7 m. The topsoil and fill materials thickness in the remaining areas of the property averaged about 0.7 m. The topsoil and fill soils could be used in landscaping areas.

The southern part of the site will require a grade raise to construct the proposed design of the development.  The majority of the existing fill materials are not suitable for use as structural fill but could be used in parkland or landscape areas where no bearing capacity is required.

The majority of the inorganic native soils above the groundwater table are suitable for reuse as engineered fill if sufficient drying time is allotted. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

**Table 3 - Engineered Fill Requirements**

| Fill Use | Minimum Compaction Required |
|---|---|
| Structural fill to support buildings | 100% SPMDD |
| Subgrade fill beneath pavements or services | 95%SPMDD |
| Bulk fill in landscape area | 90%SPMDD |

The subgrade soils are susceptible to disturbance due to the silt content, and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the buildings should comprise granular material such as OPSS Granular ‘B’. Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal.  Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

## 5.3 Site Servicing

### 5.3.1 Excavations and Dewatering

The development will be serviced with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths in engineered fill soils.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)), exclusive of groundwater effects. Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Groundwater inflow should be expected where the excavations extend into the groundwater encountered within the granular deposits at about Elevations 243.1 to 244.8 m. It is our geotechnical opinion that proactive dewatering in the form of vacuum well points or the like would be required to handle the groundwater infiltration in this area if excavations extend below the groundwater level. It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW) will be required for the dewatering system for sewer installations at the site installed below the groundwater level. The design of the dewatering system should be completed by a specialized dewatering contractor to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base.

### 5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on properly dewatered native inorganic subsoil or imported structural fill. The existing fill and topsoil are not suitable to support pipes without significant settlement. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD).

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary.  The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth.

### 5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native soils are not considered suitable for reuse as trench backfill.  Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed.  Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

## 5.4 Pavements

It is understood pavements will be constructed for the proposed roadways at the site. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The pavement component thicknesses in the following table are recommended based on the proposed pavement usage, the frost-susceptibility and strength of the subgrade soils, Municipality standards and the Benkelman beam spring rebound coefficient for granular soils;

**Table 4 - Pavement Design**

| Pavement Component | Light Duty | Heavy Duty |
|---|---|---|
| Asphalt Hot Mix | 90 mm | 110 mm |
| OPSS 1010 Granular ‘A’ Base | 150 mm | 150 mm |
| OPSS 1010 Granular ‘B’ Subbase | 350 mm | 450 mm |

Heavy duty pavements should be used for main access ways to the development and where large vehicles will frequent, such as garbage and fire trucks.

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of HL3 surface over 50 mm of HL8 binder for the light duty pavement option and 50 mm of HL3 surface over 60 mm of HL8 binder for the heavy duty pavement option.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is strongly recommended to install subdrains beneath the low areas of pavement and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. Consideration should be given to providing continuous subdrains along the perimeter edges of the new roadways to promote drainage of the granular materials.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

## 5.5 Curbs, Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the Municipality of Middlesex Centre standards or specific requirements (OPSS 353.05.01):

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 7.0 ± 1.5%

During cold weather any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each day’s pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

## 5.6 Foundation Design

It is understood that the proposed building design may be constructed with slab-on-grade floors or with full basements.

In general, the undisturbed compact native soils or approved structural fill is considered suitable to support building foundations.

Building footings constructed on the undisturbed compact native granular soils or approved structural fill may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability

Limit States (SLS) of 150 kPa. The existing fill and topsoil are not suitable to support building foundations.

The founding materials are susceptible to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata.

The soil in trenches beneath footings for sewer and watermain services shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 25 MPa/m should be used in the design of the floor slab.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘D’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils, and temporary side slopes through this material must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation, exclusive of groundwater effects.

### 5.6.1 Basements

It is understood that basements may be installed for the proposed buildings at the site. Basement construction at the site may be problematic if a grade raise is not employed. The basement excavations will encounter groundwater conditions in the granular soils at Elevations 243.1 to 244.8 m. We recommend the basement floor levels be designed a minimum 0.5 m above the seasonal high groundwater elevations.

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service or other frost free outlet.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m$^3$ for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed compact native soil or well compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. If the subgrade soil is wet, we strongly recommend that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

## 5.7 Storm water Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may also be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). Six particle size distribution analyses were carried out on the granular deposits encountered at the site. They are plotted on **Table 101 in Appendix C**.

The estimated vertical hydraulic conductivity (k) is derived from an empirical formula by Hazen and Beyer. The estimated design infiltration rate is based on recommendations found in the Low Impact Development Stormwater Management Planning and Design Guide, Appendix C, Version 1.0, 2011, published by the Toronto and Region (TRCA) and the Credit Valley (CVC) Conservation Authority, and the approximate relationship between hydraulic conductivity and infiltration rate. A Factor of Safety of 2.5 has been applied to the calculated infiltration rates.

**Table 5 - Infiltration Rates for Native Soils**

| Borehole Number | Sample Depth (m) | Borehole Elevation (mASL) | Soil Type | Estimated K-Value (m/sec) | Infiltration Rate (mm/hr) |
|---|---|---|---|---|---|
| MW101-19 | 10.7 – 11.3 | 251.9 | Sand | 3.9E-5 | 49 |
| MW103-19 | 7.6 – 8.2 | 250.9 | Sand and Gravel | 7.4E-3 | 201 |
| MW104-19 | 7.6 – 8.1 | 250.2 | Gravelly Sand | 6.5E-5 | 56 |
| BH106-19 | 3.8 – 4.3 | 245.3 | Silty Sand | 1.7E-5 | 39 |
| MW107-19 | 3.8 – 4.3 | 245.8 | Silty Sand | 2.9E-5 | 46 |
| MW108-19 | 1.5 – 2.0 | 245.3 | Sand | 6.5E-5 | 57 |

It is our opinion that at-source infiltration of stormwater runoff is feasible for this development but will be dependent on the type of imported structural fill soils used to raise grades at the site.

## 5.8 Construction inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford and London offices.

# 6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

**MTE Consultants Inc.**

| | |
|---|---|
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| Geotechnical Engineer | Geotechnical Engineer |
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BXT:MXW

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# Appendix A

## Figures

Figure 1- Location Plan

Figure 2- Site Plan

January 16, 2020 — 11:07 a.m. — Plotted By: dgross

1 LOCATION PLAN

Project: 43705-301 CAD: \\MTE85.LOCAL\MTE\DWG\P\43705\301\BH FIGURES\43705-301-BH

## REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO

MTE
Engineers, Scientists, Surveyors
519-271-7952

SCALE: N.T.S

CLIENT
2270942 ONTARIO LTD.

PROJECT
OXBOW DRIVE GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

SITE
10125 OXBOW DRIVE,
MIDDLESEX CENTRE, ONTARIO

TITLE
LOCATION PLAN

| | |
|---|---|
| Reviewed By | DMG |
| Prepared By | AKW |
| Drawn By | AKW |
| Date | JANUARY 2020 |
| Project No. | 43705-301 |
| Figure No. | 1 |

N

NORTH

January 16, 2020 — 11:07 a.m. — Plotted By: dgross    2 SITE PLAN    Project: 43705-301    CAD: \\MTE85.LOCAL\MTE\DWG\P\43705\301\BH FIGURES\43705-

## LEGEND

BH101-20
⊕ MTE BOREHOLE

MW103-20
◐ MTE MONITORING WELL

BH01-15
⊕ LVM BOREHOLE (2015)

TBM
▲ TEMPORARY BENCHMARK

## REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO.
- EXISTING LVM BH FROM LVM DWG #P-0008182-01-100 SHEET 002 REV 00
- TBM: EXISTING TOP OF FIRE HYDRANT NORTH OF SITE (TOP OF SPINDLE, ELEVATION=251.12m)

N

NORTH

0 20 40 60 80 100m

Scale(11x17): 1:2000

MTE

Engineers, Scientists, Surveyors

519-271-7952

CLIENT
2270942 ONTARIO LTD.

PROJECT
OXBOW DRIVE GEOTECHNICAL
AND HYDROGEOLOGICAL
INVESTIGATION

SITE
10125 OXBOW DRIVE,
MIDDLESEX CENTRE, ONTARIO

TITLE
SITE PLAN

| | | | |
|---|---|---|---|
| Reviewed By | BXT | | |
| Prepared By | AKW | Project No. | 43705-301 |
| Drawn By | AKW | Figure No. | 2 |
| Date | JANUARY 2020 | | |

# Appendix B

# Borehole Logs

Abbreviations and Symbols

Boreholes BH101-19 to BH108-19

LVM Boreholes BH-01-15 to BH-09-15

## ID Number: MW101-19

**Project:** 10125 Oxbow Drive Development
**Project No:** 43705-301
**Client:** 2270942 Ontario Ltd.
**Site Location:** 10125 Oxbow Drive, Komoka, ON

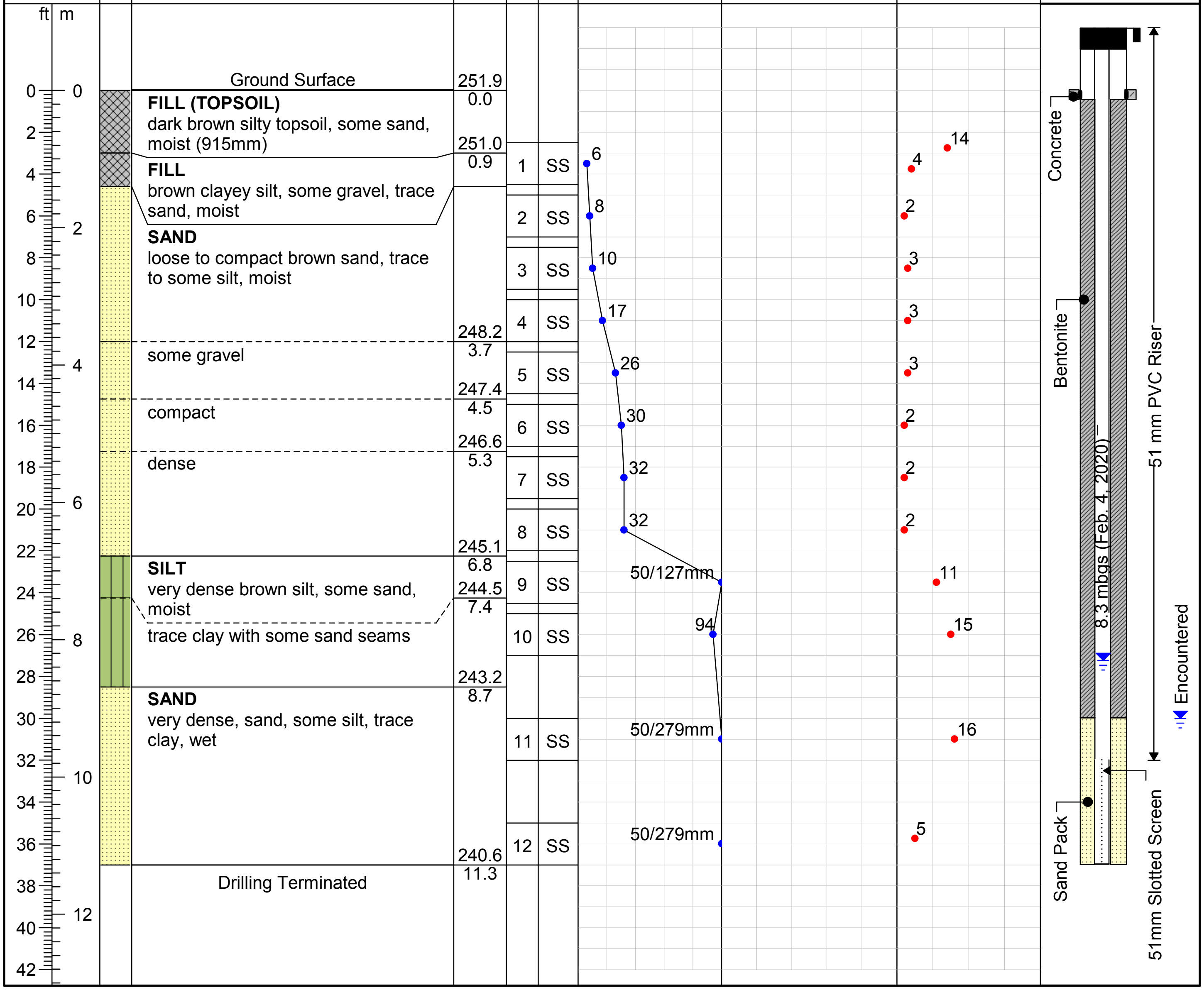
**Drill Date:** 12/11/2019
**Drilling Contractor:** London Soil Test Ltd.
**Drill Rig:** D50T Track
**Drill Method:** Hollow Stem Augers
**Protective Cover:** Monument Casing

**Subsurface Profile**

| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 251.9<br>0.0 |
| **FILL (TOPSOIL)** dark brown silty topsoil, some sand, moist (915mm) | 251.0<br>0.9 |
| **FILL** brown clayey silt, some gravel, trace sand, moist | |
| **SAND** loose to compact brown sand, trace to some silt, moist | 248.2<br>3.7 |
| some gravel | 247.4<br>4.5 |
| compact | 246.6<br>5.3 |
| dense | 245.1<br>6.8 |
| **SILT** very dense brown silt, some sand, moist | 244.5<br>7.4 |
| trace clay with some sand seams | 243.2<br>8.7 |
| **SAND** very dense, sand, some silt, trace clay, wet | 240.6<br>11.3 |
| Drilling Terminated | |

**Sample**

| Number | Type |
|---|---|
| 1 | SS |
| 2 | SS |
| 3 | SS |
| 4 | SS |
| 5 | SS |
| 6 | SS |
| 7 | SS |
| 8 | SS |
| 9 | SS |
| 10 | SS |
| 11 | SS |
| 12 | SS |



**Field Technician:** M. Costello
**Drafted by:** M. Costello
**Reviewed by:** B. Thorner

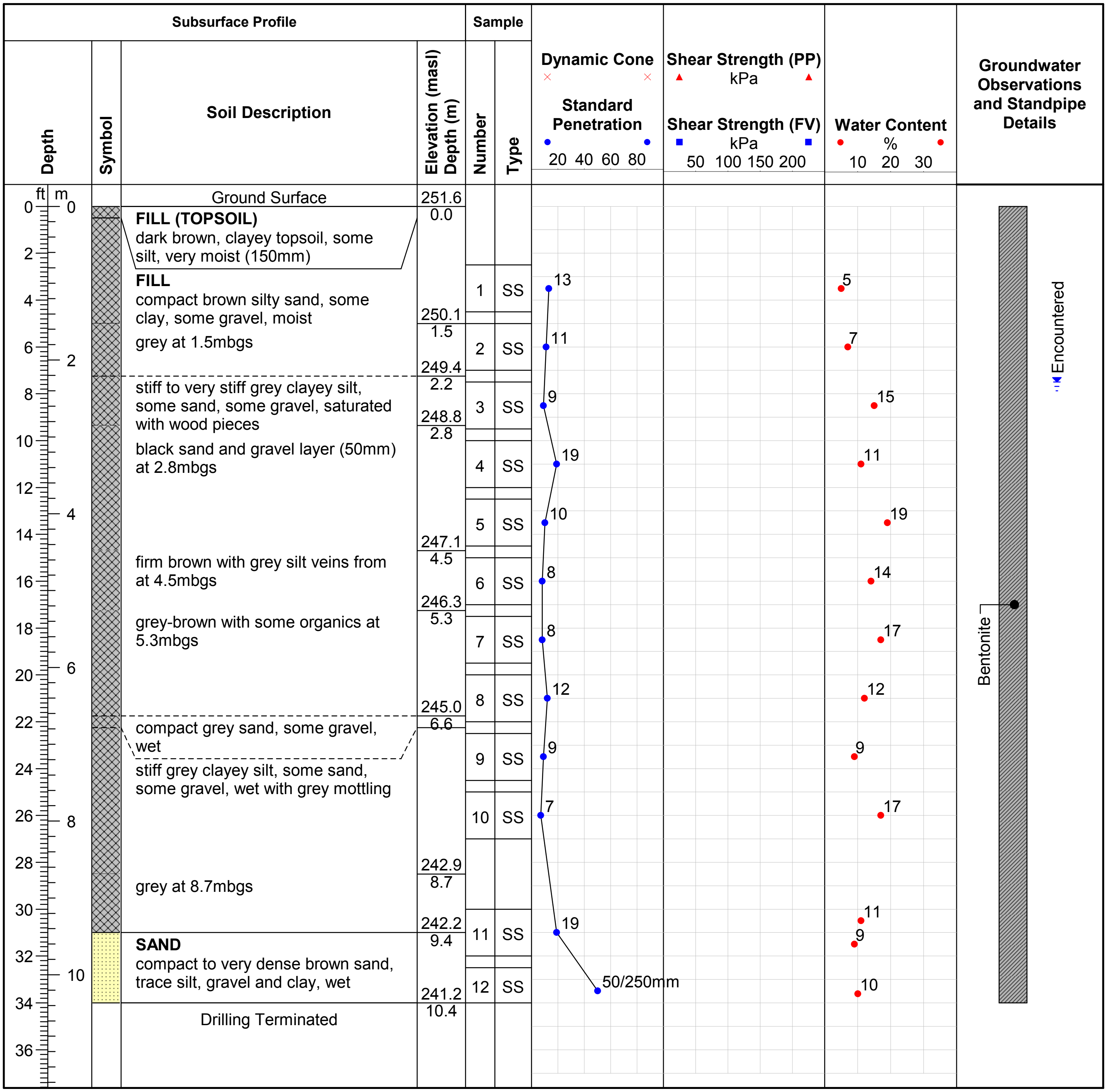
**Sheet:** 1 of 1

Top of pipe elevation: 252.57m asl
Water encountered at 9.1mbgs during drilling
Water level measured at 243.11m asl on January 7, 2020
Water level measured at 243.57m asl on February 4, 2020

## ID Number: BH102-19

**Project:** 10125 Oxbow Drive Development
**Project No:** 43705-301
**Client:** 2270942 Ontario Ltd.
**Site Location:** 10125 Oxbow Drive, Komoka, ON

**Drill Date:** 12/10/2019
**Drilling Contractor:** London Soil Test Ltd.
**Drill Rig:** D50T Track
**Drill Method:** Hollow Stem Augers
**Protective Cover:** N/A



| Elevation (masl)<br>Depth (m) | Soil Description |
|---|---|
| 251.6 | Ground Surface |
| 0.0 | **FILL (TOPSOIL)**<br>dark brown, clayey topsoil, some silt, very moist (150mm) |
| | **FILL**<br>compact brown silty sand, some clay, some gravel, moist |
| 250.1<br>1.5 | grey at 1.5mbgs |
| 249.4<br>2.2 | stiff to very stiff grey clayey silt, some sand, some gravel, saturated with wood pieces |
| 248.8<br>2.8 | black sand and gravel layer (50mm) at 2.8mbgs |
| 247.1<br>4.5 | firm brown with grey silt veins from at 4.5mbgs |
| 246.3<br>5.3 | grey-brown with some organics at 5.3mbgs |
| 245.0<br>6.6 | compact grey sand, some gravel, wet<br>stiff grey clayey silt, some sand, some gravel, wet with grey mottling |
| 242.9<br>8.7 | grey at 8.7mbgs |
| 242.2<br>9.4 | **SAND**<br>compact to very dense brown sand, trace silt, gravel and clay, wet |
| 241.2<br>10.4 | Drilling Terminated |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 13 | 5 |
| 2 | SS | 11 | 7 |
| 3 | SS | 9 | 15 |
| 4 | SS | 19 | 11 |
| 5 | SS | 10 | 19 |
| 6 | SS | 8 | 14 |
| 7 | SS | 8 | 17 |
| 8 | SS | 12 | 12 |
| 9 | SS | 9 | 9 |
| 10 | SS | 7 | 17 |
| 11 | SS | 19 | 11<br>9 |
| 12 | SS | 50/250mm | 10 |

**Field Technician:** M. Costello
**Drafted by:** M. Costello
**Reviewed by:** B. Thorner

Water encountered at 2.3mbgs during drilling

**Sheet:** 1 of 1

## ID Number: MW103-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

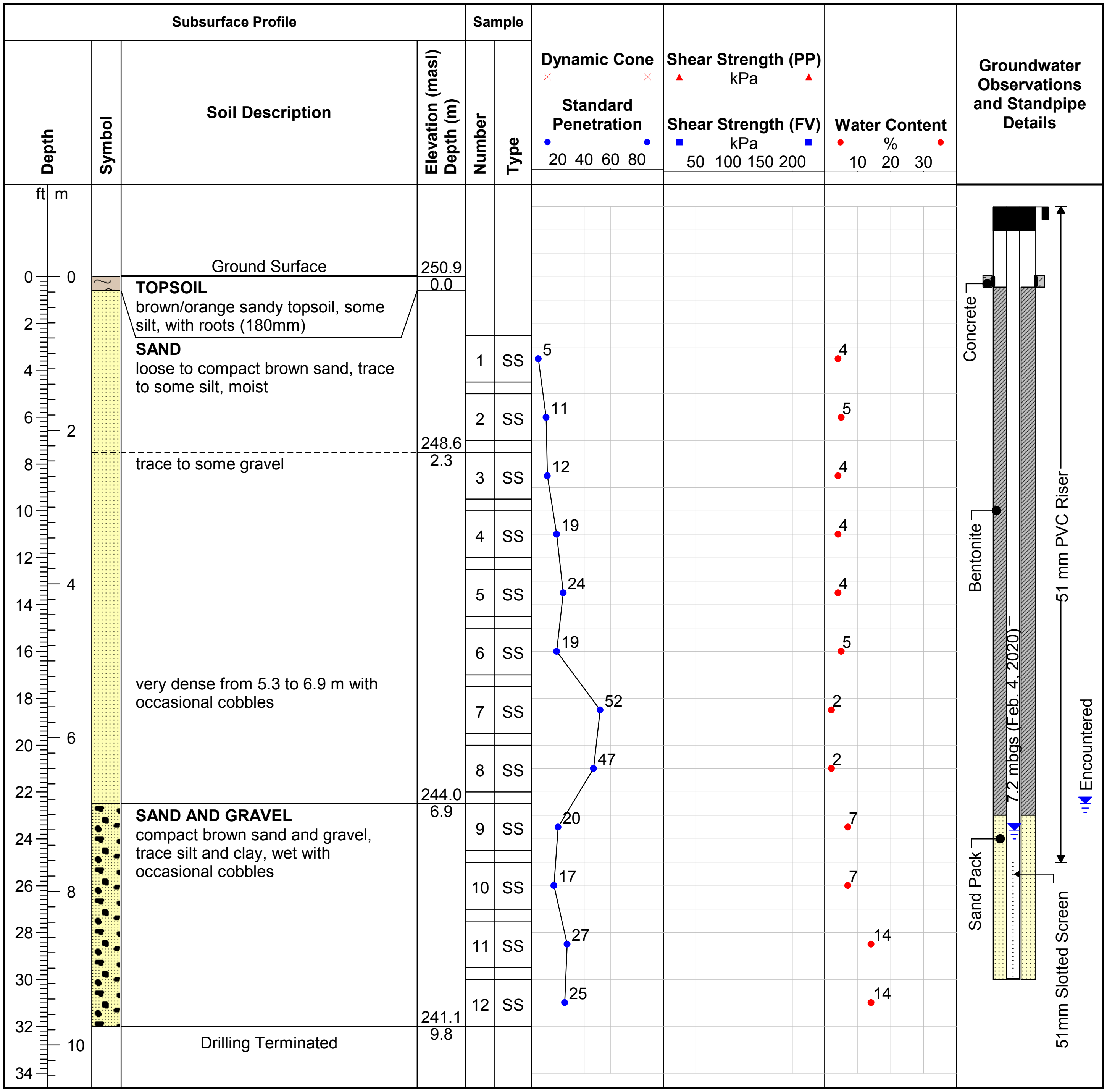
**Drill Date:** 12/10/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



| Elevation (masl) Depth (m) | Soil Description |
|---|---|
| 250.9 | Ground Surface |
| 0.0 | **TOPSOIL**<br>brown/orange sandy topsoil, some silt, with roots (180mm) |
| | **SAND**<br>loose to compact brown sand, trace to some silt, moist |
| 248.6<br>2.3 | trace to some gravel |
| | very dense from 5.3 to 6.9 m with occasional cobbles |
| 244.0<br>6.9 | **SAND AND GRAVEL**<br>compact brown sand and gravel, trace silt and clay, wet with occasional cobbles |
| 241.1<br>9.8 | Drilling Terminated |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 5 | 4 |
| 2 | SS | 11 | 5 |
| 3 | SS | 12 | 4 |
| 4 | SS | 19 | 4 |
| 5 | SS | 24 | 4 |
| 6 | SS | 19 | 5 |
| 7 | SS | 52 | 2 |
| 8 | SS | 47 | 2 |
| 9 | SS | 20 | 7 |
| 10 | SS | 17 | 7 |
| 11 | SS | 27 | 14 |
| 12 | SS | 25 | 14 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

Top of pipe elevation: 251.74m asl
Water encountered at 6.9mbgs during drilling
Water level measured at 243.45m asl on January 7, 2020
Water level measured at 243.73m asl on February 4, 2020

**Sheet:** 1 of 1

## ID Number: MW104-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

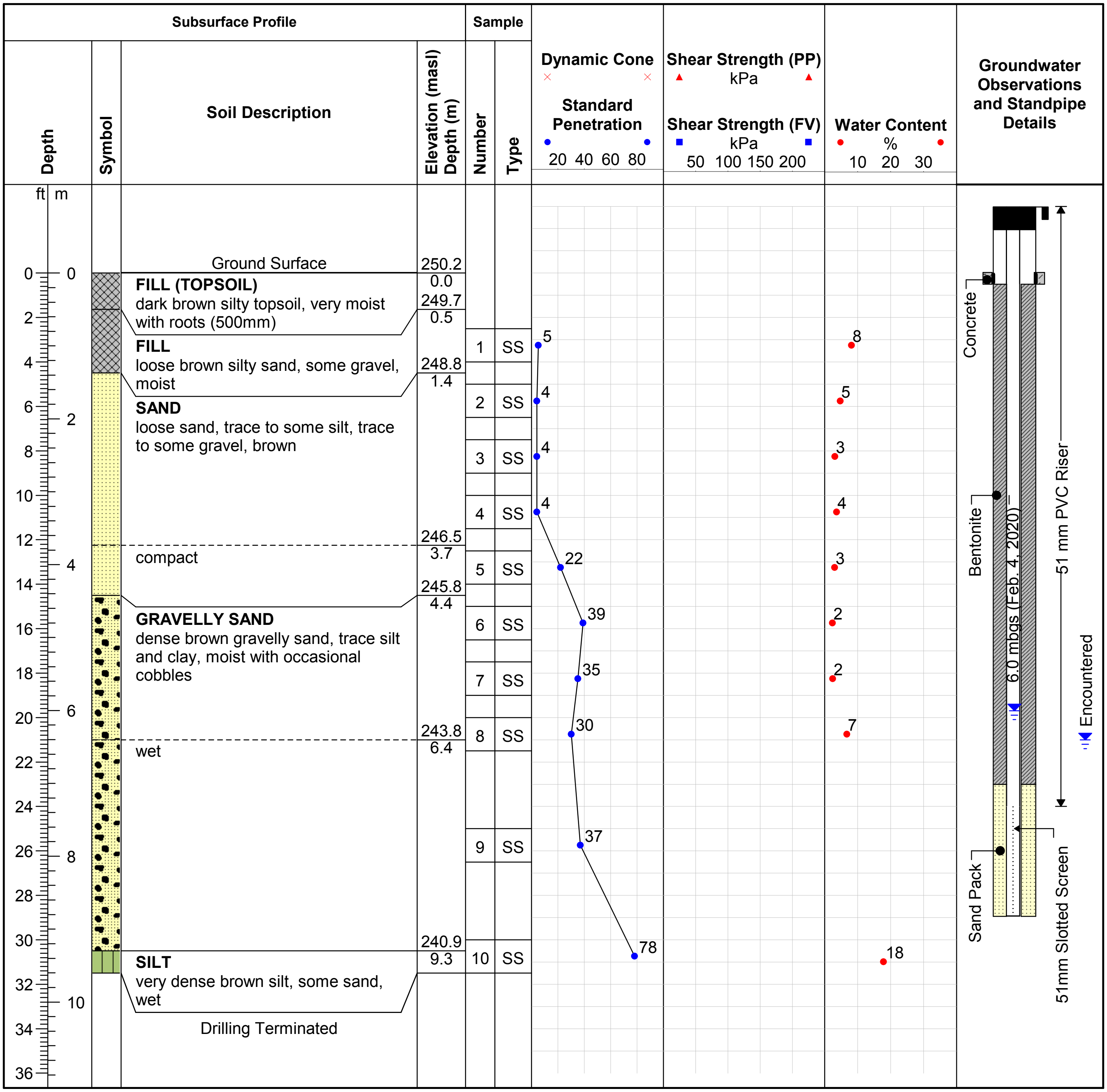
**Drill Date:** 12/19/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



| Soil Description | Elevation (masl) / Depth (m) | Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|---|---|
| Ground Surface | 250.2 / 0.0 | | | | |
| **FILL (TOPSOIL)** dark brown silty topsoil, very moist with roots (500mm) | 249.7 / 0.5 | 1 | SS | 5 | 8 |
| **FILL** loose brown silty sand, some gravel, moist | 248.8 / 1.4 | 2 | SS | 4 | 5 |
| **SAND** loose sand, trace to some silt, trace to some gravel, brown | | 3 | SS | 4 | 3 |
| | | 4 | SS | 4 | 4 |
| compact | 246.5 / 3.7 | 5 | SS | 22 | 3 |
| **GRAVELLY SAND** dense brown gravelly sand, trace silt and clay, moist with occasional cobbles | 245.8 / 4.4 | 6 | SS | 39 | 2 |
| | | 7 | SS | 35 | 2 |
| wet | 243.8 / 6.4 | 8 | SS | 30 | 7 |
| | | 9 | SS | 37 | |
| **SILT** very dense brown silt, some sand, wet | 240.9 / 9.3 | 10 | SS | 78 | 18 |
| Drilling Terminated | | | | | |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 251.13m asl
Water encountered at 6.4mbgs during drilling
Water level measured at 243.91m asl on January 7, 2020
Water level measured at 244.19m asl on February 4, 2020

## ID Number: BH105-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

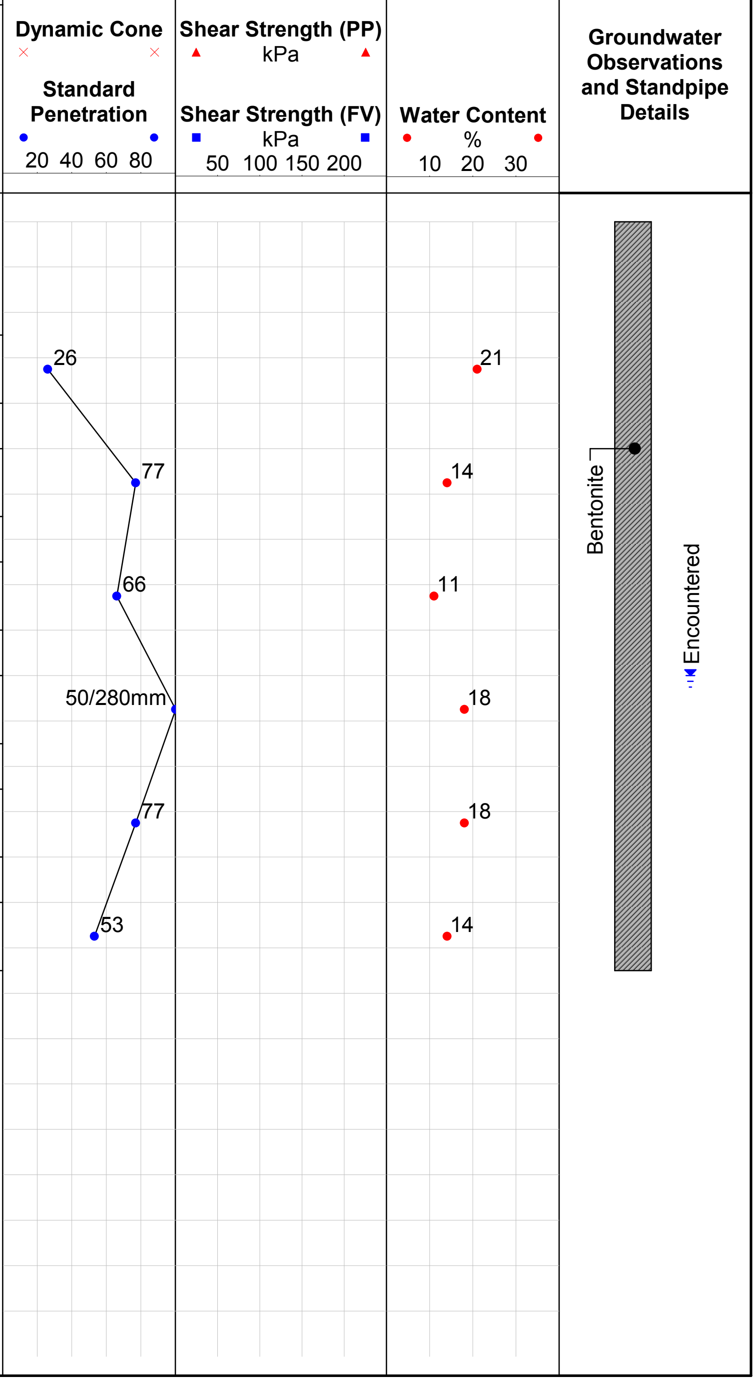
**Protective Cover:** N/A

**Subsurface Profile**

| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 246.3 |
| **FILL (TOPSOIL)** dark brown clayey topsoil, some silt, very moist with rootlets (80mm) | 0.0 |
| **FILL** brown sand and gravel, moist (40mm) | |
| **SILT** very stiff to hard brown silt, some sand, moist | |
| trace gravel | 244.9<br>1.4 |
| **SILTY SAND** very dense brown silty fine sand, trace gravel, wet | 243.4<br>2.9 |
| Drilling Terminated | 241.3<br>5.0 |

**Sample**

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 26 | 21 |
| 2 | SS | 77 | 14 |
| 3 | SS | 66 | 11 |
| 4 | SS | 50/280mm | 18 |
| 5 | SS | 77 | 18 |
| 6 | SS | 53 | 14 |



**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

Water encountered at 3.0mbgs during drilling

**Sheet:** 1 of 1

## ID Number: BH106-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

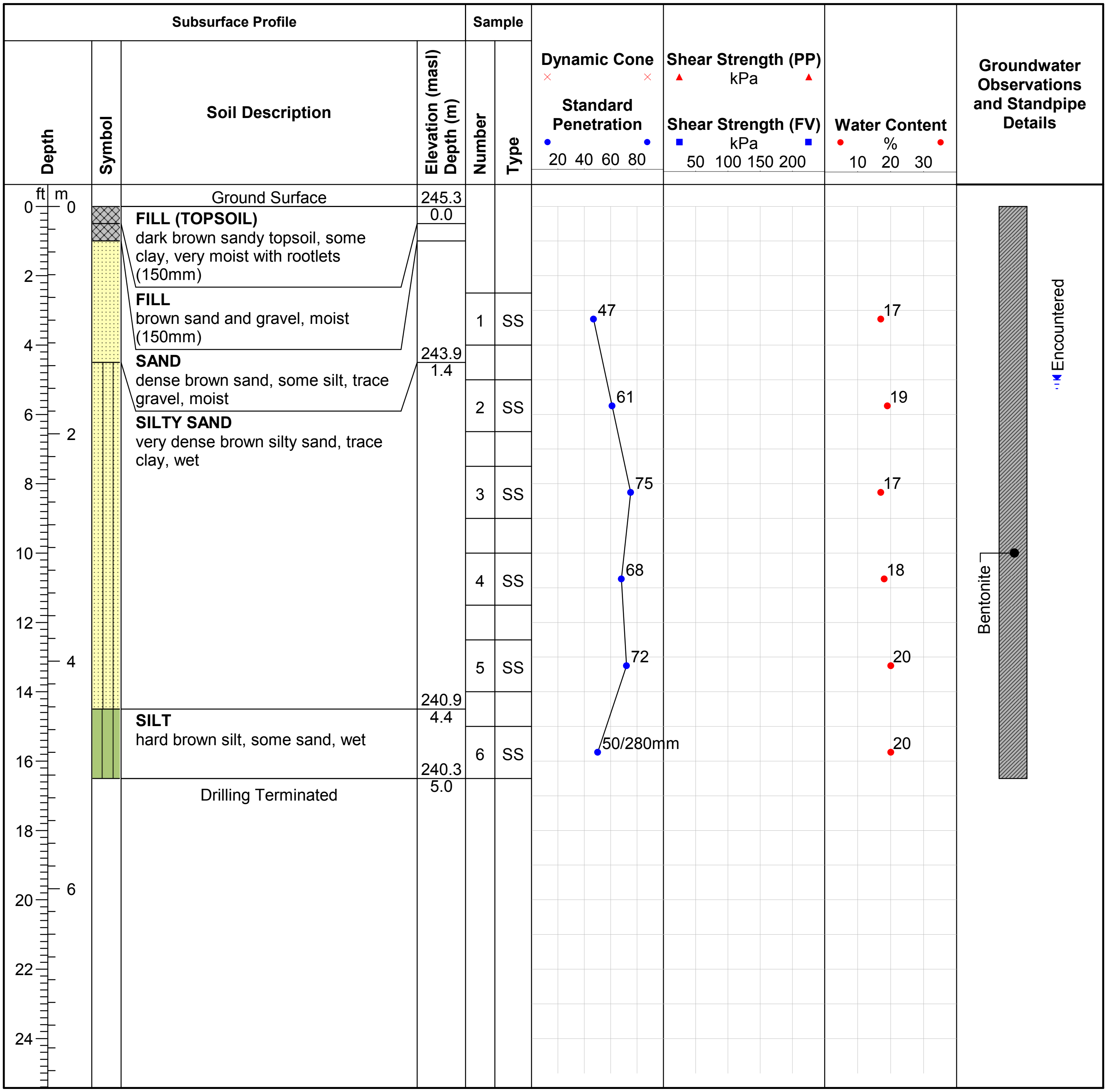
**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** N/A



| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 245.3 |
| **FILL (TOPSOIL)** dark brown sandy topsoil, some clay, very moist with rootlets (150mm) | 0.0 |
| **FILL** brown sand and gravel, moist (150mm) | |
| **SAND** dense brown sand, some silt, trace gravel, moist | |
| **SILTY SAND** very dense brown silty sand, trace clay, wet | 243.9<br>1.4 |
| **SILT** hard brown silt, some sand, wet | 240.9<br>4.4 |
| Drilling Terminated | 240.3<br>5.0 |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 47 | 17 |
| 2 | SS | 61 | 19 |
| 3 | SS | 75 | 17 |
| 4 | SS | 68 | 18 |
| 5 | SS | 72 | 20 |
| 6 | SS | 50/280mm | 20 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

Water encountered at 1.5mbgs during drilling

**Sheet:** 1 of 1

## ID Number: MW107-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

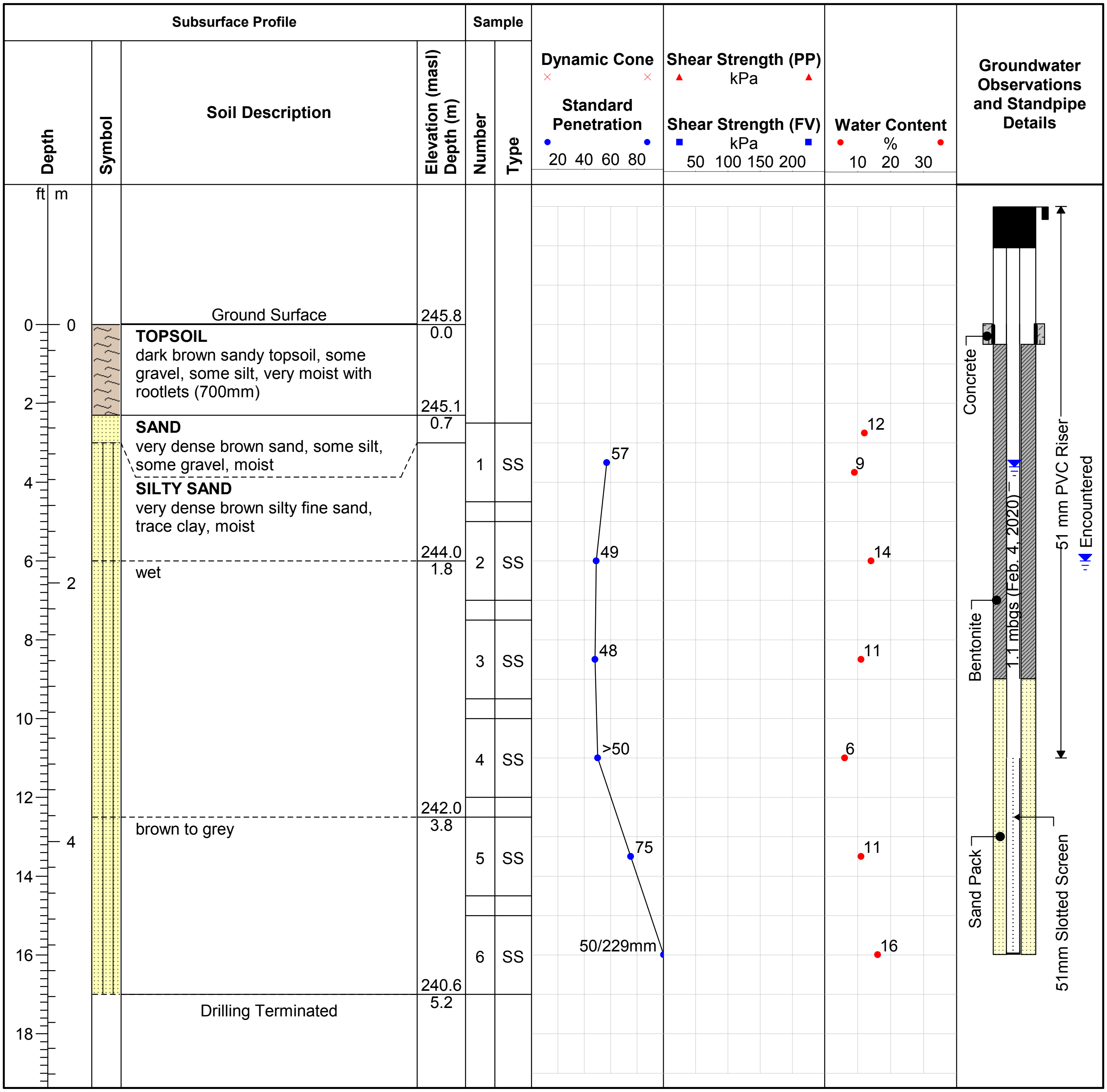
**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 245.8<br>0.0 |
| **TOPSOIL**<br>dark brown sandy topsoil, some gravel, some silt, very moist with rootlets (700mm) | 245.1<br>0.7 |
| **SAND**<br>very dense brown sand, some silt, some gravel, moist | |
| **SILTY SAND**<br>very dense brown silty fine sand, trace clay, moist | 244.0<br>1.8 |
| wet | 242.0<br>3.8 |
| brown to grey | 240.6<br>5.2 |
| Drilling Terminated | |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 57 | 12<br>9 |
| 2 | SS | 49 | 14 |
| 3 | SS | 48 | 11 |
| 4 | SS | >50 | 6 |
| 5 | SS | 75 | 11 |
| 6 | SS | 50/229mm | 16 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 247.12m asl
Water encountered at 1.8mbgs during drilling
Water level measured at 244.08m asl on January 7, 2020
Water level measured at 244.70m asl on February 4, 2020

# ID Number: MW108-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

**Drill Date:** 12/12/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

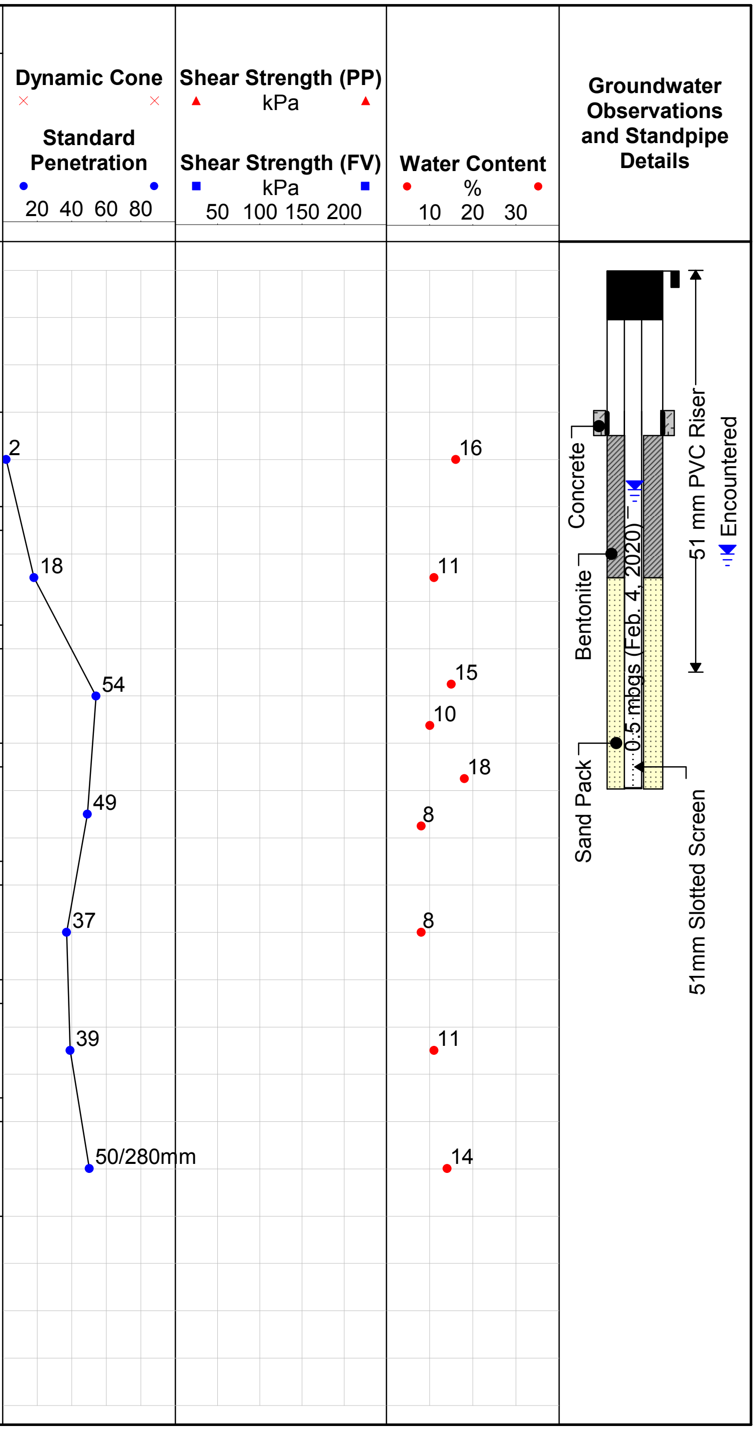
**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing

**Subsurface Profile**

Depth: ft 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20; m 0, 2, 4, 6

| Soil Description | Elevation (masl) Depth (m) | Number | Type |
|---|---|---|---|
| Ground Surface | 245.3<br>0.0 | | |
| **FILL (TOPSOIL)** very loose brown silty sand topsoil, some gravel, moist with rootlets (760mm) | | 1 | SS |
| **SILTY SAND** compact brown silty fine sand, moist | 244.5<br>0.8 | 2 | SS |
| **TOPSOIL** compact brown silty sand topsoil layer (30mm) | 244.2<br>1.1 | | |
| **SAND** compact brown sand, trace silt, gravel and clay, wet | | 3 | SS |
| dense to very dense, some gravel | 243.4<br>1.9 | | |
| **CLAYEY SILT** hard grey clayey silt, trace sand, some gravel, wet | 242.9<br>2.4 | 4 | SS |
| | | 5 | SS |
| | | 6 | SS |
| silt seams | 240.8<br>4.5 | 7 | SS |
| Drilling Terminated | 240.1<br>5.2 | | |



**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 246.63m asl
Water encountered at 0.9mbgs during drilling
Water level measured at 244.45m asl on January 7, 2020
Water level measured at 244.76m asl on February 4, 2020

# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

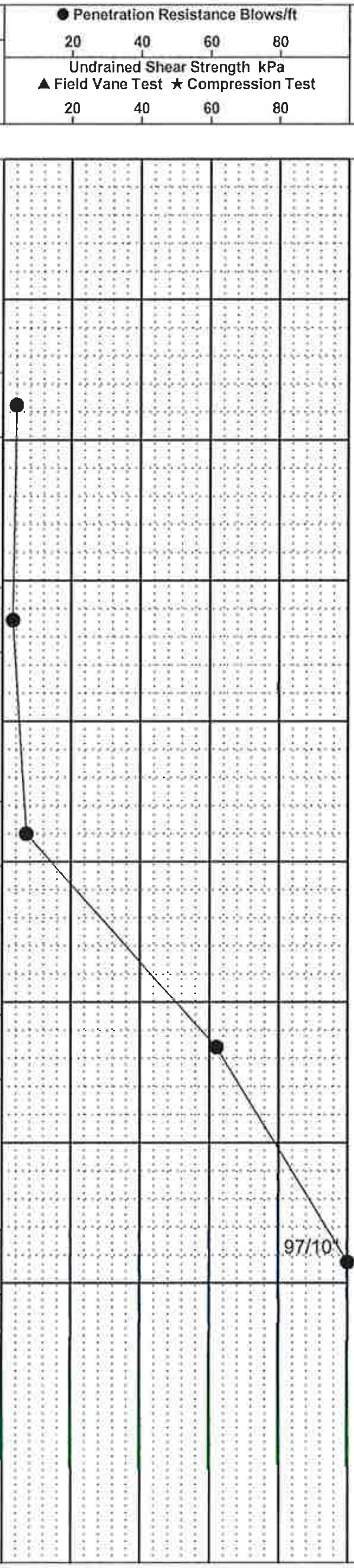
## LOG OF BOREHOLE NO.
## 01-15

**Encl. No.** 1 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

251.1

SUBSURFACE PROFILE

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.93 | 0 | Soft to firm, brown, clayey silt FILL, wood fragments. | ▨ | | | | | | | |
| | | | | | 1 | ss | 4 | | 21 | |
| | | | | | 2 | ss | 3 | | 21 | |
| 96 | 4 | Loose, brown silt & sand FILL, trace to some clay, trace of gravel. | ▨ | | | | | | | |
| | | | | | 3 | ss | 7 | | 17 | |
| 94 | 6 | Very dense, brown, fine sandy SILT to silty fine SAND. | ░ | | | | | | | |
| | | | | | 4 | ss | 62 | | 15 | |
| | | | | ▽ | | | | | | |
| | | | | | 5 | ss | 97/ 10" | | 20 | |
| | 8 | End of Borehole.<br>Water levl at 7.3m depth at completion. | | | | | | | | |



# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

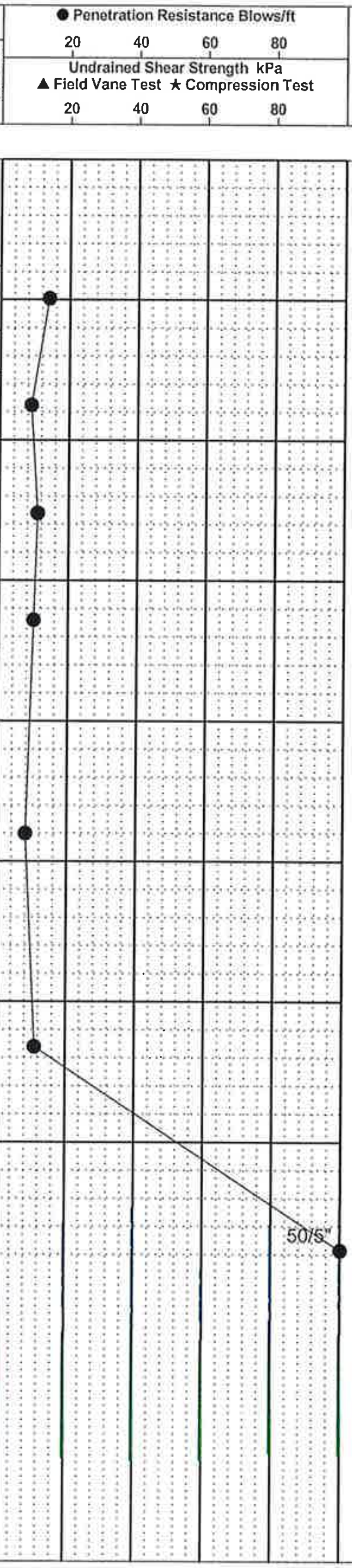
## LOG OF BOREHOLE NO.

## 02-15

**Encl. No.** 2 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

251.5

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.35 | 0 | Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams. | ▨ | | 1 | ss | 14 | | 17 | |
| | | Loose, brown silt, sand & gravel FILL, asphalt fragments. | ▨ | | 2 | ss | 9 | | 7 | |
| | | Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel. | ▨ | | 3 | ss | 11 | | 16 | |
| | | | | | 4 | ss | 10 | | 19 | |
| | | | | | 5 | ss | 8 | | 12 | |
| | | | | | 6 | ss | 11 | | 10 | |
| | | Very dense, brown, moist, SAND & GRAVEL, some silt to silty. | | | 7 | ss | 50/<br>5" | | 3 | |
| | | End of Borehole.<br>Hole dry & open at completion. | | | | | | | | |



# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

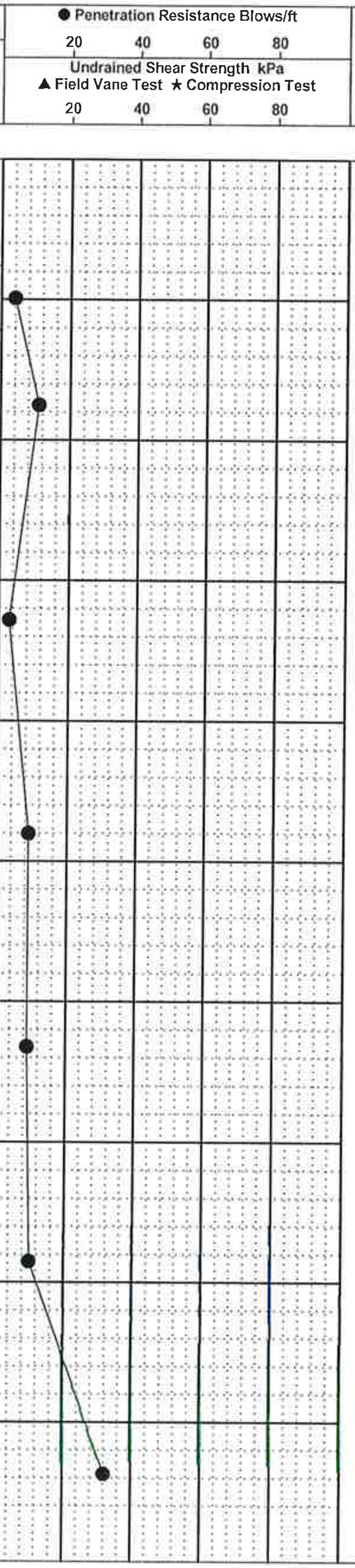
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 03-15

**Encl. No.** 3 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

252.2

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 101.06 | 0 | Loose, brown, gravelly silt & sand FILL, some clay. | ▨ |  | 1 | ss | 4 |  | 16 |  |
|  |  | Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers. | ▨ |  | 2 | ss | 11 |  | 7 |  |
|  |  |  |  |  | 3 | ss | 3 |  | 17 |  |
|  |  |  |  |  | 4 | ss | 9 |  | 11 |  |
|  |  | Loose, brown sand FILL, some silt. | ▨ |  | 5 | ss | 9 |  | 8 |  |
|  |  | Loose to compact, brown sand & gravel FILL, trace to some silt. | ▨ |  | 6 | ss | 10 |  | 6 |  |
|  |  | Dense, grey SAND & GRAVEL, trace of silt. |  | ∇ | 7 | ss | 32 |  | 9 |  |
|  |  | End of Borehole.<br>Water levl at 8.5m depth at completion. |  |  |  |  |  |  |  |  |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

**L V M**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

# LOG OF BOREHOLE NO. 04-15

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**Encl. No.** 4 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

251.5

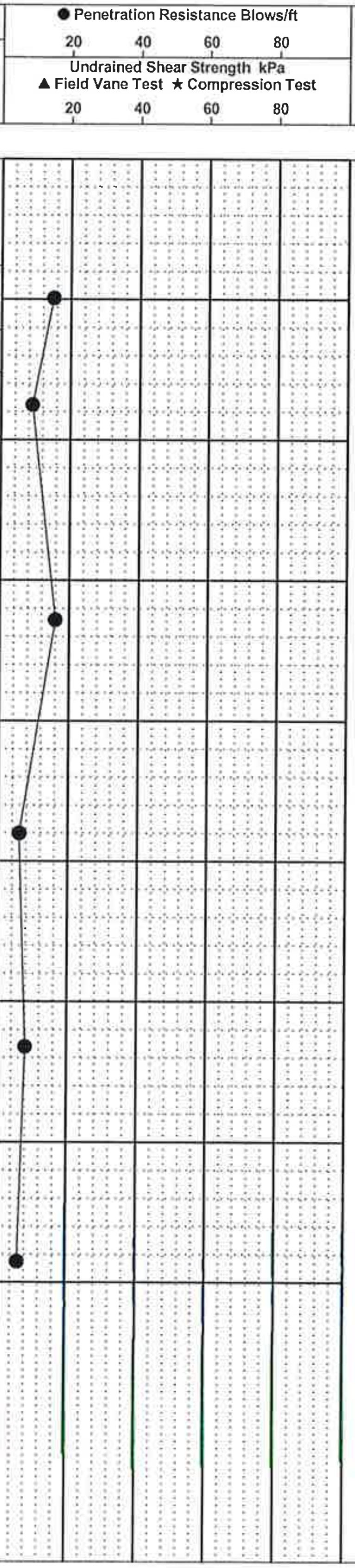
**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.38 | 0 | Compact, brown silt, sand & gravel FILL, wood fragments, clay seams. | ▨ | | 1 | ss | 15 | | 4 | |
| | | Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer. | ▨ | | 2 | ss | 9 | | 11 | |
| | | | | | 3 | ss | 16 | | 5 | |
| | | | | | 4 | ss | 6 | | 19 | |
| | | Loose, brown silt, sand & gravel FILL, clayey seams. | ▨ | | 5 | ss | 8 | | 17 | |
| | | Firm, brown, silty clay FILL. | ▨ | | 6 | ss | 6 | | 13 | |
| | 8 | End of Borehole.<br>Hole dry & open at completion. | | | | | | | | |

● Penetration Resistance Blows/ft

Undrained Shear Strength kPa

▲ Field Vane Test ★ Compression Test



**LVM**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

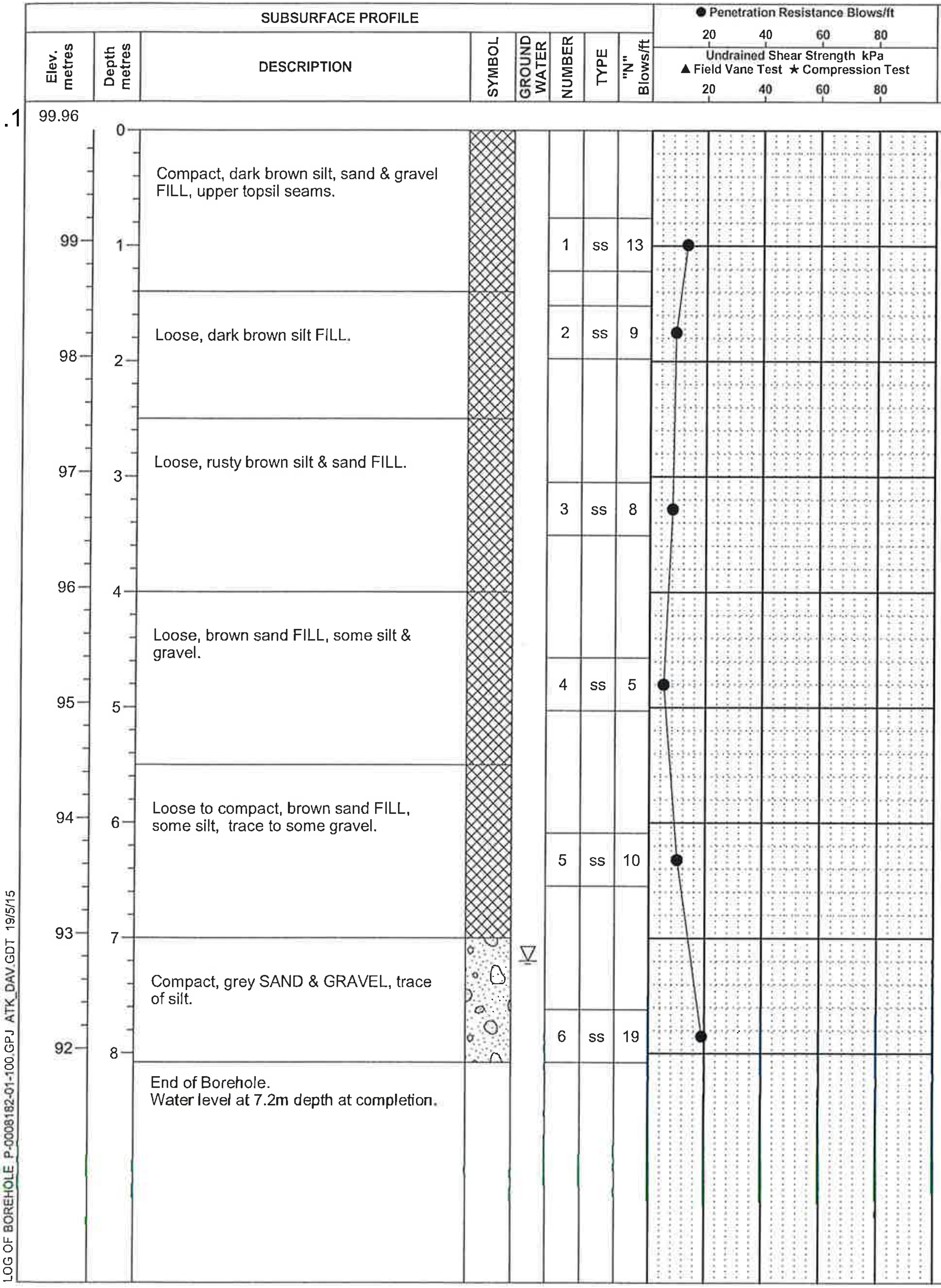
## LOG OF BOREHOLE NO.
## 05-15

**Encl. No.** 5 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

251.1

SUBSURFACE PROFILE

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.96 | 0 | Compact, dark brown silt, sand & gravel FILL, upper topsil seams. | ▨ | | 1 | ss | 13 | | 9 | |
| | | Loose, dark brown silt FILL. | ▨ | | 2 | ss | 9 | | 15 | |
| | | Loose, rusty brown silt & sand FILL. | ▨ | | 3 | ss | 8 | | 9 | |
| | | Loose, brown sand FILL, some silt & gravel. | ▨ | | 4 | ss | 5 | | 6 | |
| | | Loose to compact, brown sand FILL, some silt, trace to some gravel. | ▨ | | 5 | ss | 10 | | 8 | |
| | | Compact, grey SAND & GRAVEL, trace of silt. | | ∇ | 6 | ss | 19 | | 10 | |
| | | End of Borehole.<br>Water level at 7.2m depth at completion. | | | | | | | | |



**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

# LOG OF BOREHOLE NO.
# 06-15

**Encl. No.** 6 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

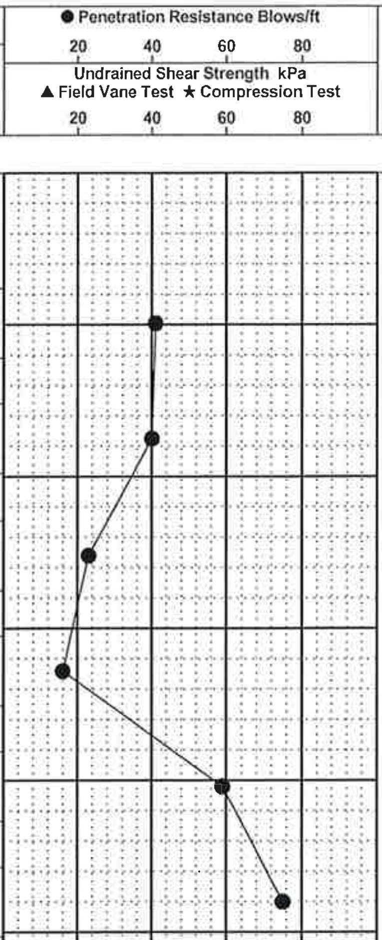
246.6

SUBSURFACE PROFILE

| Elev. metres | DESCRIPTION | SYMBOL |
|---|---|---|
| 95.49 | Loose, dark brown, silty sand FILL, trace to some gravel. | ▨ |
| | Compact to dense, brown SAND & GRAVEL, trace to some silt. | |
| | Compact to very dense, brown SILT & fine SAND. | |
| | End of Borehole.<br>Water level at 2.8m depth at completion. | |

GROUND WATER: ▽ at 2.8m

| NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|
| 1 | ss | 41 | | 2 | |
| 2 | ss | 40 | | 2 | |
| 3 | ss | 23 | | 9 | |
| 4 | ss | 16 | | 14 | |
| 5 | ss | 59 | | 19 | |
| 6 | ss | 75 | | 19 | |



**LVM**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

12 - 60 Meg Drive, London, ON, N6E 3T6

Phone: 519-685-6400 Fax: 519-685-0943

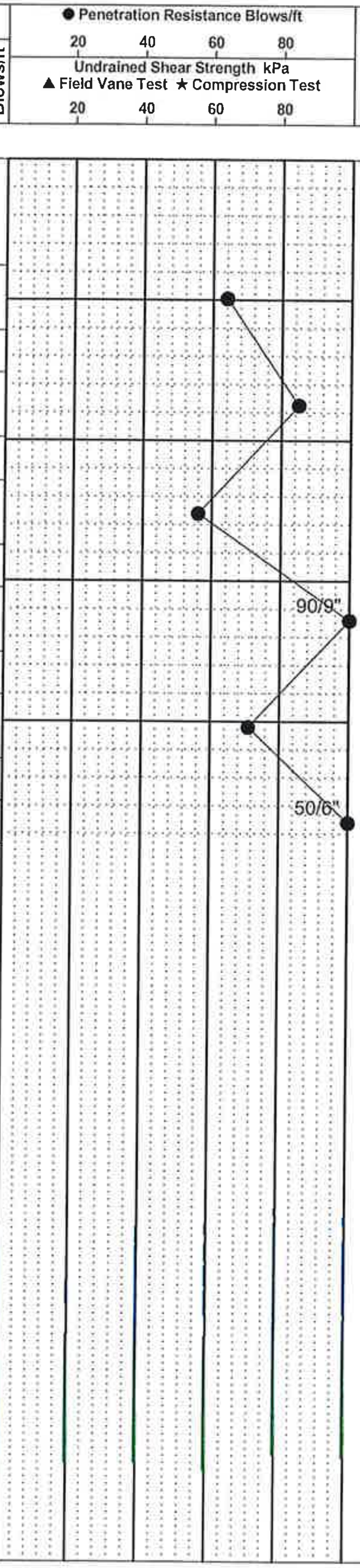
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 07-15

**Encl. No.** 7 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

245.4

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 94.24 | 0 | 150mm TOPSOIL. | | | | | | | | |
| | | Very dense, brown SILT, upper sand seams. | | | 1 | ss | 64 | | 13 | |
| | | Very dense, silty fine SAND, occasional silt seams. | | ▽ | 2 | ss | 85 | | 18 | |
| | | | | | 3 | ss | 56 | | 18 | |
| | | | | | 4 | ss | 90/<br>9" | | 15 | |
| | | | | | 5 | ss | 71 | | 20 | |
| | | | | | 6 | ss | 50/<br>6" | | 18 | |
| | | End of Borehole.<br>Water level at 1.6m depth at completion. | | | | | | | | |



# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

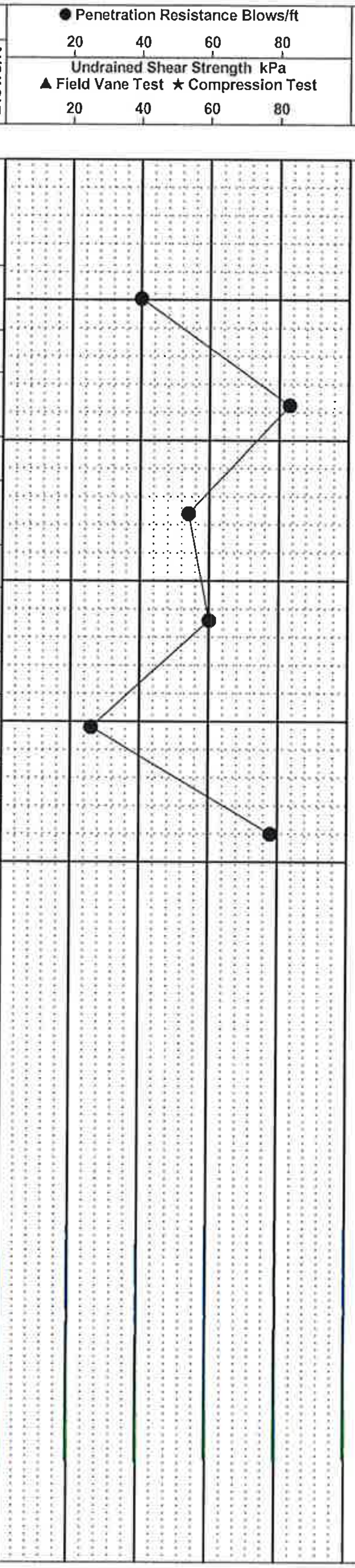
## LOG OF BOREHOLE NO.
## 08-15

**Encl. No.** 8 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

245.5

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 94.33 | 0 | Dense, brown SAND & GRAVEL, trace to some silt. | | ∇ | 1 | ss | 40 | | 7 | |
| | | Very dense, brown SILT, sand seams. | | | 2 | ss | 83 | | 16 | |
| | | | | | 3 | ss | 54 | | 18 | |
| | | Very dense, brown SILT & fine SAND. | | | 4 | ss | 60 | | 18 | |
| | | Compact to very dense, brown, fine SAND, some silt to silty. | | | 5 | ss | 26 | | 18 | |
| | | | | | 6 | ss | 78 | | 16 | |
| | | End of Borehole.<br>Water level at 1.0m depth at completion. | | | | | | | | |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

**L V M**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

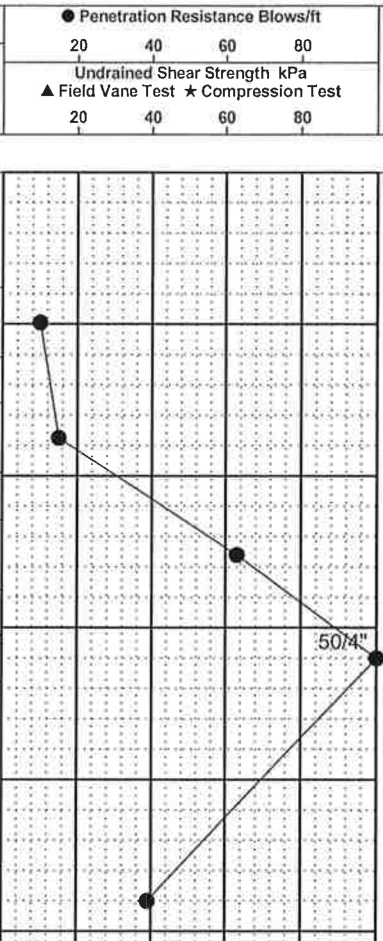
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

# LOG OF BOREHOLE NO. 09-15

**Encl. No.** 9 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

244.1

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 93.02 | 0 | Compact, brown SAND & GRAVEL, trace to some silt. |  | ∇ |  |  |  |  |  |  |
| 92 | 1 |  |  |  | 1 | ss | 10 |  | 13 |  |
|  |  |  |  |  | 2 | ss | 15 |  | 6 |  |
| 91 | 2 |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 3 | ss | 63 |  | 15 |  |
|  |  | Very dense, brown SILT & fine SAND, clayey seam. |  |  |  |  |  |  |  |  |
| 90 | 3 | Very dense, brown SAND & GRAVEL, some silt. |  |  | 4 | ss | 50/ 4" |  | 10 |  |
|  |  | Very stiff to hard, grey, clayey SILT to silty CLAY till. |  |  |  |  |  |  |  |  |
| 89 | 4 |  |  |  | 5 | as |  |  | 9 |  |
|  |  |  |  |  | 6 | ss | 39 |  | 12 |  |
| 88 | 5 | End of Borehole.<br>Water level at 0.2m depth at completion. |  |  |  |  |  |  |  |  |



# Appendix C

# Laboratory Test Results

Table 101

MTE

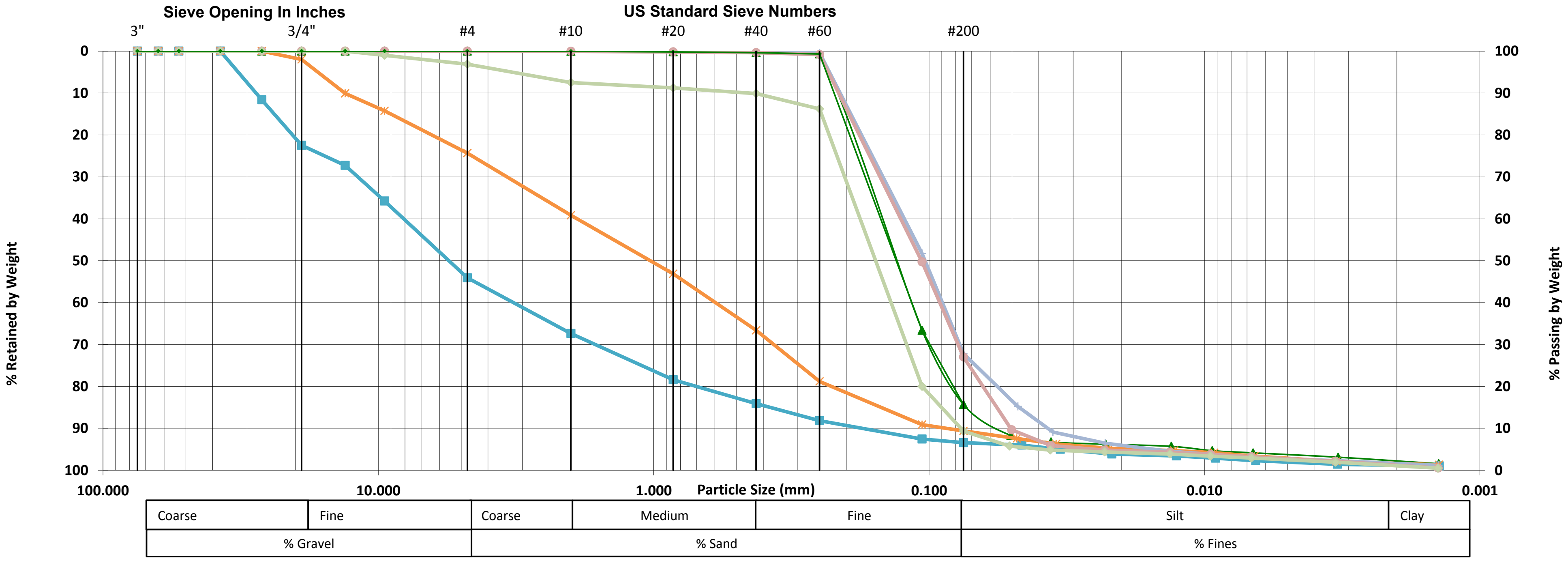
# Particle Size Distribution Analysis Test Results

**Project Name:** 10125 Oxbow Drive Additional Investigation
**Client:** 2270942 Ontario Ltd.
**Project Location:** 10125 Oxbow Drive, Middlesex Centre, ON

**Date Sampled:** Dec. 10-12, 2019
**Date Tested:** Jan. 7-10, 2020

**MTE File No.:** 43705-301
**Table No:** 101

## Unified Soil Classification



| Symbol | Borehole ID | Sample # | Sample Depth | Description |
|---|---|---|---|---|
| ▲ | MW101-19 | SS-12 | 10.7-11.3 mbgs | SAND, some Silt, trace Clay |
| ■ | MW103-19 | SS-10 | 7.6-8.2 mbgs | SAND and GRAVEL, trace Silt and Clay |
| ✱ | MW104-19 | SS-9 | 7.6-8.1 mbgs | Gravelly SAND, trace Silt and Clay |
| + | MW106-19 | SS-5 | 3.8-4.3 mbgs | Silty SAND, trace Clay |
| ● | MW107-19 | SS-5 | 3.8-4.4 mbgs | Silty SAND, trace Clay |
| ◆ | MW108-19 | SS-3 | 1.5-2.0 mbgs | SAND, trace Silt, Gravel and Clay |

CERTIFIED BY
CCIL
Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

**NOTES:**

LVM

## 2270942 Ontario Ltd.

# Planned Residential Development
# 10125 Oxbow Drive
# Komoka, Ontario

## Geotechnical Engineering Report
## 161-P-0008182-01-100-GE-R-0001-00

LICENSED PROFESSIONAL ENGINEER
S. W. BURT
May 21/15
PROVINCE OF ONTARIO

Prepared by:

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LVM

Soil and Materials Engineering
Environmental Engineering
Building Science
Supply Chain Quality

## 2270942 Ontario Ltd.

# Planned Residential Development
# 10125 Oxbow Drive
# Komoka, Ontario

## Geotechnical Engineering Report

Date: May 20, 2015
Ref. N°: 161-P-0008182-01-100-GE-R-0001-00

**LVM, a division of EnGlobe Corp.**

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| Appendix 2 | Boreholes |
| Appendix 3 | Grain Size Distribution Analyses |
| Appendix 4 | Chemical Analysis |
| Appendix 5 | Benching of Earth Slopes |

0 1 2 3 4 5 10 cm

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\25_CAD\P-8182-01-100_DRAWING 2_ SITE PLAN.DWG

NOTES :

1-REFERENCES : County of Middlesex Online Interactive Map (2010), Accessed April 2015.

2-TEMPORARY BENCHMARK : Top of Fire Hydrant Spindle Located NW of Intersection of Oxbow Drive. and Union St., Elevation 100.00 m (assumed local datum).

3-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 25 50 75 100 m
SCALE 1:2500

Project

**Planned Residential Development**

10125 Oxbow Drive, Komoka

Title

**Site Plan**

LVM

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12-60 Meg Drive
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Drawn A.Stewart
Checked S.Burt

Discipline GEOTECHNICAL
Scale 1 : 2500
Date 2015-04-28

Project manager
R.Helwig
Sequence no
02 of 02

| M. dept | Project | Disc. | Dwg no. | Rev. |
|---|---|---|---|---|
| 161 | P-0008182-01-100 | GE | 002 | 00 |

## Property and Confidentiality

2270942 Ontario Ltd.
42663 Huron-Bruce Road
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Wroxeter, Ontario  N0G 2X0

Attention: Ms. Heather Johnston-Inglis, President

| REVISION AND PUBLICATION REGISTER | | |
|---|---|---|
| **Revision N°** | **Date** | **Modification And/Or Publication Details** |
| 00 | 2015-05-20 | Report Issued |
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# INTRODUCTION

LVM, a division of EnGlobe Corp., (LVM) was retained by 2270942 Ontario Ltd. to perform a Geotechnical Investigation at 10125 Oxbow Drive, Komoka, Ontario, shown on the Location Plan, Drawing 1 in Appendix 1. This work was authorized by Ms. Heather Johnston-Inglis of 2270942 Ontario Ltd. on March 6, 2015.

The conception plan for the residential development includes creating 77 building lots as well as three condominium blocks. The purpose of this investigation was to determine the composition of the fill and native soils at the site and, based on that information, provide geotechnical recommendations for the reuse of the soil as engineered fill material.

# 1 INVESTIGATION PROCEDURE

## 1.1 FIELD PROGRAM

The fieldwork for this investigation was performed on April 14 and 15, 2015, and involved drilling nine boreholes located as shown on the Site Plan, Drawing 2 in Appendix 1.

The boreholes were advanced to sampling depths of 4.9 to 9.6 metres (m) using a power auger machine equipped with conventional soil sampling equipment, which was supplied and operated by a specialist drilling company.

Soil samples were recovered from the boreholes at frequent intervals of depth using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values are shown on the borehole logs in Appendix 2.

Groundwater observations were carried out in the boreholes during and upon completion of the drilling operations. The observations are summarized on the appended borehole logs.

The fieldwork was monitored throughout by a member of our engineering staff who directed the drilling and sampling procedures, documented the soil stratigraphies, and cared for the recovered soil samples.

The level of the ground surface at each borehole location was related to a local benchmark, which was taken as the top of the spindle of a fire hydrant located as shown on the Site Plan, Drawing 2 in Appendix 1. The benchmark was assigned an arbitrary elevation of 100.0 m.

## 1.2 LABORATORY TESTING

All soil samples recovered during this investigation were returned to our laboratory for visual examination and moisture content testing. The moisture content values are shown on the appended borehole logs.

Nine samples of the fill materials revealed in Boreholes 1 to 5 were submitted to the ALS Environmental London office and subjected to metals, inorganics, PHC and BTEX analyses. The Certificate of Analysis is provided in Appendix 4.

The soil samples will be stored for a period of three months from the date of this report. After this time, they will be discarded unless prior arrangements have been made for longer storage.

## 2 SUMMARIZED SUBSURFACE CONDITIONS

Refer to the borehole logs in Appendix 2 for descriptions of the soil stratigraphies, results of SPT testing, moisture content values, and groundwater observations. The following notes are intended only to amplify this data.

From the ground surface, Boreholes 1 to 6 revealed layers of soft to stiff clayey silt to silty clay fill and loose to compact silt, sand and gravel fill materials, and Borehole 4 was terminated within the fill at a depth of 8.1 m. The fill samples yielded moisture contents ranging from 4 to 21%. Borehole 7 revealed a 150mm thick surface layer of topsoil.

Beneath the fill and topsoil layers, and at the ground surface in Boreholes 8 and 9, layers of compact to very dense silt, sand and gravel materials were encountered, and Boreholes 1, 2, 3, and 5 to 8, were terminated within these layers at depths of 4.9 to 9.6 m. The silt and sand strata displayed natural moisture contents of 13 to 20%, and the sand and gravel displayed values of 6 to 13% near and below the groundwater levels and 2 to 3% above the groundwater level.

Borehole 9 penetrated the silt, sand and gravel layers at a depth of 3.5 m, and it was terminated within very stiff to hard clayey silt to silty clay till at a depth of 5.0 m. The two till samples yielded natural moisture contents of 9 and 12%.

At the completion of the drilling operations, groundwater levels were measured in Boreholes 1, 3, and 5 to 9 at depths of 0.2 to 8.5 m (Elevations 92.6 to 93.3), and groundwater seepage was not observed in Boreholes 2 and 4.

# 3 DISCUSSION AND RECOMMENDATIONS

## 3.1 EXCAVATIONS AND GROUNDWATER CONTROL

The soils revealed on this site which are not excessively wet can be classified as Type 3 soil in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Any saturated and submerged soil shall be classified as Type 4 soil.

The sides of open excavations within a Type 3 soil must be carried out using side slopes not steeper than 1 vertical to 1 horizontal from the bottom of the excavation. Type 4 may be dewatered to be classified as Type 3 soil, or be adequately braced, otherwise side slopes of 1 vertical to 3 horizontal or flatter will be required for excavations intersecting type 4 soil.

Based on the borehole findings it is anticipated that groundwater and surface water entering open excavations may be controlled by gravity drainage and filtered pumps up to 0.5 to 1.0 m below the groundwater table. The borehole findings indicate that the level of the prevailing groundwater table at the site is near Elevation 92.7. Lowering the water level by more than one metre will require a permit to take water (PTTW) and positive dewatering system installed by a specialist dewatering contractor.

Where groundwater seepage is occurring it will be necessary to provide stability by flattening the excavation side slopes.

## 3.2 SITE PREPARATION AND GRADING

It is understood that sand and gravel materials have been mined from the site and fill has been placed along the northwestern part of the site represented by Borehole 1 to 5 locations. Although final design grades had not been established at the time of this investigation, it is anticipated that low-lying areas would be filled by utilizing the fill material cut from the higher area in the northwest part of the site. It is recommended that houses and other structures be supported on engineered fill constructed with Granular 'B' type material with a maximum aggregate size of 50 mm. The borehole findings and grain size distribution analysis test results, shown graphically on Figures 1 and 2 in Appendix 3, indicate that the fill materials revealed in Boreholes 1 to 5 are generally not suitable for reuse as engineered fill. The onsite fill which is not excessively wet may be used as bulk fill. The bulk fill is not considered suitable for supporting house foundations or other structures, and reference is made to Section 3.3 'Engineered Fill' for preparation requirements for the construction of house foundations.

POND.

Site preparation would consist of stripping the surface topsoil layer from within fill placement areas to expose an approved inorganic native subgrade. The groundwater level within the pond will need to be dewatered to accommodate the placement and compaction of fill materials, and the use of well graded stoney Granular 'B' type material is recommended for the initial lift of fill placed on approved wet to saturated subgrades. During fill placement it is recommended that slopes steeper than 1 vertical to 3 horizontal (18 degrees) be benched in accordance with Ontario Provincial Standard Drawing (OPSD) 208.010 provided in Appendix 5. Within road way right-of-ways and house lot landscaped areas, bulk fill should be placed in controlled lifts and compacted throughout to at least 95% of the material's maximum standard Proctor dry density (MSPDD).

## 3.3 FOUNDATION DESIGN

It is anticipated that the residential development will feature buildings designed in accordance with Part 9 of the Ontario Building Code.

The topsoil and fill materials must be removed from new foundation areas, and the following table provides the highest founding levels at each borehole location where conventional spread footings founded on the approved native subgrades will provide a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Table 1 - Highest Foundation Founding Levels

| BOREHOLE | HIGHEST EL. / DEPTH FOR A SLS DESIGN PRESSURE OF 143 KPA (3,000 PSF) |
|---|---|
| 01-15 | 93.8 / 6.1 m |
| 02-15 | 92.7 / 7.6 m |
| 03-15 | 92.4 / 8.6 m |
| 04-15 | Below 92.3 / 8.1 m |
| 05-15 | 92.8 / 7.1 m |
| 06-15 | 94.7 / 0.8 m |
| 07-15 | 93.4 / 0.8 m |
| 08-15 | 93.5 / 0.8 m |
| 09-15 | 92.2 / 0.8 m |

} at g/w elevation

For ultimate limit states design, a factored geotechnical resistance value ($\varphi R_n$) of 215 kPa (4,500 psf) may be used, where the resistance factor ($\varphi$) is equal to 0.5.

## 3.4 ENGINEERED FILL

In areas where bulk fill has been placed, sub-excavation may be required within the influence of footings to expose an approved native subgrade and a structural fill pad must be constructed or the footings stepped down by extending the foundation walls. It is recommended that the engineered fill consist of Granular 'B' type material with a maximum aggregate size of 50 mm. It is considered that some of the native sand and gravel and the lower layers of sand and gravel fill materials revealed in Boreholes 3 and 5 below Elevation 96 may be considered for use as engineered fill material, provided it is segregated for use without contamination with other materials. Engineered fill must extend outside the foundation area for a minimum horizontal distance equal to the depth of fill placed below the footing founding level. The engineered fill shall be placed in maximum 300 mm thick lifts, and each lift must be compacted to a minimum of 98% of its MSPDD under the direction and testing of the geotechnical consultant. Approved engineered fill can also support a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Where deep bulk fill requires excavation for the construction of engineered fill to extend onto adjacent building lots, constructing engineered fill pads on a lot by lot basis will not be feasible due to the risk of undermining pre-constructed house foundations. In this regard a strip of engineered fill will need to be constructed to provide support for the building envelopes over a row of building lots. Once final grades have been established, a review should be done by the geotechnical engineer to identify which building lots require construction of engineered fill pads and provide recommended construction methods.

The total and differential settlements of footings not more than three metres in width and subjected to the maximum allowable design pressure of 143 kPa (3,000 psf) are estimated to be less than 25 and 20 mm respectively.

To provide sufficient protection against heave due to frost action, all exterior footings and footings in non-heated areas must incorporate a minimum depth of soil cover of 1.2 m between the footing subgrade and the finished ground surface.

In order to minimize the disturbance of soil subgrades it is recommended that foundation excavations be carried out using a smooth-blade bucket.

## 3.5 ENVIRONMENTAL TESTING

Nine representative samples of fill from the boreholes were submitted to the ALS Environmental Laboratory in London and subjected to metals, inorganics, PHC and BTEX analyses, and the Certificate of Analysis is provided in Appendix 4. The test results indicate that the applicable Table 2 Soil Standards under Ont. Reg. 153/04 as amended have been exceeded for SAR and conductivity for the samples tested from Boreholes 3 and 4.

Elevated SAR and conductivity levels are indicative of salt impacts. Materials with salt impacts are phytotoxic to plants and must be placed at least 1.5 m below final grades. No other exceedances of the applicable MOE Table 2 soil standards were obtained.

# 4 STATEMENT OF LIMITATIONS

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, LVM, a division of EnGlobe Corp. should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its' agent and may not be used by a Third Party without the expressed written consent of LVM and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. LVM accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions. LVM will not be responsible to any party for damages incurred as a result of failing to notify LVM that differing site or subsurface conditions are present upon becoming aware of such conditions.

The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its' Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

## Appendix 1 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\25_CAD\P-8182-01-100_DRAWING 1_LOCATION PLAN.DWG

0 1 2 3 4 5 10 cm

0 100 200 300 400 500 m

SCALE 1:10000

NOTES :
1-REFERENCES : © OpenStreetMap contributors (2015).
2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

**Planned Residential Development**

10125 Oxbow Drive, Komoka

Title

**Location Plan**

LVM

12-60 Meg Drive
London (Ontario) N6E 3T6
Telephone : 519 685 6400
Fax : 519.685.0943

| | | | | | |
|---|---|---|---|---|---|
| Prepared | A.Stewart | Discipline | GEOTECHNICAL | Project manager | R.Helwig |
| Drawn | A.Stewart | Scale | 1 : 10000 | Sequence no. | 01 of 02 |
| Checked | S.Burt | Date | 2015-04-28 | | |

| M. dept. | Project | Disc. | Dwg no. | Rev. |
|---|---|---|---|---|
| 161 | P-0008182-01-100 | GE | 001 | 00 |

# Appendix 2 Boreholes

List of Abbreviations
Boreholes 01-15 to 09-15

# LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

| **Sample Types** | | **Soil Tests and Properties** | |
|---|---|---|---|
| AS | Auger Sample | SPT | Standard Penetration Test |
| CS | Chunk Sample | UC | Unconfined Compression |
| RC | Rock Core | FV | Field Vane Test |
| SS | Split Spoon | ø | Angle of internal friction |
| TW | Thinwall, Open | $\gamma$ | Unit weight |
| WS | Wash Sample | $w_p$ | Plastic limit |
| BS | Bulk Sample | $w$ | Water content |
| GS | Grab Sample | $w_l$ | Liquid limit |
| WC | Water Content Sample | $I_L$ | Liquidity index |
| TP | Thinwall, Piston | $I_p$ | Plasticity index |
| | | PP | Pocket penetrometer |

| **Penetration Resistances** | |
|---|---|
| Dynamic Penetration Resistance | The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60 ° cone a distance 300 m (12 in.).<br>The cone is attached to 'A' size drill rods and casing is not used. |
| Standard Penetration Resistance, N (ASTM D1586) | The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 m (12 in.) |
| WH | sampler advanced by static weight of hammer |
| PH | sampler advanced by hydraulic pressure |
| PM | sampler advanced by manual pressure |

**Soil Description**

| **Cohesionless Soils**<br>**Compactness Condition** | **SPT N-Value**<br>(blows per 0.30 m) | **Relative Density ($D_r$)**<br>(%) |
|---|---|---|
| Very Loose | 0 to 4 | 0 to 20 |
| Loose | 4 to 10 | 20 to 40 |
| Compact | 10 to 30 | 40 to 60 |
| Dense | 30 to 50 | 60 to 80 |
| Very Dense | over 50 | 80 to 100 |

| **Cohesive Soils** | **Undrained Shear Strength ($C_u$)** | |
|---|---|---|
| **Consistency** | **kPa** | **psf** |
| Very Soft | less than 12 | less than 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1000 |
| Stiff | 50 to 100 | 1000 to 2000 |
| Very Stiff | 100 to 200 | 2000 to 4000 |
| Hard | over 200 | over 4000 |

| | |
|---|---|
| DTPL | Drier than plastic limit |
| APL | About plastic limit |
| WTPL | Wetter than plastic limit |

**L V M**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**
**Phone: 519-685-6400 Fax: 519-685-0943**

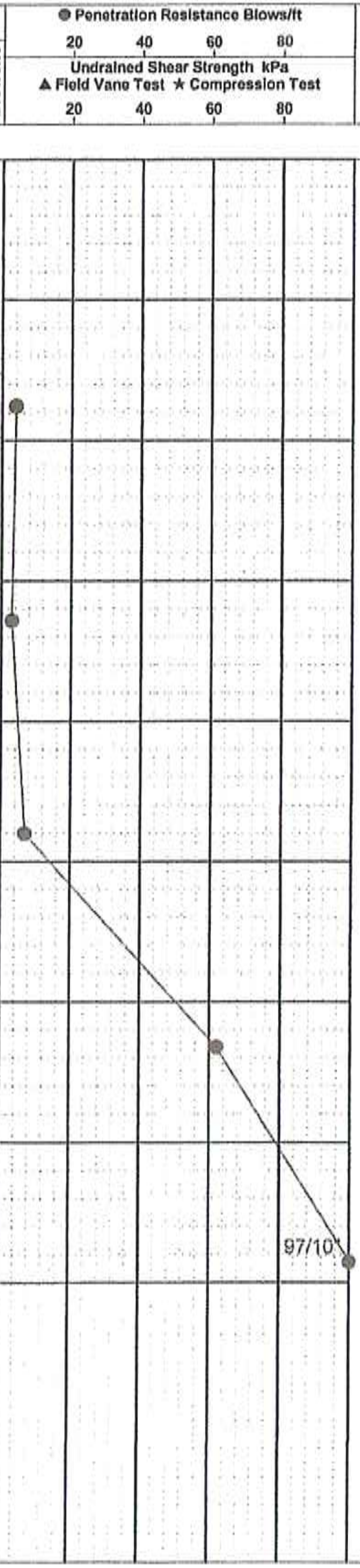
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 01-15

**Encl. No.** 1 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.93 | 0 | Soft to firm, brown, clayey silt FILL, wood fragments. | | | | | | | | |
| | | | | | 1 | ss | 4 | | 21 | |
| | | | | | 2 | ss | 3 | | 21 | |
| | 4 | Loose, brown silt & sand FILL, trace to some clay, trace of gravel. | | | | | | | | |
| | | | | | 3 | ss | 7 | | 17 | |
| | 6 | Very dense, brown, fine sandy SILT to silty fine SAND. | | | 4 | ss | 62 | | 15 | |
| | | | | ▽ | | | | | | |
| | | | | | 5 | ss | 97/10" | | 20 | |
| | 8 | End of Borehole.<br>Water levl at 7.3m depth at completion. | | | | | | | | |



LVM
*CONSULTING SOILS AND MATERIALS ENGINEERS*
**12 - 60 Meg Drive, London, ON, N6E 3T6**
**Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

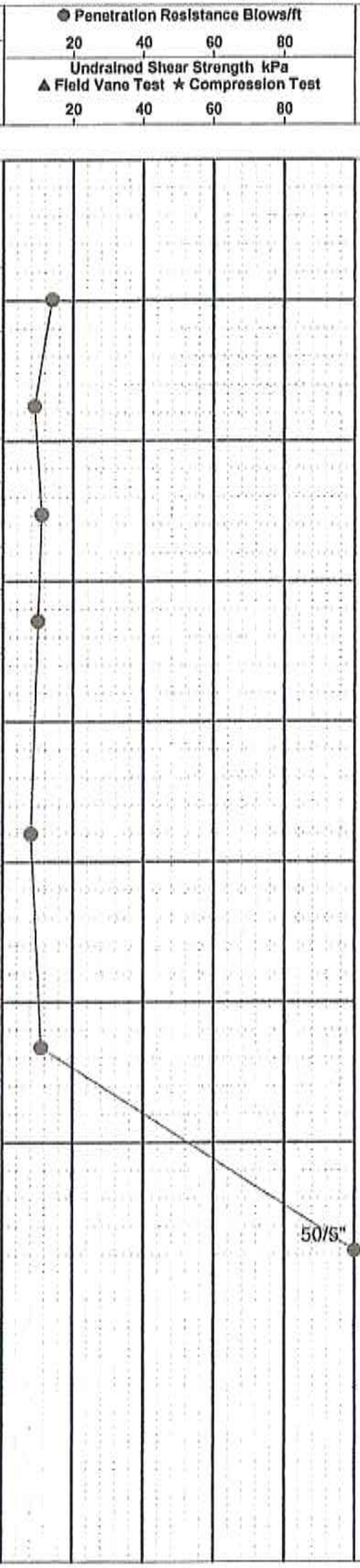
## LOG OF BOREHOLE NO.
## 02-15

**Encl. No.** 2 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|
| 100.35 | 0 | Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams. | 1 | ss | 14 | | 17 | |
| | | Loose, brown silt, sand & gravel FILL, asphalt fragments. | 2 | ss | 9 | | 7 | |
| | | Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel. | 3 | ss | 11 | | 16 | |
| | | | 4 | ss | 10 | | 19 | |
| | | | 5 | ss | 8 | | 12 | |
| | | | 6 | ss | 11 | | 10 | |
| | | Very dense, brown, moist, SAND & GRAVEL, some silt to silty. | 7 | ss | 50/<br>5" | | 3 | |

End of Borehole.
Hole dry & open at completion.



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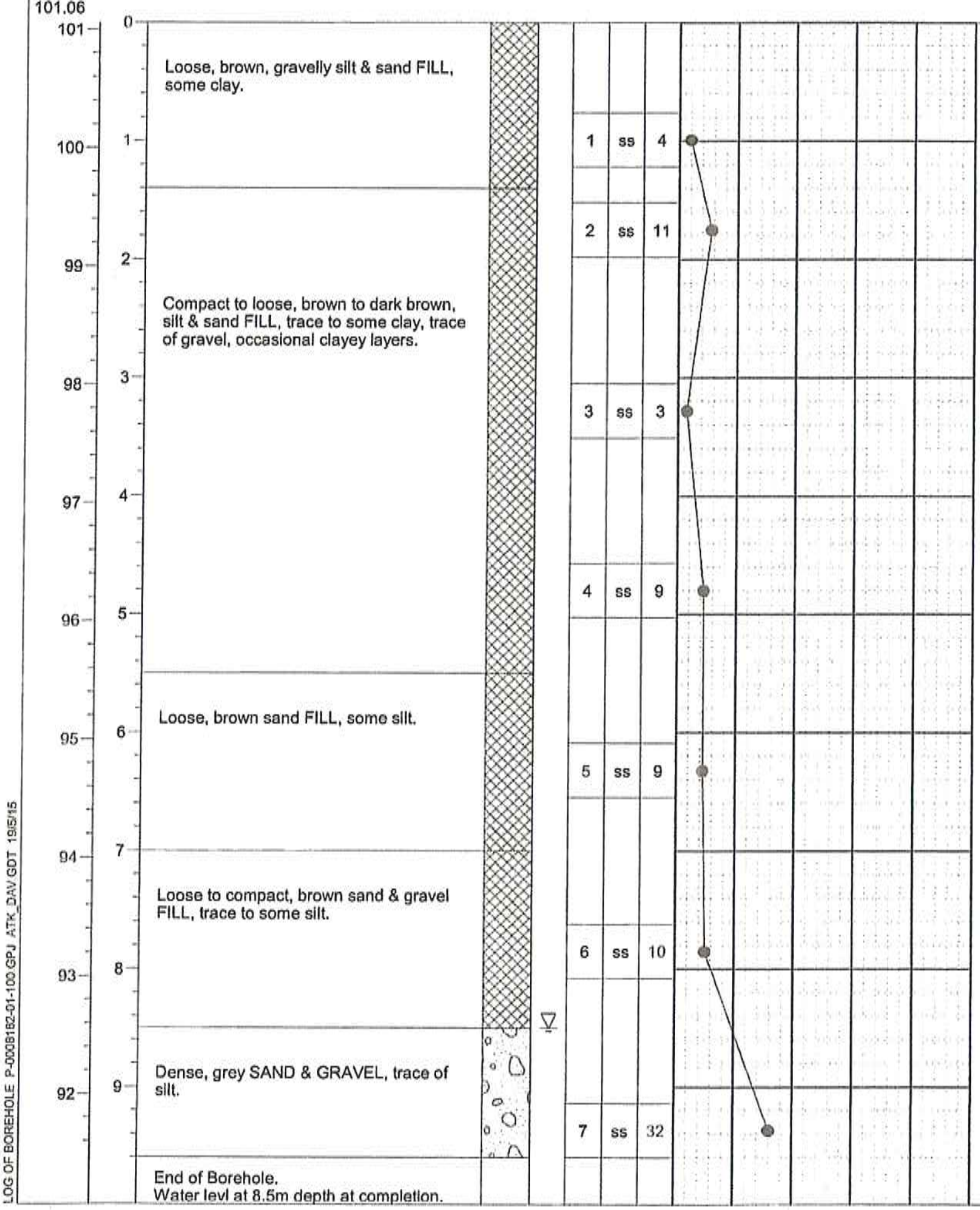
**Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 03-15

**Encl. No.** 3 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

| SUBSURFACE PROFILE | | | | | | | | ● Penetration Resistance Blows/ft 20 40 60 80<br>Undrained Shear Strength kPa<br>▲ Field Vane Test ★ Compression Test 20 40 60 80 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
| 101.06 | 0 | Loose, brown, gravelly silt & sand FILL, some clay. | | | 1 | ss | 4 | | | 16 | |
| | | Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers. | | | 2 | ss | 11 | | | 7 | |
| | | | | | 3 | ss | 3 | | | 17 | |
| | | | | | 4 | ss | 9 | | | 11 | |
| | | Loose, brown sand FILL, some silt. | | | 5 | ss | 9 | | | 8 | |
| | | Loose to compact, brown sand & gravel FILL, trace to some silt. | | | 6 | ss | 10 | | | 6 | |
| | | Dense, grey SAND & GRAVEL, trace of silt. | | ▽ | 7 | ss | 32 | | | 9 | |
| | | End of Borehole.<br>Water levl at 8.5m depth at completion. | | | | | | | | | |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**
**Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

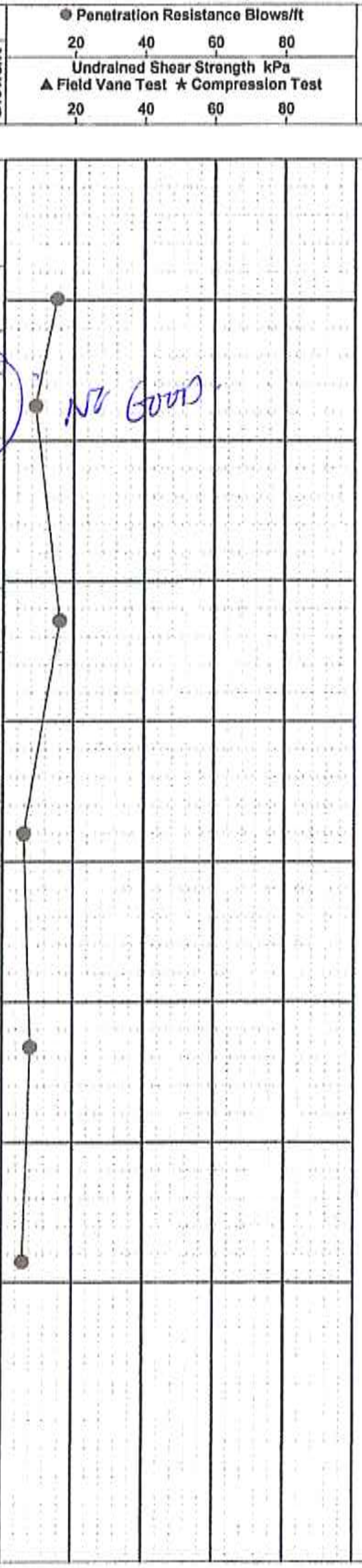
## LOG OF BOREHOLE NO.

## 04-15

**Encl. No.** 4 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.38 | 0 | Compact, brown silt, sand & gravel FILL, wood fragments, clay seams. | ▨ | | | | | | | |
| | | | | | 1 | ss | 15 | | 4 | |
| | | Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer. | ▨ | | 2 | ss | 9 | | 11 | |
| | | | | | 3 | ss | 16 | | 5 | |
| | | | | | 4 | ss | 6 | | 19 | |
| | | Loose, brown silt, sand & gravel FILL, clayey seams. | ▨ | | 5 | ss | 8 | | 17 | |
| | | Firm, brown, silty clay FILL. | ▨ | | 6 | ss | 6 | | 13 | |
| | | End of Borehole.<br>Hole dry & open at completion. | | | | | | | | |



NT Good.

# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

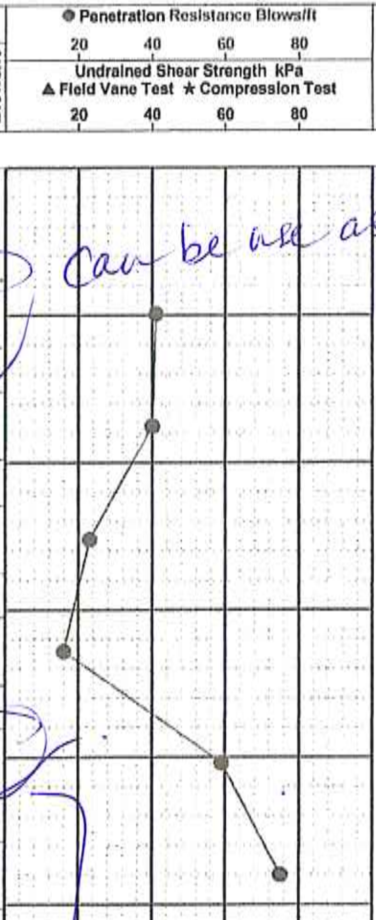
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 06-15

**Encl. No.** 6 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 95.49 | 0 | Loose, dark brown, silty sand FILL, trace to some gravel. sieve | | | | | | | | |
| | 1 | Compact to dense, brown SAND & GRAVEL, trace to some silt. | | | 1 | SS | 41 | | 2 | |
| 94 | | | | | 2 | SS | 40 | | 2 | |
| 93 | 2 | | | ∇ | 3 | SS | 23 | | 9 | |
| 92 | 3 | Compact to very dense, brown SILT & fine SAND. | | | 4 | SS | 16 | | 14 | |
| | 4 | | | | 5 | SS | 59 | | 19 | |
| 91 | | | | | 6 | SS | 75 | | 19 | |
| | 5 | End of Borehole.<br>Water level at 2.8m depth at completion. | | | | | | | | |



Can be use as eng fill.

can be used as eng fill.

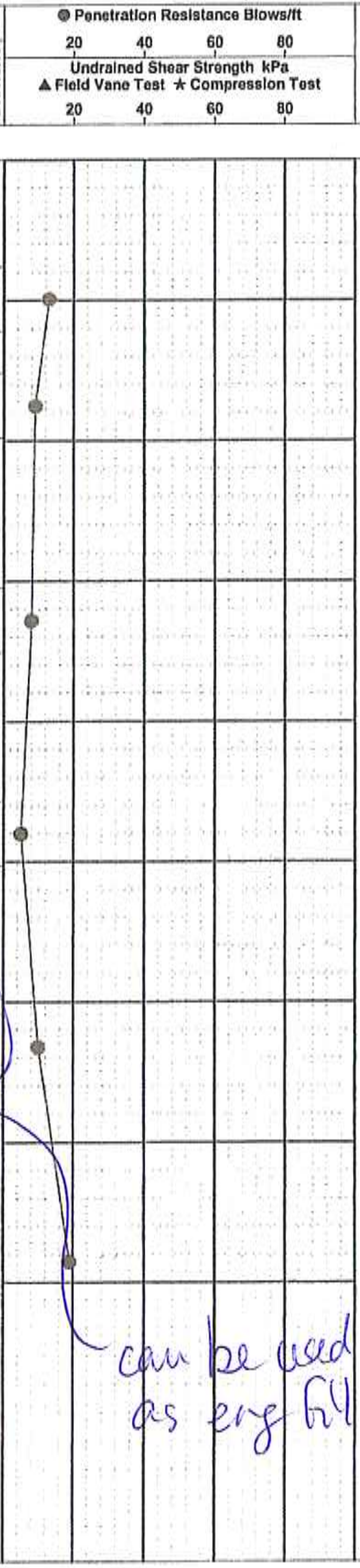
LVM
*CONSULTING SOILS AND MATERIALS ENGINEERS*
12 - 60 Meg Drive, London, ON, N6E 3T6
Phone: 519-685-6400 Fax: 519-685-0943

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 05-15

**Encl. No.** 5 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.96 | 0 | Compact, dark brown silt, sand & gravel FILL, upper topsil seams. | ▨ | | 1 | ss | 13 | | 9 | |
| | | Loose, dark brown silt FILL. | ▨ | | 2 | ss | 9 | | 15 | |
| | | Loose, rusty brown silt & sand FILL. | ▨ | | 3 | ss | 8 | | 9 | |
| | | Loose, brown sand FILL, some silt & gravel. | ▨ | | 4 | ss | 5 | | 6 | |
| | | Loose to compact, brown sand FILL, some silt, trace to some gravel. | ▨ | | 5 | ss | 10 | | 8 | |
| | | Compact, grey SAND & GRAVEL, trace of silt. | ○ | ∇ | 6 | ss | 19 | | 10 | |
| | | End of Borehole.<br>Water level at 7.2m depth at completion. | | | | | | | | |



can be used as eng fill.

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**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

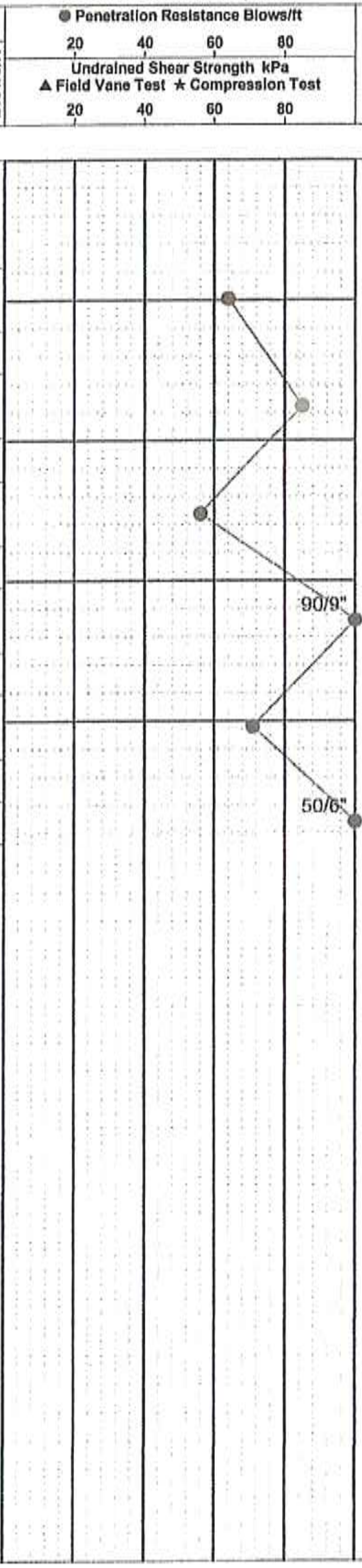
## LOG OF BOREHOLE NO.

## 07-15

**Encl. No.** 7 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 94.24 | 0 | 150mm TOPSOIL. | | | | | | | | |
| | | Very dense, brown SILT, upper sand seams. | | | 1 | ss | 64 | | 13 | |
| | | Very dense, silty fine SAND, occasional silt seams. | | ▽ | 2 | ss | 85 | | 18 | |
| | | | | | 3 | ss | 56 | | 18 | |
| | | | | | 4 | ss | 90/ 9" | | 15 | |
| | | | | | 5 | ss | 71 | | 20 | |
| | | | | | 6 | ss | 50/ 6" | | 18 | |
| | | End of Borehole.<br>Water level at 1.6m depth at completion. | | | | | | | | |



# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

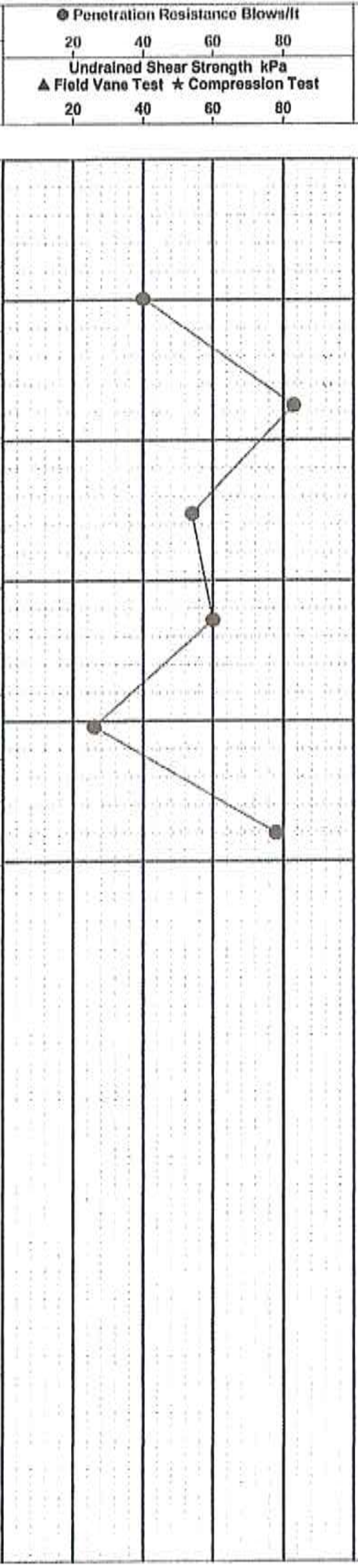
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.

## 08-15

**Encl. No.** 8 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

| Elev. metres | Depth metres | DESCRIPTION | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|
| 94.33 | 0 | Dense, brown SAND & GRAVEL, trace to some silt. | ∇ | 1 | ss | 40 | | 7 | |
| | | Very dense, brown SILT, sand seams. | | 2 | ss | 83 | | 16 | |
| | | | | 3 | ss | 54 | | 18 | |
| | | Very dense, brown SILT & fine SAND. | | 4 | ss | 60 | | 18 | |
| | | Compact to very dense, brown, fine SAND, some silt to silty. | | 5 | ss | 26 | | 18 | |
| | | | | 6 | ss | 78 | | 16 | |
| | 5 | End of Borehole.<br>Water level at 1.0m depth at completion. | | | | | | | |



LVM

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**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

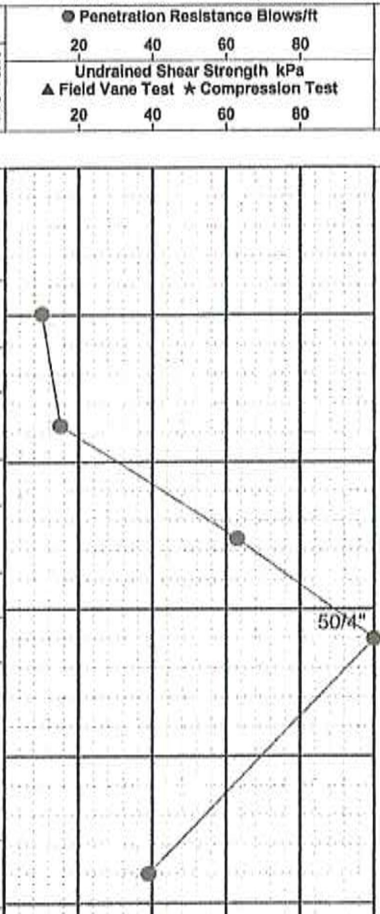
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 09-15

**Encl. No.** 9 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

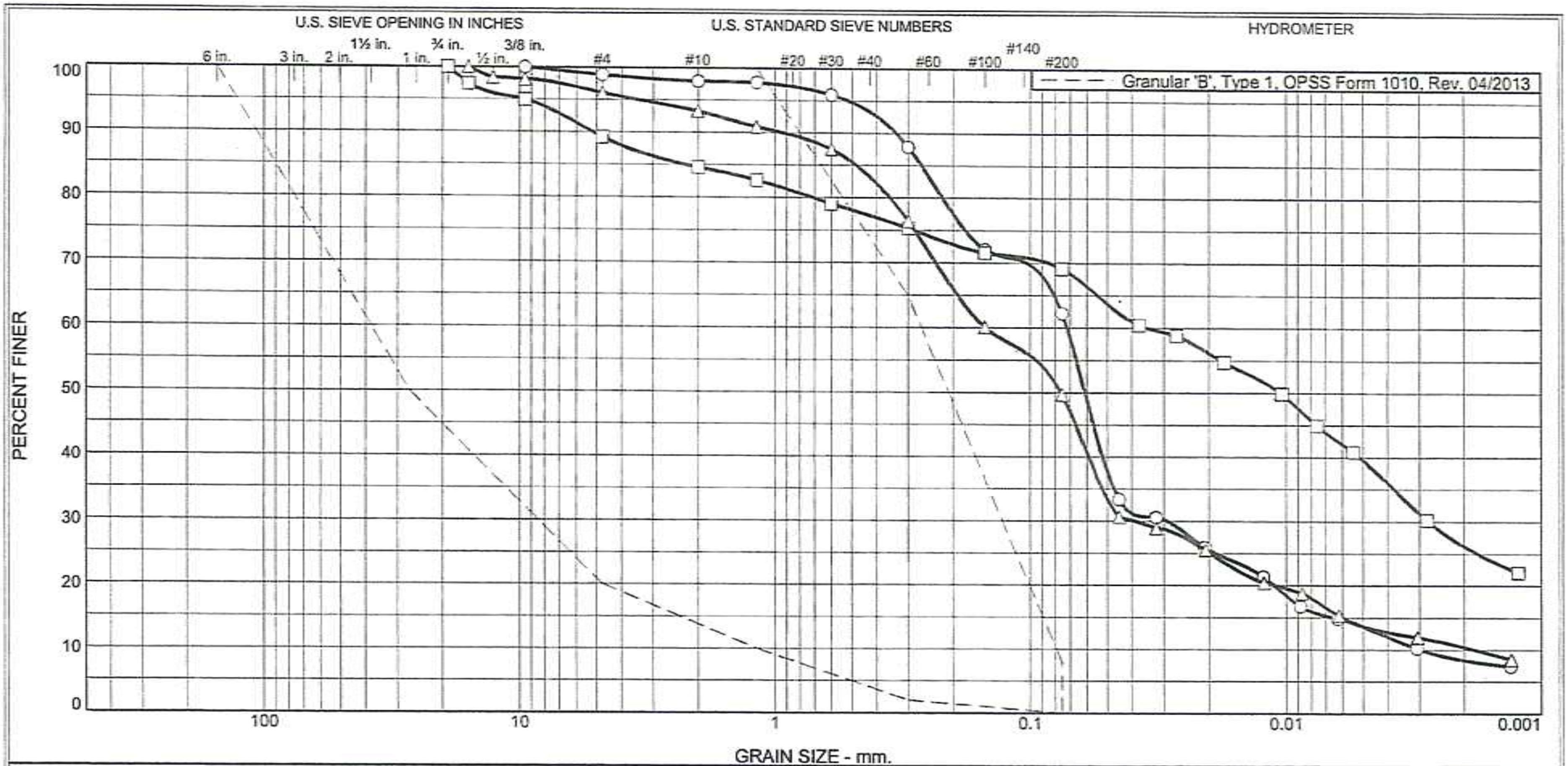
**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 93.02<br>93 | 0 | Compact, brown SAND & GRAVEL, trace to some silt. | | ▽ | | | | | | |
| 92 | 1 | | | | 1 | ss | 10 | | 13 | |
| | | | | | 2 | ss | 15 | | 6 | |
| 91 | 2 | | | | | | | | | |
| | | | | | 3 | ss | 63 | | 15 | |
| | | Very dense, brown SILT & fine SAND, clayey seam. | | | | | | | | |
| 90 | 3 | Very dense, brown SAND & GRAVEL, some silt. | | | 4 | ss | 50/ 4" | | 10 | |
| | | Very stiff to hard, grey, clayey SILT to silty CLAY till. | | | | | | | | |
| 89 | 4 | | | | 5 | as | | | 9 | |
| | | | | | 6 | ss | 39 | | 12 | |
| 88 | 5 | End of Borehole.<br>Water level at 0.2m depth at completion. | | | | | | | | |



# Appendix 3 Grain Size Distribution Analyses

Figures 1 and 2: Grain Size Distribution Analyses



| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |

| | Location | Source | Sample # | Depth/Elev. | Sample Information |
|---|---|---|---|---|---|
| ○ | Borehole 01-15 | | Sample 3 | 4.8m / 95.1 | Silt & Sand FILL, some clay, trace gravel. |
| ☐ | Borehole 02-15 | | Sample 4 | 3.3m / 97.0 | Sandy, silty clay FILL, some gravel. |
| △ | Borehole 03-15 | | Sample 3 | 3.3m / 97.8 | Silt & Sand FILL, traces of clay & gravel. |

**Project No.** P-0008182-01-100 **Client** 2270942 Ontario Ltd.

**Figure 1**

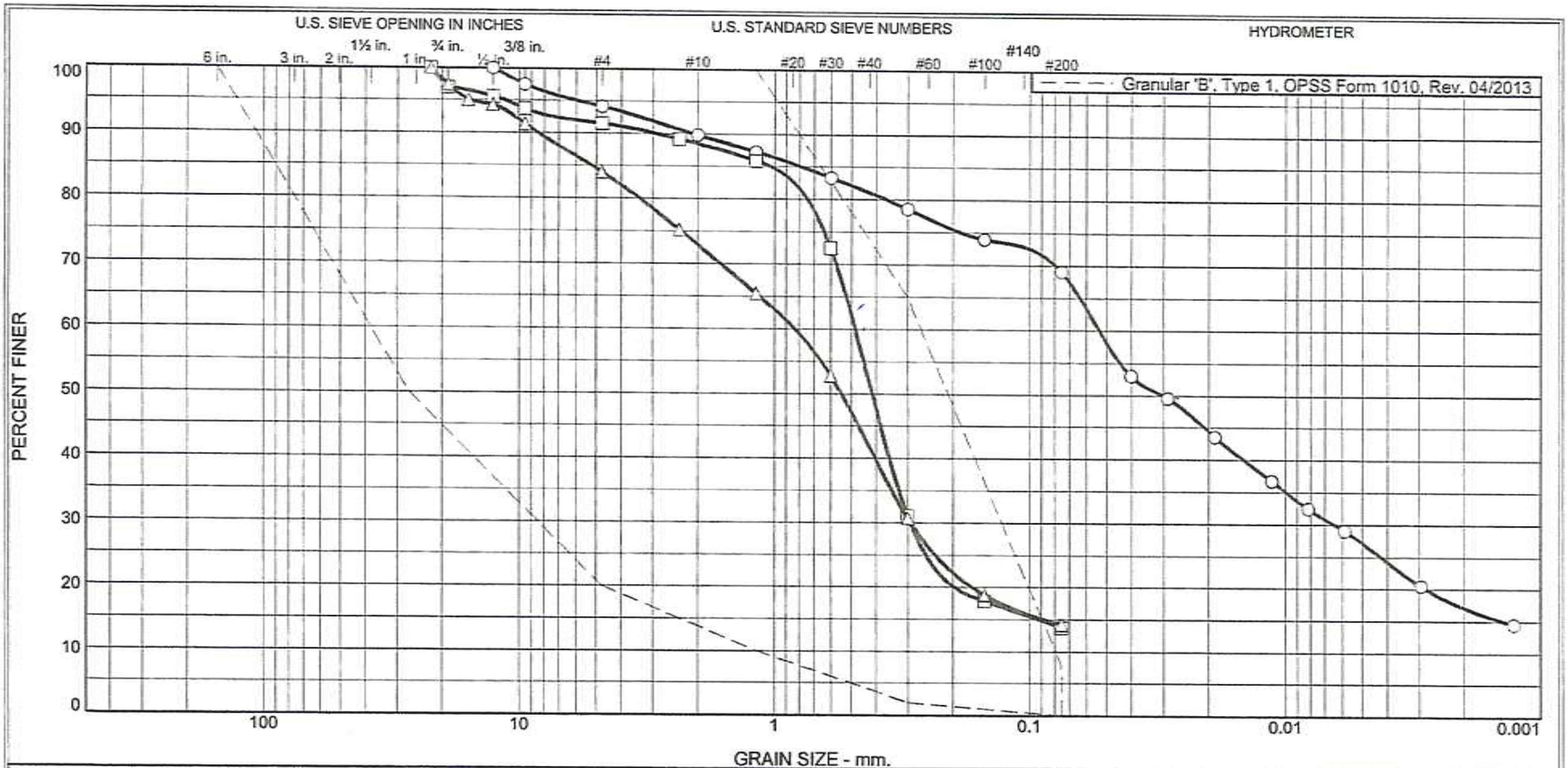
Grain Size Analysis

## Planned Residential Development, 10125 Oxbow Drive, Komoka

**LVM, a division of EnGlobe Corp.**

**London, Ontario**

**Tested By:** AH/JH **Checked By:** SB



| % +3" | % Gravel |  | % Sand |  |  | % Fines |  |
|---|---|---|---|---|---|---|---|
|  | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |

|  | Location | Source | Sample # | Depth/Elev. | Sample Information |
|---|---|---|---|---|---|
| ○ | Borehole 04-15 |  | Sample 2 | 1.7m / 98.7 | Sandy, clayey silt FILL, trace gravel. |
| □ | Borehole 05-15 |  | Sample 5 | 6.3m / 93.7 | Sand FILL, some silt, trace gravel. |
| △ | Borehole 06-15 |  | Sample 1 | 1.0m / 94.5 | SAND, some silt, some gravel.<br>FILL |

**Project No.** P-0008182-01-100 **Client** 2270942 Ontario Ltd.

**Figure 2**

Grain Size Analysis

# Planned Residential Development, 10125 Oxbow Drive, Komoka

**LVM, a division of EnGlobe Corp.**

**London, Ontario**

**Tested By:** AH/JH **Checked By:** SB

# Appendix 4 Chemical Analysis

ALS Work Order: L1600418

LVM, a Division of EnGlobe Corp.
ATTN: ROB HELWIG
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

Date Received: 17-APR-15
Report Date: 23-APR-15 14:13 (MT)
Version: FINAL

Client Phone: 519-685-6400

# Certificate of Analysis

**Lab Work Order #: L1600418**
Project P.O. #: A01072
Job Reference: P-8182-0-01-100
C of C Numbers:
Legal Site Desc:

Gayle Braun

Gayle Braun
Senior Account Manager

# ANALYTICAL REPORT

## SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

| | | | | ALS ID | L1600418-1 | L1600418-2 | L1600418-3 | L1600418-4 | L1600418-5 | L1600418-6 | L1600418-7 | L1600418-8 | L1600418-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampled Date | 14-APR-15 | 14-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 14-APR-15 | 14-APR-15 | 15-APR-15 |
| | | | | Sampled Time | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 |
| | | | | Sample ID | BH1 SA1 | BH1 SA2 | BH2 SA2 | BH2 SA5 | BH3 SA2 | BH3 SA4 | BH4 SA1 | BH4 SA3 | BH5 SA1 |
| Grouping | Analyte | Unit | Guide Limits #1 | Guide Limits #2 | | | | | | | | | |
| Physical Tests | Conductivity | mS/cm | 0.7 | - | 0.180 | 0.206 | 0.543 | 0.334 | 0.750 | 0.155 | 0.703 | 0.369 | 0.252 |
| | % Moisture | % | - | - | 18.5 | 17.5 | 12.5 | 17.8 | 10.7 | 10.9 | 10.4 | 12.0 | 9.37 |
| | pH | pH units | - | - | 7.31 | 7.05 | 7.73 | 7.60 | 7.81 | 7.32 | 7.53 | 7.67 | 7.35 |
| Cyanides | Cyanide, Weak Acid Diss | ug/g | 0.051 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Saturated Paste Extractables | SAR | SAR | 5 | - | <0.10 | <0.10 | 4.90 | 2.65 | 7.68 | 0.27 | 7.55 | 2.10 | 0.48 |
| | Calcium (Ca) | mg/L | - | - | 26.6 | 28.1 | 34.5 | 26.6 | 32.5 | 20.0 | 18.6 | 27.4 | 29.9 |
| | Magnesium (Mg) | mg/L | - | - | 2.26 | 2.74 | 1.17 | 1.75 | 1.21 | 1.65 | 1.35 | 2.26 | 3.25 |
| | Sodium (Na) | mg/L | - | - | 1.13 | 1.61 | 108 | 52.3 | 164 | 4.70 | 125 | 42.5 | 10.4 |
| Metals | Antimony (Sb) | ug/g | 7.5 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Arsenic (As) | ug/g | 18 | - | 3.7 | 3.8 | 3.9 | 4.0 | 3.8 | 3.2 | 3.2 | 2.9 | 3.4 |
| | Barium (Ba) | ug/g | 390 | - | 52.2 | 55.3 | 58.0 | 65.4 | 47.3 | 41.6 | 40.1 | 57.4 | 43.0 |
| | Beryllium (Be) | ug/g | 4 | - | <0.50 | <0.50 | <0.50 | 0.56 | <0.50 | <0.50 | <0.50 | 0.51 | <0.50 |
| | Boron (B) | ug/g | 120 | - | 5.9 | 5.9 | 11.9 | 13.2 | 10.2 | 5.1 | 10.2 | 15.7 | 8.9 |
| | Boron (B), Hot Water Ext. | ug/g | 1.5 | - | 0.46 | 0.46 | 0.15 | 0.19 | 0.22 | 0.18 | 0.14 | 0.84 | 0.25 |
| | Cadmium (Cd) | ug/g | 1.2 | - | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| | Chromium (Cr) | ug/g | 160 | - | 28.6 | 28.8 | 20.7 | 22.5 | 17.4 | 14.7 | 15.5 | 21.1 | 16.2 |
| | Cobalt (Co) | ug/g | 22 | - | 5.8 | 6.6 | 7.2 | 7.7 | 5.8 | 5.0 | 5.6 | 6.6 | 5.0 |
| | Copper (Cu) | ug/g | 140 | - | 10.5 | 11.6 | 16.3 | 14.8 | 16.5 | 11.2 | 12.5 | 13.2 | 11.7 |
| | Lead (Pb) | ug/g | 120 | - | 12.5 | 12.4 | 12.6 | 15.1 | 11.9 | 10.6 | 9.9 | 7.5 | 13.6 |
| | Mercury (Hg) | ug/g | 0.27 | - | 0.0634 | 0.0623 | 0.0226 | 0.0260 | 0.0243 | 0.0260 | 0.0165 | 0.0145 | 0.0454 |
| | Molybdenum (Mo) | ug/g | 6.9 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.2 | <1.0 |
| | Nickel (Ni) | ug/g | 100 | - | 11.3 | 12.8 | 17.3 | 19.0 | 14.1 | 10.2 | 13.7 | 16.3 | 11.0 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

# ANALYTICAL REPORT

**SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards**

| | | | | ALS ID | L1600418-1 | L1600418-2 | L1600418-3 | L1600418-4 | L1600418-5 | L1600418-6 | L1600418-7 | L1600418-8 | L1600418-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampled Date | 14-APR-15 | 14-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 14-APR-15 | 14-APR-15 | 15-APR-15 |
| | | | | Sampled Time | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 |
| | | | | Sample ID | BH1 SA1 | BH1 SA2 | BH2 SA2 | BH2 SA5 | BH3 SA2 | BH3 SA4 | BH4 SA1 | BH4 SA3 | BH5 SA1 |
| Grouping | Analyte | Unit | Guide Limits #1 | #2 | | | | | | | | | |
| Metals | Selenium (Se) | ug/g | 2.4 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Silver (Ag) | ug/g | 20 | - | 0.29 | 0.25 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | Thallium (Tl) | ug/g | 1 | - | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| | Uranium (U) | ug/g | 23 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Vanadium (V) | ug/g | 86 | - | 28.9 | 31.3 | 30.8 | 32.4 | 28.0 | 26.2 | 23.2 | 26.7 | 31.5 |
| | Zinc (Zn) | ug/g | 340 | - | 44.2 | 48.0 | 52.3 | 56.1 | 53.5 | 49.9 | 42.2 | 47.8 | 44.7 |
| Speciated Metals | Chromium, Hexavalent | ug/g | 8 | - | <0.20 | <0.20 | <0.20 | 0.41 | 0.34 | <0.20 | <0.20 | 0.53 | <0.20 |
| Volatile Organic Compounds | Benzene | ug/g | 0.21 | - | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 |
| | Ethylbenzene | ug/g | 1.1 | - | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 |
| | Toluene | ug/g | 2.3 | - | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 |
| | o-Xylene | ug/g | - | - | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | m+p-Xylenes | ug/g | - | - | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 |
| | Xylenes (Total) | ug/g | 3.1 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: 4-Bromofluorobenzene | % | - | - | 99.9 | 99.2 | 96.6 | 94.7 | 97.1 | 97.8 | 97.1 | 100.3 | 98.6 |
| | Surrogate: 1,4-Difluorobenzene | % | - | - | 101.3 | 101.2 | 101.1 | 100.3 | 100.5 | 102.4 | 99.8 | 100.7 | 101.1 |
| Hydrocarbons | F1 (C6-C10) | ug/g | 55 | - | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| | F1-BTEX | ug/g | 55 | - | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| | F2 (C10-C16) | ug/g | 98 | - | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | F3 (C16-C34) | ug/g | 300 | - | <50 | <50 | 56 | 81 | 96 | <50 | <50 | <50 | <50 |
| | F4 (C34-C50) | ug/g | 2800 | - | <50 | <50 | 114 | 256 | 271 | <50 | 136 | <50 | <50 |
| | F4G-SG (GHH-Silica) | mg/kg | 2800 | - | | | | | 980 | | | | |
| | Total Hydrocarbons (C6-C50) | ug/g | - | - | <72 | <72 | 171 | 337 | 367 | <72 | 136 | <72 | <72 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

# ANALYTICAL REPORT

## SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

| | | | | ALS ID | L1600418-1 | L1600418-2 | L1600418-3 | L1600418-4 | L1600418-5 | L1600418-6 | L1600418-7 | L1600418-8 | L1600418-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampled Date | 14-APR-15 | 14-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 14-APR-15 | 14-APR-15 | 15-APR-15 |
| | | | | Sampled Time | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 |
| | | | | Sample ID | BH1 SA1 | BH1 SA2 | BH2 SA2 | BH2 SA5 | BH3 SA2 | BH3 SA4 | BH4 SA1 | BH4 SA3 | BH5 SA1 |
| | | | Guide Limits | | | | | | | | | | |
| Grouping | Analyte | Unit | #1 | #2 | | | | | | | | | |
| **Hydrocarbons** | Chrom. to baseline at nC50 | | - | - | YES | YES | YES | YES | NO | YES | YES | YES | YES |
| | Surrogate: 2-Bromobenzotrifluoride | % | - | - | 75.4 | 76.3 | 72.4 | 74.5 | 76.6 | 75.2 | 74.9 | 76.9 | 76.1 |
| | Surrogate: 3,4-Dichlorotoluene | % | - | - | 86.4 | 89.8 | 95.5 | 85.5 | 96.1 | 92.1 | 89.2 | 91.9 | 93.1 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

## Summary of Guideline Exceedances

| Guideline | | | | | | |
|---|---|---|---|---|---|---|
| ALS ID | Client ID | Grouping | Analyte | Result | Guideline Limit | Unit |
| **Ontario Regulation 153/04 - April 15, 2011 Standards - T2-Soil-Res/Park/Inst. Property Use (Coarse)** | | | | | | |
| L1600418-5 | BH3 SA2 | Physical Tests | Conductivity | 0.750 | 0.7 | mS/cm |
| | | Saturated Paste Extractables | SAR | 7.68 | 5 | SAR |
| L1600418-7 | BH4 SA1 | Physical Tests | Conductivity | 0.703 | 0.7 | mS/cm |
| | | Saturated Paste Extractables | SAR | 7.55 | 5 | SAR |

# Reference Information

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **B-HWS-R511-WT** | Soil | Boron-HWE-O.Reg 153/04 (July 2011) | HW EXTR, EPA 6010B |

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **BTX-511-HS-WT** | Soil | BTEX-O.Reg 153/04 (July 2011) | SW846 8260 |

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **CN-WAD-R511-WT** | Soil | Cyanide (WAD)-O.Reg 153/04 (July 2011) | MOE 3015/APHA 4500CN I-WAD |

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **CR-CR6-IC-WT** | Soil | Hexavalent Chromium in Soil | SW846 3060A/7199 |

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **EC-R511-WT** | Soil | Conductivity-O.Reg 153/04 (July 2011) | MOEE E3138 |

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **F1-F4-511-CALC-WT** | Soil | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-S |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:

# Reference Information

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|

1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| **F1-HS-511-WT** | Soil | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **F2-F4-511-WT** | Soil | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **F4G-ADD-511-WT** | Soil | F4G SG-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

F4G, gravimetric analysis, is determined if the chromatogram does not return to baseline at or before C50. A soil sample is extracted with a solvent mix, the solvent is evaporated and the weight of the residue is determined.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **HG-200.2-CVAA-WT** | Soil | Mercury in Soil by CVAAS | EPA 200.2/1631E (mod) |

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **MET-200.2-CCMS-WT** | Soil | Metals in Soil by CRC ICPMS | EPA 200.2/6020A (mod) |

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **MOISTURE-WT** | Soil | % Moisture | Gravimetric: Oven Dried |
| **PH-R511-WT** | Soil | pH-O.Reg 153/04 (July 2011) | MOEE E3137A |

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **SAR-R511-WT** | Soil | SAR-O.Reg 153/04 (July 2011) | SW846 6010C |

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

# Reference Information

**Methods Listed** (if applicable):

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **XYLENES-SUM-CALC-WT** | Soil | Sum of Xylene Isomer Concentrations | CALCULATION |

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

## GLOSSARY OF REPORT TERMS

*Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.*
*mg/kg - milligrams per kilogram based on dry weight of sample*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight*
*mg/L - unit of concentration based on volume, parts per million.*
*< - Less than.*
*D.L. - The reporting limit.*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

ALS Environmental

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| B-HWS-R511-WT | Soil | | | | | | | |
| **Batch R3177129** | | | | | | | | |
| **WG2073524-3 DUP** | | **L1600218-19** | | | | | | |
| Boron (B), Hot Water Ext. | | 0.21 | 0.21 | | ug/g | 1.7 | 40 | 21-APR-15 |
| **WG2073524-2 IRM** | | **SALINITY_SOIL4** | | | | | | |
| Boron (B), Hot Water Ext. | | | 85.4 | | % | | 70-130 | 21-APR-15 |
| **WG2073524-1 MB** | | | | | | | | |
| Boron (B), Hot Water Ext. | | | <0.10 | | ug/g | | 0.1 | 21-APR-15 |
| **WG2073524-4 MS** | | **L1600218-19** | | | | | | |
| Boron (B), Hot Water Ext. | | | 84.4 | | % | | 60-140 | 21-APR-15 |
| BTX-511-HS-WT | Soil | | | | | | | |
| **Batch R3176973** | | | | | | | | |
| **WG2073160-3 DUP** | | **WG2073160-5** | | | | | | |
| Benzene | | <0.0068 | <0.0068 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| Ethylbenzene | | <0.018 | <0.018 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| m+p-Xylenes | | <0.030 | <0.030 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| o-Xylene | | <0.020 | <0.020 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| Toluene | | <0.080 | <0.080 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| **WG2073160-2 LCS** | | | | | | | | |
| Benzene | | | 99.4 | | % | | 70-130 | 21-APR-15 |
| Ethylbenzene | | | 95.0 | | % | | 70-130 | 21-APR-15 |
| m+p-Xylenes | | | 95.6 | | % | | 70-130 | 21-APR-15 |
| o-Xylene | | | 96.0 | | % | | 70-130 | 21-APR-15 |
| Toluene | | | 96.6 | | % | | 70-130 | 21-APR-15 |
| **WG2073160-1 MB** | | | | | | | | |
| Benzene | | | <0.0068 | | ug/g | | 0.0068 | 20-APR-15 |
| Ethylbenzene | | | <0.018 | | ug/g | | 0.018 | 20-APR-15 |
| m+p-Xylenes | | | <0.030 | | ug/g | | 0.03 | 20-APR-15 |
| o-Xylene | | | <0.020 | | ug/g | | 0.02 | 20-APR-15 |
| Toluene | | | <0.080 | | ug/g | | 0.08 | 20-APR-15 |
| Surrogate: 1,4-Difluorobenzene | | | 101.4 | | % | | 70-130 | 20-APR-15 |
| Surrogate: 4-Bromofluorobenzene | | | 102.0 | | % | | 70-130 | 20-APR-15 |
| **WG2073160-4 MS** | | **WG2073160-5** | | | | | | |
| Benzene | | | 96.0 | | % | | 60-140 | 20-APR-15 |
| Ethylbenzene | | | 97.7 | | % | | 60-140 | 20-APR-15 |
| m+p-Xylenes | | | 99.8 | | % | | 60-140 | 20-APR-15 |
| o-Xylene | | | 95.3 | | % | | 60-140 | 20-APR-15 |
| Toluene | | | 95.7 | | % | | 60-140 | 20-APR-15 |

# Quality Control Report

**Client:** LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

**Contact:** ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| BTX-511-HS-WT | Soil | | | | | | | |
| **Batch R3176999** | | | | | | | | |
| **WG2073262-3 DUP** | | **L1600418-8** | | | | | | |
| Benzene | | <0.0068 | <0.0068 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| Ethylbenzene | | <0.018 | <0.018 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| m+p-Xylenes | | <0.030 | <0.030 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| o-Xylene | | <0.020 | <0.020 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| Toluene | | <0.080 | <0.080 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| **WG2073262-2 LCS** | | | | | | | | |
| Benzene | | | 99.8 | | % | | 70-130 | 21-APR-15 |
| Ethylbenzene | | | 93.9 | | % | | 70-130 | 21-APR-15 |
| m+p-Xylenes | | | 97.2 | | % | | 70-130 | 21-APR-15 |
| o-Xylene | | | 94.3 | | % | | 70-130 | 21-APR-15 |
| Toluene | | | 94.2 | | % | | 70-130 | 21-APR-15 |
| **WG2073262-1 MB** | | | | | | | | |
| Benzene | | | <0.0068 | | ug/g | | 0.0068 | 21-APR-15 |
| Ethylbenzene | | | <0.018 | | ug/g | | 0.018 | 21-APR-15 |
| m+p-Xylenes | | | <0.030 | | ug/g | | 0.03 | 21-APR-15 |
| o-Xylene | | | <0.020 | | ug/g | | 0.02 | 21-APR-15 |
| Toluene | | | <0.080 | | ug/g | | 0.08 | 21-APR-15 |
| Surrogate: 1,4-Difluorobenzene | | | 94.9 | | % | | 70-130 | 21-APR-15 |
| Surrogate: 4-Bromofluorobenzene | | | 89.0 | | % | | 70-130 | 21-APR-15 |
| **WG2073262-4 MS** | | **L1600418-8** | | | | | | |
| Benzene | | | 102.4 | | % | | 60-140 | 21-APR-15 |
| Ethylbenzene | | | 96.1 | | % | | 60-140 | 21-APR-15 |
| m+p-Xylenes | | | 98.4 | | % | | 60-140 | 21-APR-15 |
| o-Xylene | | | 96.3 | | % | | 60-140 | 21-APR-15 |
| Toluene | | | 97.3 | | % | | 60-140 | 21-APR-15 |
| CN-WAD-R511-WT | Soil | | | | | | | |
| **Batch R3177212** | | | | | | | | |
| **WG2072484-3 DUP** | | **L1600418-1** | | | | | | |
| Cyanide, Weak Acid Diss | | <0.050 | <0.050 | RPD-NA | ug/g | N/A | 35 | 20-APR-15 |
| **WG2072484-2 LCS** | | | | | | | | |
| Cyanide, Weak Acid Diss | | | 98.5 | | % | | 80-120 | 20-APR-15 |
| **WG2072484-1 MB** | | | | | | | | |
| Cyanide, Weak Acid Diss | | | <0.050 | | ug/g | | 0.05 | 20-APR-15 |
| **WG2072484-4 MS** | | **L1600418-1** | | | | | | |
| Cyanide, Weak Acid Diss | | | 90.8 | | % | | 70-130 | 20-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| CR-CR6-IC-WT | Soil | | | | | | | |
| **Batch R3176826** | | | | | | | | |
| **WG2072597-3 CRM** | | **WT-SQC012** | | | | | | |
| Chromium, Hexavalent | | | 88.6 | | % | | 70-130 | 20-APR-15 |
| **WG2072597-4 DUP** | | **L1600485-1** | | | | | | |
| Chromium, Hexavalent | | 0.26 | 0.25 | | ug/g | 4.3 | 25 | 20-APR-15 |
| **WG2072597-2 LCS** | | | | | | | | |
| Chromium, Hexavalent | | | 95.4 | | % | | 70-130 | 20-APR-15 |
| **WG2072597-1 MB** | | | | | | | | |
| Chromium, Hexavalent | | | <0.20 | | ug/g | | 0.2 | 20-APR-15 |
| EC-R511-WT | Soil | | | | | | | |
| **Batch R3177103** | | | | | | | | |
| **WG2073525-4 DUP** | | **WG2073525-3** | | | | | | |
| Conductivity | | 0.0970 | 0.0990 | | mS/cm | 2.0 | 20 | 21-APR-15 |
| **WG2073883-1 LCS** | | | | | | | | |
| Conductivity | | | 99.8 | | % | | 90-110 | 21-APR-15 |
| **WG2073883-2 LCS** | | | | | | | | |
| Conductivity | | | 98.0 | | % | | 90-110 | 21-APR-15 |
| **WG2073525-1 MB** | | | | | | | | |
| Conductivity | | | <0.0040 | | mS/cm | | 0.004 | 21-APR-15 |
| F1-HS-511-WT | Soil | | | | | | | |
| **Batch R3176973** | | | | | | | | |
| **WG2073160-3 DUP** | | **WG2073160-5** | | | | | | |
| F1 (C6-C10) | | <5.0 | <5.0 | RPD-NA | ug/g | N/A | 50 | 20-APR-15 |
| **WG2073160-2 LCS** | | | | | | | | |
| F1 (C6-C10) | | | 102.0 | | % | | 80-120 | 20-APR-15 |
| **WG2073160-1 MB** | | | | | | | | |
| F1 (C6-C10) | | | <5.0 | | ug/g | | 5 | 20-APR-15 |
| Surrogate: 3,4-Dichlorotoluene | | | 85.3 | | % | | 60-140 | 20-APR-15 |
| **WG2073160-7 MS** | | **WG2073160-6** | | | | | | |
| F1 (C6-C10) | | | 94.5 | | % | | 60-140 | 20-APR-15 |
| **Batch R3176999** | | | | | | | | |
| **WG2073262-3 DUP** | | **L1600418-8** | | | | | | |
| F1 (C6-C10) | | <5.0 | <5.0 | RPD-NA | ug/g | N/A | 50 | 21-APR-15 |
| **WG2073262-2 LCS** | | | | | | | | |
| F1 (C6-C10) | | | 102.8 | | % | | 80-120 | 21-APR-15 |
| **WG2073262-1 MB** | | | | | | | | |
| F1 (C6-C10) | | | <5.0 | | ug/g | | 5 | 21-APR-15 |
| Surrogate: 3,4-Dichlorotoluene | | | 97.4 | | % | | 60-140 | 21-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| F1-HS-511-WT | Soil | | | | | | | |
| **Batch** **R3176999** | | | | | | | | |
| **WG2073262-7** | **MS** | **L1600418-9** | | | | | | |
| F1 (C6-C10) | | | 113.4 | | % | | 60-140 | 21-APR-15 |
| F2-F4-511-WT | Soil | | | | | | | |
| **Batch** **R3176940** | | | | | | | | |
| **WG2072486-3** | **CRM** | **ALS PHC2 IRM** | | | | | | |
| F2 (C10-C16) | | | 96.8 | | % | | 70-130 | 20-APR-15 |
| F3 (C16-C34) | | | 113.5 | | % | | 70-130 | 20-APR-15 |
| F4 (C34-C50) | | | 119.5 | | % | | 70-130 | 20-APR-15 |
| **WG2073249-1** | **CVS** | | | | | | | |
| F2 (C10-C16) | | | 109.8 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 110.3 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 115.5 | | % | | 80-120 | 20-APR-15 |
| **WG2073249-2** | **CVS** | | | | | | | |
| F2 (C10-C16) | | | 108.6 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 109.7 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 114.8 | | % | | 80-120 | 20-APR-15 |
| **WG2073249-3** | **CVS** | | | | | | | |
| F2 (C10-C16) | | | 108.2 | | % | | 80-120 | 21-APR-15 |
| F3 (C16-C34) | | | 110.1 | | % | | 80-120 | 21-APR-15 |
| F4 (C34-C50) | | | 114.2 | | % | | 80-120 | 21-APR-15 |
| **WG2072486-5** | **DUP** | **WG2072486-4** | | | | | | |
| F2 (C10-C16) | | 950 | 1060 | | ug/g | 11 | 40 | 20-APR-15 |
| F3 (C16-C34) | | 719 | 734 | | ug/g | 2.2 | 40 | 20-APR-15 |
| F4 (C34-C50) | | <50 | <50 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| **WG2072486-2** | **LCS** | | | | | | | |
| F2 (C10-C16) | | | 89.9 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 99.5 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 100.1 | | % | | 80-120 | 20-APR-15 |
| **WG2072486-1** | **MB** | | | | | | | |
| F2 (C10-C16) | | | <10 | | ug/g | | 10 | 20-APR-15 |
| F3 (C16-C34) | | | <50 | | ug/g | | 50 | 20-APR-15 |
| F4 (C34-C50) | | | <50 | | ug/g | | 50 | 20-APR-15 |
| Surrogate: 2-Bromobenzotrifluoride | | | 72.5 | | % | | 60-140 | 20-APR-15 |
| F4G-ADD-511-WT | Soil | | | | | | | |

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| F4G-ADD-511-WT | Soil | | | | | | | |
| **Batch R3177419** | | | | | | | | |
| **WG2074262-2 LCS** | | | | | | | | |
| F4G-SG (GHH-Silica) | | | 80.1 | | % | | 60-140 | 19-APR-15 |
| **WG2074262-3 LCSD** | | **WG2074262-2** | | | | | | |
| F4G-SG (GHH-Silica) | | 80.1 | 84.0 | | % | 4.7 | 50 | 19-APR-15 |
| **WG2074262-1 MB** | | | | | | | | |
| F4G-SG (GHH-Silica) | | | <250 | | mg/kg | | 250 | 19-APR-15 |
| HG-200.2-CVAA-WT | Soil | | | | | | | |
| **Batch R3176925** | | | | | | | | |
| **WG2073530-2 CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Mercury (Hg) | | | 85.8 | | % | | 70-130 | 21-APR-15 |
| **WG2073530-6 DUP** | | **L1600418-1** | | | | | | |
| Mercury (Hg) | | 0.0634 | 0.0640 | | ug/g | 0.9 | 40 | 21-APR-15 |
| **WG2073530-4 LCS** | | | | | | | | |
| Mercury (Hg) | | | 101.0 | | % | | 80-120 | 21-APR-15 |
| **WG2073530-1 MB** | | | | | | | | |
| Mercury (Hg) | | | <0.0050 | | mg/kg | | 0.005 | 21-APR-15 |
| **Batch R3176927** | | | | | | | | |
| **WG2073531-2 CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Mercury (Hg) | | | 90.3 | | % | | 70-130 | 21-APR-15 |
| **WG2073531-6 DUP** | | **L1600418-7** | | | | | | |
| Mercury (Hg) | | 0.0165 | 0.0156 | | ug/g | 5.5 | 40 | 21-APR-15 |
| **WG2073531-4 LCS** | | | | | | | | |
| Mercury (Hg) | | | 98.0 | | % | | 80-120 | 21-APR-15 |
| **WG2073531-1 MB** | | | | | | | | |
| Mercury (Hg) | | | <0.0050 | | mg/kg | | 0.005 | 21-APR-15 |
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177896** | | | | | | | | |
| **WG2073530-2 CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Antimony (Sb) | | | 101.0 | | % | | 70-130 | 21-APR-15 |
| Arsenic (As) | | | 111.4 | | % | | 70-130 | 21-APR-15 |
| Barium (Ba) | | | 109.7 | | % | | 70-130 | 21-APR-15 |
| Beryllium (Be) | | | 100.4 | | % | | 70-130 | 21-APR-15 |
| Boron (B) | | | 99.2 | | % | | 70-130 | 21-APR-15 |
| Cadmium (Cd) | | | 104.5 | | % | | 70-130 | 21-APR-15 |
| Chromium (Cr) | | | 118.1 | | % | | 70-130 | 21-APR-15 |
| Cobalt (Co) | | | 111.3 | | % | | 70-130 | 21-APR-15 |
| Copper (Cu) | | | 108.3 | | % | | 70-130 | 21-APR-15 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177896** | | | | | | | | |
| **WG2073530-2 CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Lead (Pb) | | | 95.6 | | % | | 70-130 | 21-APR-15 |
| Molybdenum (Mo) | | | 88.0 | | % | | 70-130 | 21-APR-15 |
| Nickel (Ni) | | | 113.1 | | % | | 70-130 | 21-APR-15 |
| Selenium (Se) | | | 95.2 | | % | | 70-130 | 21-APR-15 |
| Silver (Ag) | | | 100.0 | | % | | 70-130 | 21-APR-15 |
| Thallium (Tl) | | | 98.7 | | % | | 70-130 | 21-APR-15 |
| Uranium (U) | | | 112.2 | | % | | 70-130 | 21-APR-15 |
| Vanadium (V) | | | 119.4 | | % | | 70-130 | 21-APR-15 |
| Zinc (Zn) | | | 111.0 | | % | | 70-130 | 21-APR-15 |
| **WG2073530-6 DUP** | | **L1600418-1** | | | | | | |
| Antimony (Sb) | | <1.0 | 0.15 | | ug/g | 17 | 30 | 21-APR-15 |
| Arsenic (As) | | 3.7 | 3.71 | | ug/g | 0.6 | 30 | 21-APR-15 |
| Barium (Ba) | | 52.2 | 53.0 | | ug/g | 1.4 | 40 | 21-APR-15 |
| Beryllium (Be) | | <0.50 | 0.41 | | ug/g | 11 | 30 | 21-APR-15 |
| Boron (B) | | 5.9 | <5.0 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Cadmium (Cd) | | <0.50 | 0.282 | | ug/g | 7.5 | 30 | 21-APR-15 |
| Chromium (Cr) | | 28.6 | 27.9 | | ug/g | 2.4 | 30 | 21-APR-15 |
| Cobalt (Co) | | 5.8 | 5.87 | | ug/g | 1.1 | 30 | 21-APR-15 |
| Copper (Cu) | | 10.5 | 10.6 | | ug/g | 0.6 | 30 | 21-APR-15 |
| Lead (Pb) | | 12.5 | 12.6 | | ug/g | 0.4 | 40 | 21-APR-15 |
| Molybdenum (Mo) | | <1.0 | 0.31 | | ug/g | 4.4 | 40 | 21-APR-15 |
| Nickel (Ni) | | 11.3 | 11.8 | | ug/g | 4.0 | 30 | 21-APR-15 |
| Selenium (Se) | | <1.0 | <0.20 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Silver (Ag) | | 0.29 | 0.29 | | ug/g | 0.9 | 40 | 21-APR-15 |
| Thallium (Tl) | | <0.50 | 0.096 | | ug/g | 4.5 | 30 | 21-APR-15 |
| Uranium (U) | | <1.0 | 0.527 | | ug/g | 2.2 | 30 | 21-APR-15 |
| Vanadium (V) | | 28.9 | 28.9 | | ug/g | 0.2 | 30 | 21-APR-15 |
| Zinc (Zn) | | 44.2 | 45.6 | | ug/g | 3.1 | 30 | 21-APR-15 |
| **WG2073530-3 LCS** | | | | | | | | |
| Antimony (Sb) | | | 101.7 | | % | | 80-120 | 21-APR-15 |
| Arsenic (As) | | | 95.2 | | % | | 80-120 | 21-APR-15 |
| Barium (Ba) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Beryllium (Be) | | | 92.5 | | % | | 80-120 | 21-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177896** | | | | | | | | |
| **WG2073530-3 LCS** | | | | | | | | |
| Boron (B) | | | 93.9 | | % | | 80-120 | 21-APR-15 |
| Cadmium (Cd) | | | 96.1 | | % | | 80-120 | 21-APR-15 |
| Chromium (Cr) | | | 95.8 | | % | | 80-120 | 21-APR-15 |
| Cobalt (Co) | | | 95.5 | | % | | 80-120 | 21-APR-15 |
| Copper (Cu) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Lead (Pb) | | | 99.0 | | % | | 80-120 | 21-APR-15 |
| Molybdenum (Mo) | | | 94.5 | | % | | 80-120 | 21-APR-15 |
| Nickel (Ni) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Selenium (Se) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Silver (Ag) | | | 93.7 | | % | | 80-120 | 21-APR-15 |
| Thallium (Tl) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Uranium (U) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Vanadium (V) | | | 97.9 | | % | | 80-120 | 21-APR-15 |
| Zinc (Zn) | | | 92.1 | | % | | 80-120 | 21-APR-15 |
| **WG2073530-1 MB** | | | | | | | | |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Arsenic (As) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Beryllium (Be) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Boron (B) | | | <5.0 | | mg/kg | | 5 | 21-APR-15 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 21-APR-15 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Copper (Cu) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Molybdenum (Mo) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Nickel (Ni) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Selenium (Se) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Silver (Ag) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Thallium (Tl) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Uranium (U) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Vanadium (V) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 21-APR-15 |

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177901** | | | | | | | | |
| **WG2073531-2** **CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Antimony (Sb) | | | 93.1 | | % | | 70-130 | 21-APR-15 |
| Arsenic (As) | | | 97.4 | | % | | 70-130 | 21-APR-15 |
| Barium (Ba) | | | 94.2 | | % | | 70-130 | 21-APR-15 |
| Beryllium (Be) | | | 94.1 | | % | | 70-130 | 21-APR-15 |
| Boron (B) | | | 120.4 | | % | | 70-130 | 21-APR-15 |
| Cadmium (Cd) | | | 90.3 | | % | | 70-130 | 21-APR-15 |
| Chromium (Cr) | | | 104.8 | | % | | 70-130 | 21-APR-15 |
| Cobalt (Co) | | | 96.7 | | % | | 70-130 | 21-APR-15 |
| Copper (Cu) | | | 93.3 | | % | | 70-130 | 21-APR-15 |
| Lead (Pb) | | | 83.8 | | % | | 70-130 | 21-APR-15 |
| Molybdenum (Mo) | | | 85.3 | | % | | 70-130 | 21-APR-15 |
| Nickel (Ni) | | | 99.0 | | % | | 70-130 | 21-APR-15 |
| Selenium (Se) | | | 95.0 | | % | | 70-130 | 21-APR-15 |
| Silver (Ag) | | | 90.6 | | % | | 70-130 | 21-APR-15 |
| Thallium (Tl) | | | 92.2 | | % | | 70-130 | 21-APR-15 |
| Uranium (U) | | | 98.0 | | % | | 70-130 | 21-APR-15 |
| Vanadium (V) | | | 106.2 | | % | | 70-130 | 21-APR-15 |
| Zinc (Zn) | | | 96.5 | | % | | 70-130 | 21-APR-15 |
| **WG2073531-6** **DUP** | | **L1600418-7** | | | | | | |
| Antimony (Sb) | | <1.0 | <0.10 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Arsenic (As) | | 3.2 | 2.97 | | ug/g | 7.4 | 30 | 21-APR-15 |
| Barium (Ba) | | 40.1 | 38.0 | | ug/g | 5.3 | 40 | 21-APR-15 |
| Beryllium (Be) | | <0.50 | 0.33 | | ug/g | 7.2 | 30 | 21-APR-15 |
| Boron (B) | | 10.2 | 9.5 | | ug/g | 7.3 | 30 | 21-APR-15 |
| Cadmium (Cd) | | <0.50 | 0.102 | | ug/g | 6.2 | 30 | 21-APR-15 |
| Chromium (Cr) | | 15.5 | 14.3 | | ug/g | 7.7 | 30 | 21-APR-15 |
| Cobalt (Co) | | 5.6 | 5.26 | | ug/g | 5.4 | 30 | 21-APR-15 |
| Copper (Cu) | | 12.5 | 12.0 | | ug/g | 3.9 | 30 | 21-APR-15 |
| Lead (Pb) | | 9.9 | 9.38 | | ug/g | 5.0 | 40 | 21-APR-15 |
| Molybdenum (Mo) | | <1.0 | 0.40 | | ug/g | 11 | 40 | 21-APR-15 |
| Nickel (Ni) | | 13.7 | 13.2 | | ug/g | 4.1 | 30 | 21-APR-15 |
| Selenium (Se) | | <1.0 | <0.20 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Silver (Ag) | | <0.20 | <0.10 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177901** | | | | | | | | |
| **WG2073531-6 DUP** | | **L1600418-7** | | | | | | |
| Thallium (Tl) | | <0.50 | 0.089 | | ug/g | 8.5 | 30 | 21-APR-15 |
| Uranium (U) | | <1.0 | 0.632 | | ug/g | 2.4 | 30 | 21-APR-15 |
| Vanadium (V) | | 23.2 | 21.4 | | ug/g | 8.0 | 30 | 21-APR-15 |
| Zinc (Zn) | | 42.2 | 39.5 | | ug/g | 6.6 | 30 | 21-APR-15 |
| **WG2073531-3 LCS** | | | | | | | | |
| Antimony (Sb) | | | 101.7 | | % | | 80-120 | 21-APR-15 |
| Arsenic (As) | | | 95.2 | | % | | 80-120 | 21-APR-15 |
| Barium (Ba) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Beryllium (Be) | | | 92.5 | | % | | 80-120 | 21-APR-15 |
| Boron (B) | | | 93.9 | | % | | 80-120 | 21-APR-15 |
| Cadmium (Cd) | | | 96.1 | | % | | 80-120 | 21-APR-15 |
| Chromium (Cr) | | | 95.8 | | % | | 80-120 | 21-APR-15 |
| Cobalt (Co) | | | 95.5 | | % | | 80-120 | 21-APR-15 |
| Copper (Cu) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Lead (Pb) | | | 99.0 | | % | | 80-120 | 21-APR-15 |
| Molybdenum (Mo) | | | 94.5 | | % | | 80-120 | 21-APR-15 |
| Nickel (Ni) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Selenium (Se) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Silver (Ag) | | | 93.7 | | % | | 80-120 | 21-APR-15 |
| Thallium (Tl) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Uranium (U) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Vanadium (V) | | | 97.9 | | % | | 80-120 | 21-APR-15 |
| Zinc (Zn) | | | 92.1 | | % | | 80-120 | 21-APR-15 |
| **WG2073531-1 MB** | | | | | | | | |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Arsenic (As) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Beryllium (Be) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Boron (B) | | | <5.0 | | mg/kg | | 5 | 21-APR-15 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 21-APR-15 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Copper (Cu) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177901** | | | | | | | | |
| **WG2073531-1 MB** | | | | | | | | |
| Molybdenum (Mo) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Nickel (Ni) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Selenium (Se) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Silver (Ag) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Thallium (Tl) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Uranium (U) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Vanadium (V) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 21-APR-15 |
| MOISTURE-WT | Soil | | | | | | | |
| **Batch R3176280** | | | | | | | | |
| **WG2072498-3 DUP** | | **L1600509-4** | | | | | | |
| % Moisture | | 13.2 | 13.4 | | % | 2.0 | 20 | 19-APR-15 |
| **WG2072498-2 LCS** | | | | | | | | |
| % Moisture | | | 100.0 | | % | | 70-130 | 19-APR-15 |
| **WG2072498-1 MB** | | | | | | | | |
| % Moisture | | | <0.10 | | % | | 0.1 | 19-APR-15 |
| **Batch R3176283** | | | | | | | | |
| **WG2072503-3 DUP** | | **L1587803-21** | | | | | | |
| % Moisture | | 10.5 | 10.3 | | % | 1.3 | 20 | 19-APR-15 |
| **WG2072503-2 LCS** | | | | | | | | |
| % Moisture | | | 99.9 | | % | | 70-130 | 19-APR-15 |
| **WG2072503-1 MB** | | | | | | | | |
| % Moisture | | | <0.10 | | % | | 0.1 | 19-APR-15 |
| PH-R511-WT | Soil | | | | | | | |
| **Batch R3176288** | | | | | | | | |
| **WG2072483-1 DUP** | | **L1600418-1** | | | | | | |
| pH | | 7.31 | 7.17 | J | pH units | 0.14 | 0.3 | 20-APR-15 |
| **WG2072952-1 LCS** | | | | | | | | |
| pH | | | 7.03 | | pH units | | 6.7-7.3 | 20-APR-15 |
| SAR-R511-WT | Soil | | | | | | | |
| **Batch R3177137** | | | | | | | | |
| **WG2073525-4 DUP** | | **WG2073525-3** | | | | | | |
| Calcium (Ca) | | 14.2 | 12.4 | | mg/L | 14 | 40 | 21-APR-15 |
| Sodium (Na) | | 3.85 | 3.94 | | mg/L | 2.3 | 40 | 21-APR-15 |
| Magnesium (Mg) | | 1.67 | 1.48 | | mg/L | 12 | 40 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| SAR-R511-WT | Soil | | | | | | | |
| **Batch** **R3177137** | | | | | | | | |
| **WG2073525-2** **IRM** | | **WT SAR1** | | | | | | |
| Calcium (Ca) | | | 83.1 | | % | | 70-130 | 21-APR-15 |
| Sodium (Na) | | | 90.0 | | % | | 70-130 | 21-APR-15 |
| Magnesium (Mg) | | | 83.4 | | % | | 70-130 | 21-APR-15 |
| **WG2073525-1** **MB** | | | | | | | | |
| Calcium (Ca) | | | <0.10 | | mg/L | | 0.1 | 21-APR-15 |
| Sodium (Na) | | | <0.50 | | mg/L | | 0.5 | 21-APR-15 |
| Magnesium (Mg) | | | <0.10 | | mg/L | | 0.1 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

| | |
|---|---|
| Client: | LVM, a Division of EnGlobe Corp.<br>60 MEG DRIVE, UNIT 12A<br>LONDON ON N6E 3T6 |
| Contact: | ROB HELWIG |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

118516

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
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Toll Free: 1-800-668-9878

ALS Environmental

C of C # 00000

# CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page 1 of 1

*Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.*

Specify date required

| Service requested | |
|---|---|
| *5 day (regular)* | |
| *3-4 day (25%)* | |
| *2 day TAT (50%)* | |
| *Next day TAT (100%)* | ✓ |
| *Same day TAT (200%)* | |

COMPANY NAME: LVM
OFFICE: London
PROJECT MANAGER: Rob Helwig
PROJECT #: P-8182-001-100
PHONE: 519-685-6400
FAX: 519-685-0943
ACCOUNT #:
QUOTATION #:
PO #: A01072

CRITERIA: Criteria on report YES ✓ NO___
Reg 153/04 ☐ Reg 511/09 ☒
Table 1 [✓ 2] 3 4 5 6 7 8 9
TCLP ___ MISA ___ PWQO ___
ODWS ___ OTHER ___

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX ___ BOTH ___
SELECT: PDF ___ DIGITAL ___ BOTH ___
EMAIL 1
EMAIL 2

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <--- (F, P, F/P)
SUBMISSION #: L1600418
ENTERED BY: PStasting
DATE/TIME ENTERED: 17 Apr-15
BIN #:

L1600418-COFC

SAMPLING INFORMATION

| Date (dd-mm-yy) | Time (24hr) (hh:mm) | COMP | GRAB | WATER | SOIL | OTHER | SAMPLE DESCRIPTION TO APPEAR ON REPORT | NUMBER OF CONTAINERS | METALS+INORGANICS | PHC F1-F4 | BTEX | COMMENTS | LAB ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14/04/15 | | | | | ✓ | | BH1 Sa1 | 4 | ✓ | ✓ | ✓ | | -1 |
| 14/04/15 | | | | | ✓ | | BH1 Sa2 | | ✓ | ✓ | ✓ | | -2 |
| 14/04/15 | | | | | ✓ | | BH2 Sa2 | | ✓ | ✓ | ✓ | | -3 |
| 15/04/15 | | | | | ✓ | | BH2 Sa5 | | ✓ | ✓ | ✓ | | -4 |
| 15/04/15 | | | | | ✓ | | BH3 Sa2 | | ✓ | ✓ | ✓ | | -5 |
| 15/04/15 | | | | | ✓ | | BH3 Sa4 | | ✓ | ✓ | ✓ | | -6 |
| 14/04/15 | | | | | ✓ | | BH4 Sa1 | | ✓ | ✓ | ✓ | | -7 |
| 14/04/15 | | | | | ✓ | | BH4 Sa3 | | ✓ | ✓ | ✓ | | -8 |
| 15/04/15 | | | | | ✓ | | BH5 Sa1 | | ✓ | ✓ | ✓ | | -9 |

SPECIAL INSTRUCTIONS/COMMENTS
TABLE 2 coarse grained
Residential

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES ( CHECK Yes OR No )
Are any samples taken from a regulated DW System? Yes ☐ No ☐
If yes; an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☐

SAMPLE CONDITION
FROZEN ☐
COLD ☐
COOLING INITIATED ☑
AMBIENT ☐
MEAN TEMP: 10°C
OBSERVATIONS: Yes ☐ No ☐
INIT: PB

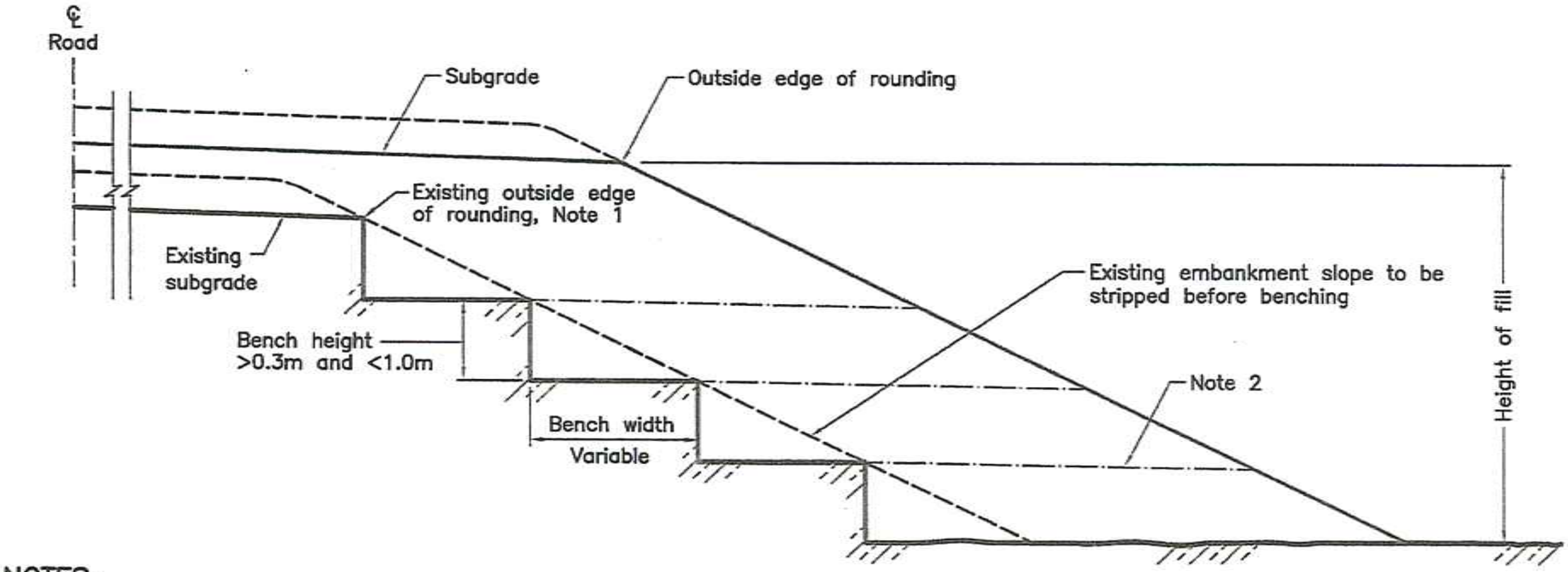
SAMPLED BY: ED Van Puymbroeck
DATE & TIME: APR 15, 2015
RECEIVED BY: R. Nelly
DATE & TIME: Apr 15, 2015
RELINQUISHED BY:
DATE & TIME:
RECEIVED AT LAB BY: PStasting
DATE & TIME: 17 Apr-15 @ 9:50

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

# Appendix 5 Benching of Earth Slopes

OPSD 208.010

LVM



NOTES:

1 When the subgrade is below the existing outside edge of rounding, benching shall be carried out below the point where the subgrade intersects the existing slope.

2 Benches are to be excavated one level at a time and the fill placed and compacted before the next bench is excavated.

A Benching is not required on existing slopes flatter than 3H:1V.

B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2008 Rev 2

# BENCHING OF EARTH SLOPES

OPSD 208.010

# 10125 Oxbow Drive
# Komoka
# Transportation Impact Study

Paradigm Transportation Solutions Limited

July 2020
200272

ptsl.com

# Project Summary

# 10125 Oxbow Drive, Komoka Transportation Impact Study

**Project Number**
200272

**July 2020**

**Client**
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LICENSED PROFESSIONAL ENGINEER
M. A. BROUWER
100079060
28 July 2020
PROVINCE OF ONTARIO

Matthew Brouwer, P.Eng.

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# Executive Summary

## Content

Paradigm Transportation Solutions Limited (Paradigm) has been retained to conduct this Transportation Impact Study (TIS) for a proposed residential development located in the village of Komoka, Municipality of Middlesex Centre, County of Middlesex.

This TIS includes an analysis of existing traffic conditions, a description of the proposed development, traffic forecasts for a five-year horizon from the estimated date of development build-out (2029), and any recommendations required to improve future traffic conditions.

## Development Concept

The subject site is located on the south side of Oxbow Drive (#10125) in the village of Komoka, Municipality of Middlesex Centre, County of Middlesex.

The proposed site redevelopment consists of 50 single family dwellings and 8 townhouse units. Vehicle access is proposed by the southerly extension of Union Avenue into the subject site and a proposed driveway to Oxbow Drive via Street ‘A’ to the west. Build-out of the site is anticipated to occur by Year 2024.

## Conclusions

The main findings and conclusions of this study are as follows:

- **Existing Traffic**: The study area intersections are operating with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are occurring at the study area intersections.
- **Trip Generation**: The site’s trip generation is estimated to be approximately 44 AM peak hour vehicle trips and 58 PM peak hour vehicle trips.
- **Background Traffic**: The study area intersections are forecast to continue to operate with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are forecast to occur at the study area intersections.
- **Total Traffic**: The study area intersections are forecast to continue to operate with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are forecast to occur at the study area intersections.

- **Left-Turn Lanes**: Left-turn lanes are not warranted at study area intersections under forecast total conditions.

## Recommendations

Based on the findings of this study, it is recommended that the subject development be approved without any external transportation related improvements.

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# 1 Introduction

## 1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) has been retained to conduct this Transportation Impact Study (TIA) for a proposed residential development located in the village of Komoka, Municipality of Middlesex Centre, County of Middlesex. **Figure 1.1** illustrates the location of the subject site.

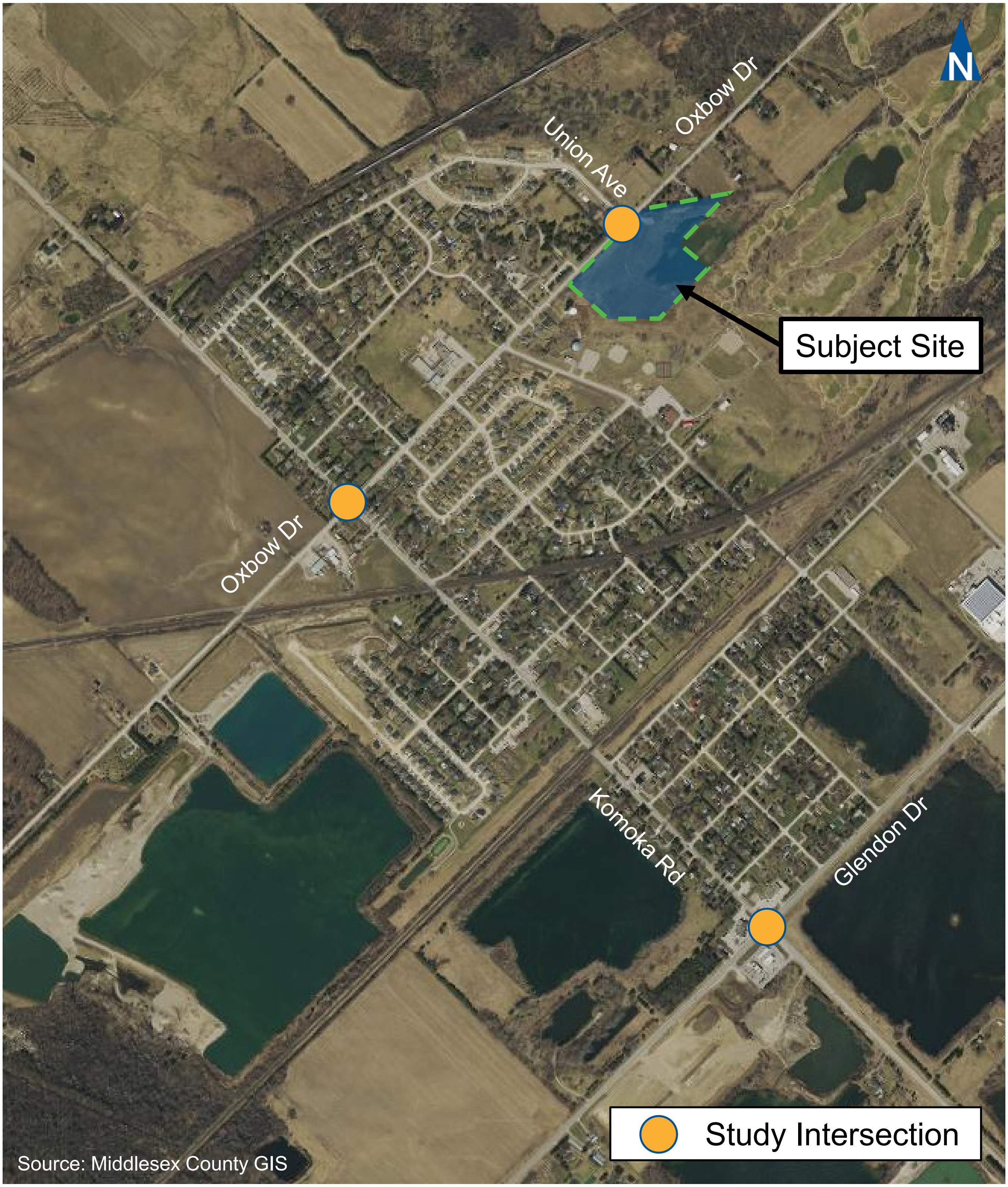
## 1.2 Purpose and Scope

The purpose of the study is to:

- Determine and assess the current study area traffic conditions;
- Forecast the additional traffic generated by the proposed development;
- Analyze the impacts of this additional traffic on the study area street network; and
- Recommend any necessary remedial measures required to mitigate these impacts.

The study scope developed in consultation with the Municipality of Middlesex Centre and the County of Middlesex via e-mail in June 2020 is aimed at evaluating the anticipated traffic impact of the proposed development and includes:

- AM and PM peak hour traffic conditions analyses for existing (2020), 2029 background (without development) and 2029 total (with development) planning horizons;
- Adjacent street network assessments at the intersections of:
  - Komoka Road and Oxbow Drive;
  - Oxbow Drive and Union Avenue;
  - Glendon Drive and Komoka Road; and
  - Oxbow Drive and proposed Street ‘A’.
- Recommendations to mitigate anticipated traffic impacts, if required, at the above locations and the site accesses.



Source: Middlesex County GIS

# Study Area and Subject Development Location

10125 Oxbow Drive TIS
200272

Figure 1.1

# 2 Existing Conditions

## 2.1 Road Network

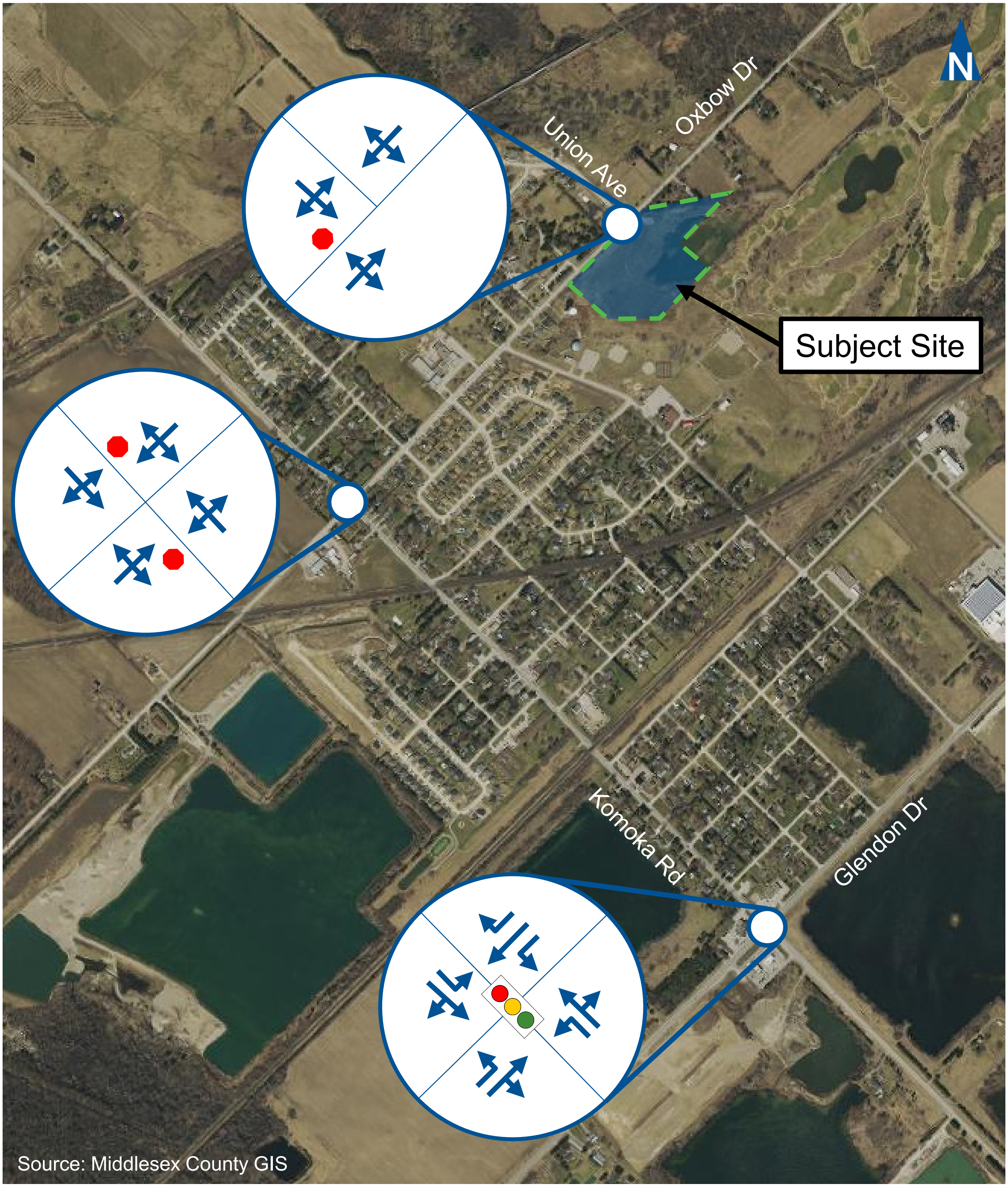
The roadways of interest within the study area include:

- **Glendon Drive (County Road 14)** is an east/west arterial road[1] under the jurisdiction of the County of Middlesex. The road has a two-lane rural cross-section and a posted speed limit of 50 km/h. Sidewalks are only provided at the intersection of Komoka Road. The intersection with Komoka Road is signalized;
- **Komoka Road (County Road 16)** is a north/south collector road under the jurisdiction of the County of Middlesex. The road has a two-lane urban cross-section between Simcoe Avenue and Glendon Drive, and a rural cross-section to the north. There is a posted speed limit of 50 km/h and a sidewalk is present on the east side of the road between Glendon Drive and Oxbow Drive. The intersection with Oxbow Drive is unsignalized with stop control on Oxbow Drive;
- **Oxbow Drive** is an east/west local road under the jurisdiction of the Municipality of Middlesex Centre. The road has a two-lane rural cross-section and a posted speed limit of 50 km/h. Sidewalks are present on both sides of the road between Komoka Road and Valleyview Drive, and are provided on the north side of the road to the east. The intersection with Union Avenue is unsignalized with stop control on Union Avenue; and
- **Union Avenue** is a north/south local road under the jurisdiction of the Municipality of Middlesex Centre. The road has a two-lane urban cross-section and a posted speed limit of 50 km/h. Sidewalks are present on the west side of the road near Oxbow Drive.

**Figure 2.1** illustrates the existing lane configuration and traffic control at the study area intersections.

---

[1] https://www.middlesex.ca/sites/default/files/documents/2015_MC_Road_map.pdf



paradigm TRANSPORTATION SOLUTIONS LIMITED

# Existing Traffic Control and Lane Configuration

10125 Oxbow Drive TIS
200272

**Figure 2.1**

## 2.2 Transit Service

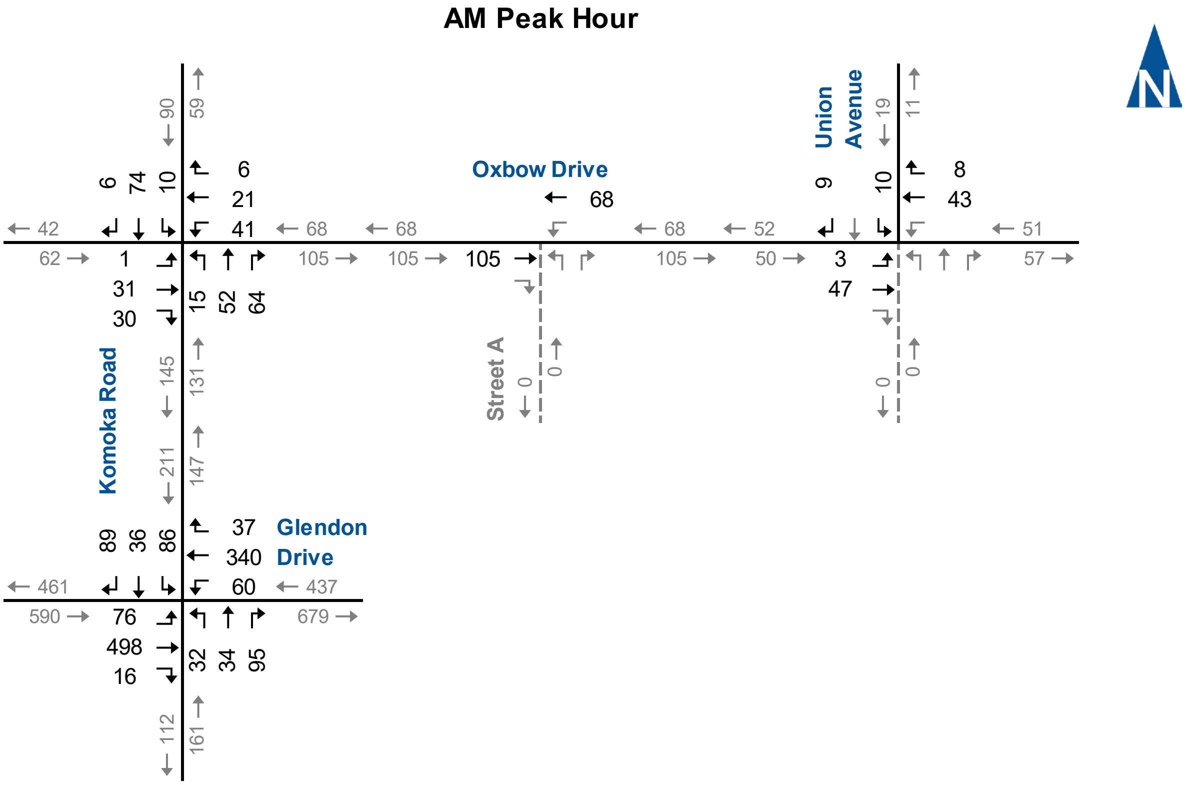
There is currently no transit service available within the study area.

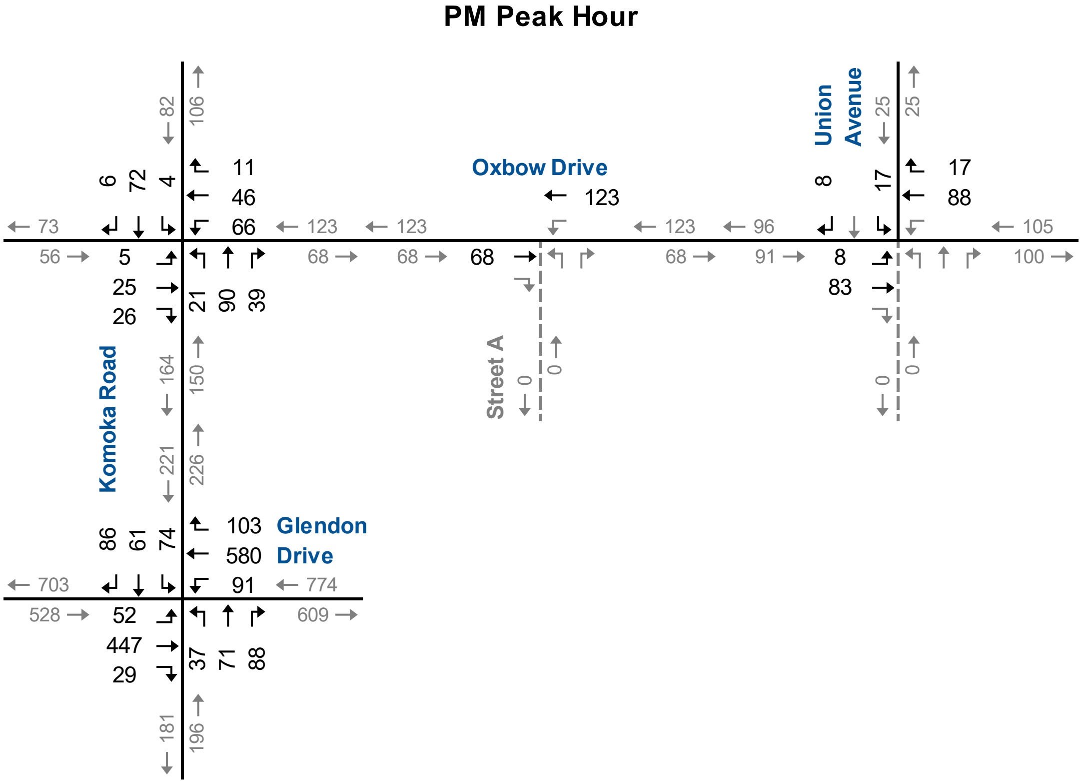
## 2.3 Traffic Volumes

**Table 2.1** summarizes the location and date of the existing turning movement count (TMC) data collected by Paradigm. **Figure 2.2** and **Figure 2.3** illustrate the existing AM and PM weekday peak hour turning movement count volumes. **Appendix A** contains the turning movement data.

TABLE 2.1: EXISTING COUNT DATA SUMMARY

| Location | Date |
|---|---|
| Komoka Rd & Oxbow Dr | 13 Sept 2018 |
| Komoka Rd & Glendon Dr | 13 Sept 2018 |
| Oxbow Dr & Union Ave | 25 June 2020 |





# Existing Traffic Volumes

Figure 2.2

## 2.4 Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles intending to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to the opposing traffic flows and intersection geometry.

The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.0, the movement is classed as LOS F and remedial measures are usually implemented, if they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

The operations of intersections in the study area were evaluated with the existing turning movement volumes using Synchro 9.

The intersection analysis considered two separate measures of performance:

- The volume to capacity ratio for each intersection; and
- The LOS for each turning movement (LOS is based on the average control delay per vehicle).

**Table 2.2** summarizes the existing intersection operations. The entries in the table indicating the AM and PM peak hour level of service (LOS), volume to capacity ratios (V/C), and 95th percentile queues experienced.

All intersections are estimated to be operating within acceptable levels, with no specific problem movements under existing traffic conditions.

**Appendix B** contains the detailed Synchro 9 reports.

# TABLE 2.2: EXISTING TRAFFIC OPERATIONS

| **Analysis Period** | **Intersection** | **Control Type** | **MOE** | **Direction / Movement / Approach** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Eastbound** | | | | **Westbound** | | | | **Northbound** | | | | **Southbound** | | | | **OVERALL** |
| | | | | **Left** | **Through** | **Right** | **Approach** | **Left** | **Through** | **Right** | **Approach** | **Left** | **Through** | **Right** | **Approach** | **Left** | **Through** | **Right** | **Approach** | |
| **AM Peak Hour** | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | B | > | **B** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 10 | > | **10** | < | 11 | > | **11** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **1** | |
| | | | V/C | < | 0.09 | > | | < | 0.12 | > | | 0.01 | 0.00 | 0.00 | | 0.01 | 0.00 | 0.00 | | |
| | | | 95th | < | 0 | > | | < | 0 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | - | **A** | - | A | A | **A** | | | | | A | - | > | **A** | |
| | | | Delay | 7 | 0 | - | **0** | - | 0 | 0 | **0** | | | | | 9 | - | > | **9** | |
| | | | V/C | 0.00 | 0.00 | - | | - | 0.00 | 0.00 | | | | | | 0.02 | - | > | | |
| | | | 95th | 0 | 0 | - | | - | 0 | 0 | | | | | | 0 | - | > | | |
| | Glendon Drive & Komoka Road | TCS | LOS | A | B | > | **A** | A | A | A | **A** | B | A | > | **A** | B | A | > | **B** | **A** |
| | | | Delay | 8 | 10 | > | **10** | 8 | 8 | 2 | **8** | 14 | 7 | > | **8** | 15 | 7 | > | **10** | **9** |
| | | | V/C | 0.16 | 0.51 | > | | 0.17 | 0.34 | 0.05 | | 0.09 | 0.23 | > | | 0.22 | 0.22 | > | | |
| | | | 95th | 9 | 54 | > | | 8 | 32 | 3 | | 8 | 14 | > | | 18 | 13 | > | | |
| **PM Peak Hour** | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | B | > | **B** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 10 | > | **10** | < | 12 | > | **12** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **0** | |
| | | | V/C | < | 0.08 | > | | < | 0.21 | > | | 0.02 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | | |
| | | | 95th | < | 0 | > | | < | 1 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | - | **A** | - | A | A | **A** | | | | | A | - | > | **A** | |
| | | | Delay | 8 | 0 | - | **1** | - | 0 | 0 | **0** | | | | | 10 | - | > | **10** | |
| | | | V/C | 0.01 | 0.00 | - | | - | 0.00 | 0.00 | | | | | | 0.03 | - | > | | |
| | | | 95th | 0 | 0 | - | | - | 0 | 0 | | | | | | 0 | - | > | | |
| | Glendon Drive & Komoka Road | TCS | LOS | A | A | > | **A** | A | B | A | **B** | B | B | > | **B** | B | A | > | **B** | **B** |
| | | | Delay | 8 | 10 | > | **10** | 9 | 12 | 2 | **10** | 16 | 11 | > | **12** | 17 | 9 | > | **12** | **11** |
| | | | V/C | 0.20 | 0.53 | > | | 0.26 | 0.63 | 0.12 | | 0.10 | 0.30 | > | | 0.21 | 0.28 | > | | |
| | | | 95th | 7 | 46 | > | | 11 | 62 | 5 | | 10 | 22 | > | | 17 | 19 | > | | |

*TWSC - Two-Way Stop Control*
*TCS - Traffic Control Signal*
*RBT - Roundabout*

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*V/C - Volume to Capacity Ratio*

*Avail. - Available Storage (m)*
*> - Shared Right-Turn Lane*
*< - Shared Left-Turn Lane*

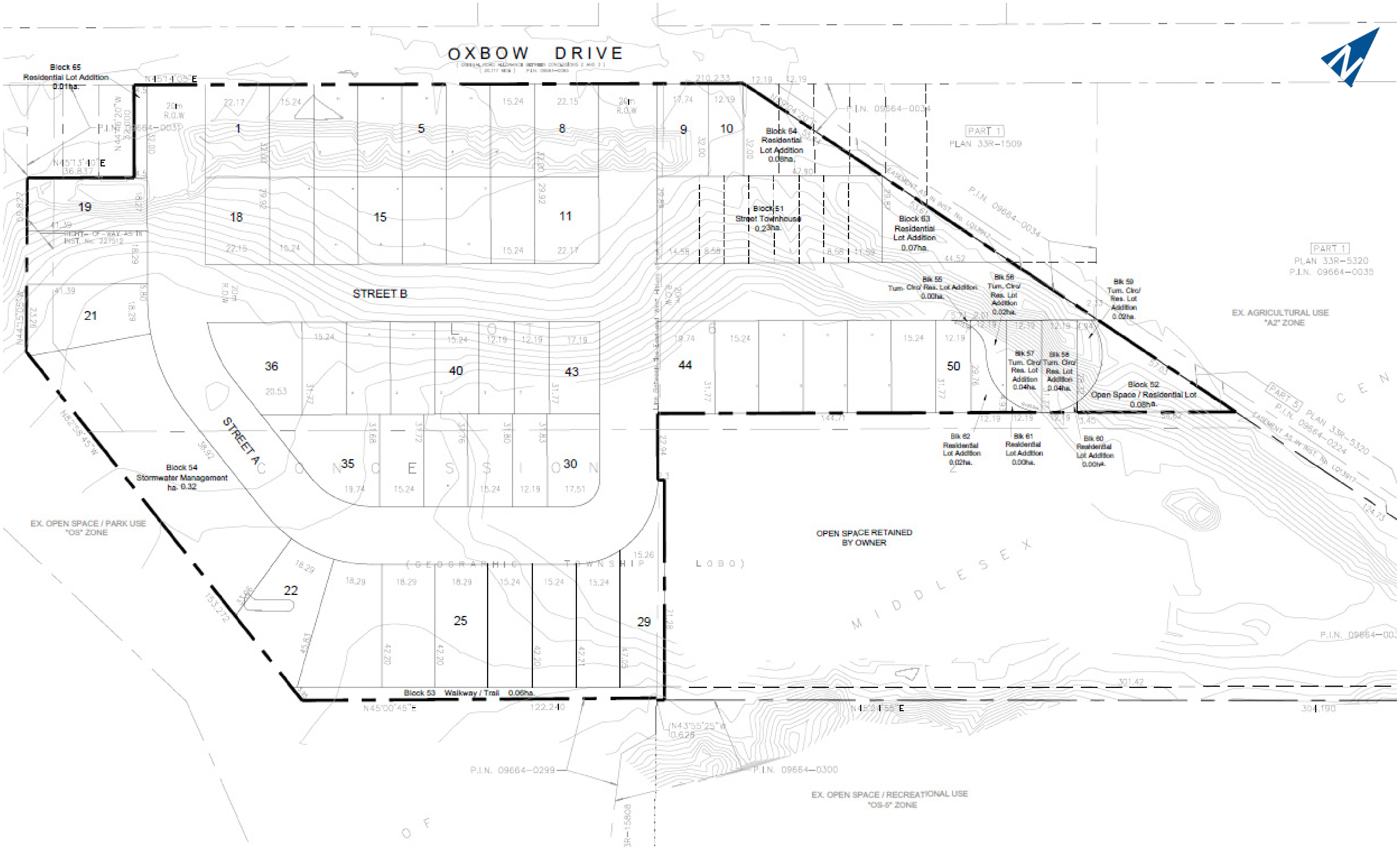
# 3 Development Concept

## 3.1 Description

The subject site is located on the south side of Oxbow Drive (#10125) in the village of Komoka, Municipality of Middlesex Centre, County of Middlesex.

The proposed site redevelopment consists of 50 single family dwellings and 8 townhouse units. Vehicle access is proposed by the southerly extension of Union Avenue into the subject site and a proposed driveway to Oxbow Drive via Street ‘A’ to the west. Build-out of the site is anticipated to occur by Year 2024.

**Figure 3.1** illustrate the proposed site plan.



# Proposed Site Plan

Figure 3.1

## 3.2 Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation[2] methods are used to estimate the site trip generation. The following Land Use Codes (LUC) were used to estimate the site trip generation using regression equations:

- LUC 210 – Single Family Housing; and
- LUC 220 – Multifamily Housing (Low Rise).

Due to the lack of public transit options and as the development only consists of residential dwellings, no trip reductions were applied for other modes of transportation.

The subject site is forecast to generate approximately 44 and 58 vehicle trips during the AM and PM peak hours, respectively. **Table 3.1** summarizes the estimated trip generation.

### TABLE 3.1: SITE GENERATED TRAFFIC

| Land Use Code | # of Units | | Formula or Rate | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Rate per Unit | In | Out | Total | Rate per Unit | In | Out | Total |
| **210: Single Family Housing** | 50 | Units | Formula | 0.81 | 10 | 30 | 40 | 1.04 | 33 | 19 | 52 |
| **220: Multifamily Housing (Low Rise)** | 8 | Units | Formula | 0.54 | 1 | 3 | 4 | 0.78 | 4 | 2 | 6 |
| **Total Net Trips** | | | | | ***11*** | ***33*** | ***44*** | | ***37*** | ***21*** | ***58*** |

Given that the proposed development and the village of Komoka primarily consists of residential dwellings, the trip assignment and distribution was based on existing travel patterns in the study area. **Table 3.2** summarizes the estimated trip distribution for site generated traffic.

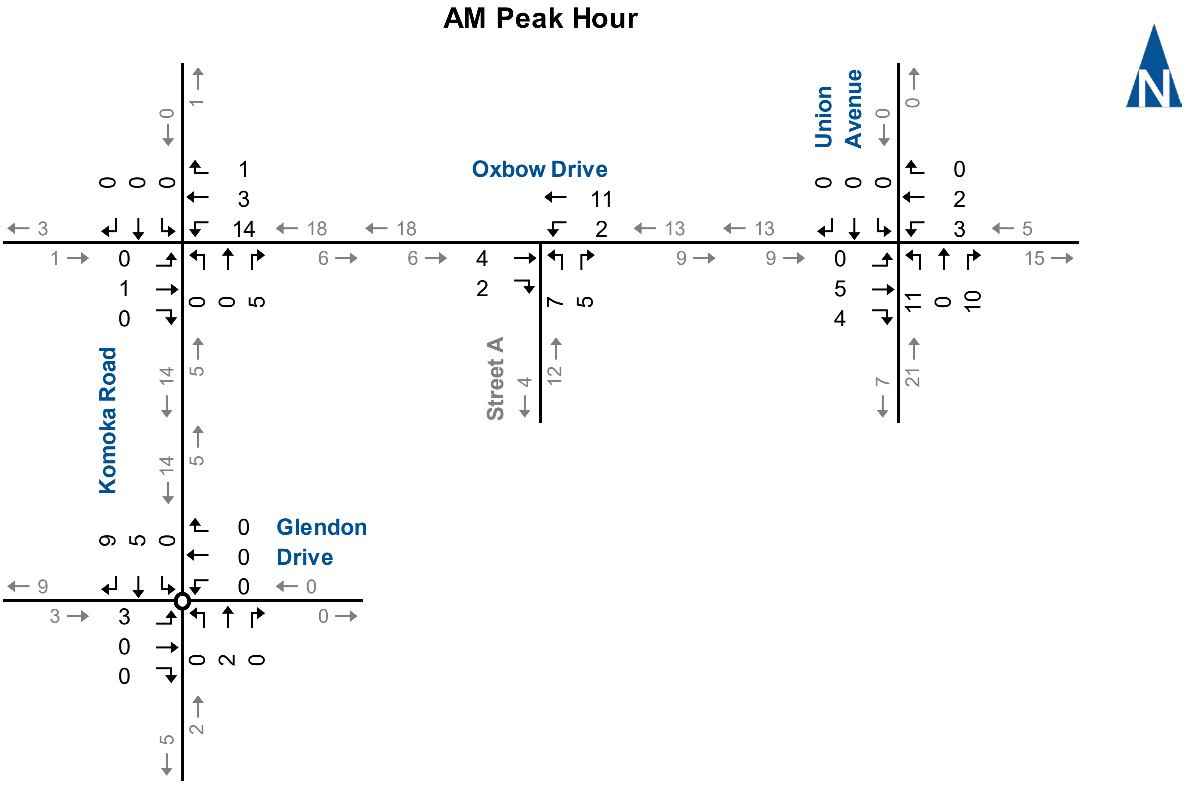
### TABLE 3.2: ESTIMATED TRIP DISTRIBUTION

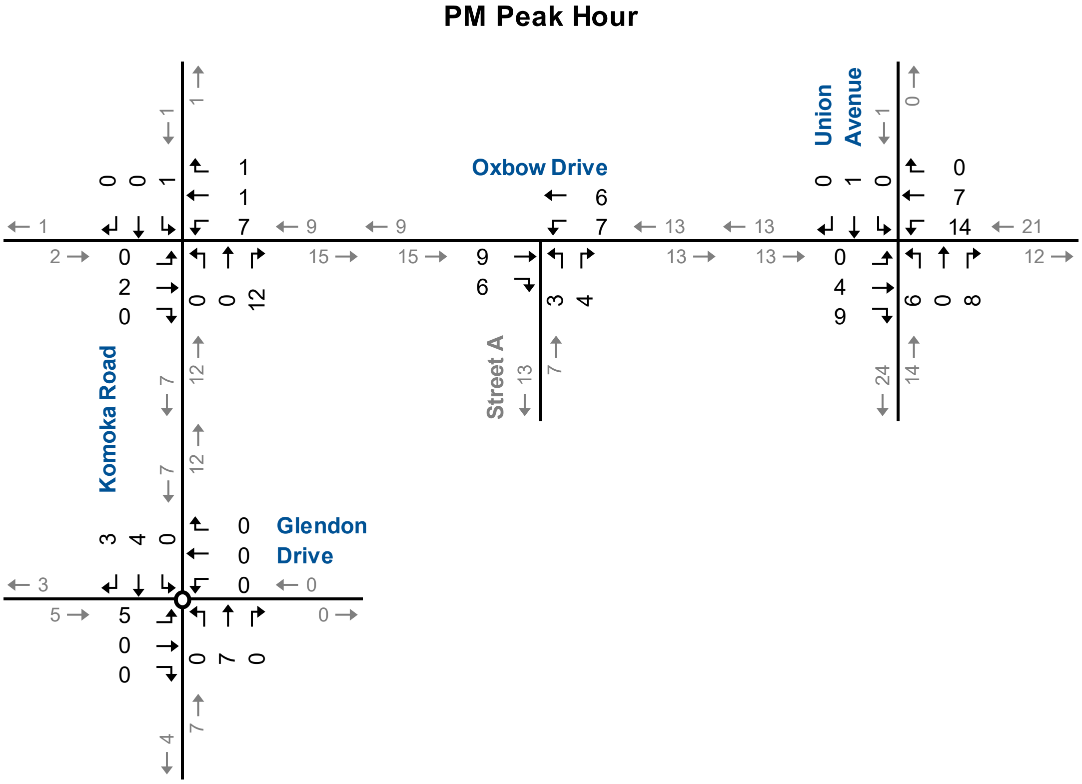
| Distribution | AM | PM |
|---|---|---|
| North | 5% | 5% |
| West | 35% | 20% |
| East | 45% | 55% |
| South | 15% | 20% |

---

[2] *Trip Generation Tenth Edition*, Institute of Transportation Engineers, Washington D.C., 2017

**Figure 3.2** illustrates the site-generated traffic volumes for the AM and PM peak hours.





## Forecast Site Traffic

10125 Oxbow Drive TIS
200272

Figure 3.2

# 4 Future Traffic Conditions

The assessment of future conditions in this section includes the following components:

- Future background traffic estimates;
- Level of service analysis for background traffic (pre-development);
- Future total traffic estimates; and
- Level of service analysis for total traffic (post-development).

## 4.1 Forecast Traffic

A five-year horizon (Year 2029) following the expected build-out of the site has been assessed. The likely future traffic volumes near the subject site are estimated to consist of:

- Increased non-site traffic (generalized background traffic growth);
- Traffic generated by nearby in-stream developments; and
- Traffic generated by the proposed development.

### 4.1.1 Background Traffic

The non-site traffic increase is the generalized traffic growth in the Municipality of Middlesex Centre. The generalized growth is anticipated to follow the average increase in population within the area. The County of Middlesex confirmed a growth rate of 2% per annum to forecast the background traffic.

### 4.1.2 Other Developments

During pre-study consultations, Paradigm requested information from known development applications within the Municipality of Middlesex Centre. The development at 9904 Oxbow Drive[3] was identified, and the development traffic information was added to the general background traffic volumes **Figure 4.1** illustrates the 2029 background traffic volumes for the AM and PM peak hours. **Appendix C** contains the detailed traffic forecast for the 9904 Oxbow Drive development.

---

[3] *9904 Oxbow Drive, Komoka TIS,* Paradigm Transportation Solutions Limited, April 2019.

**Figure 4.2** illustrates the 2029 total traffic forecasts for the AM and PM peak hours, which is the combination of the forecast background traffic volumes and the site generated traffic volumes.

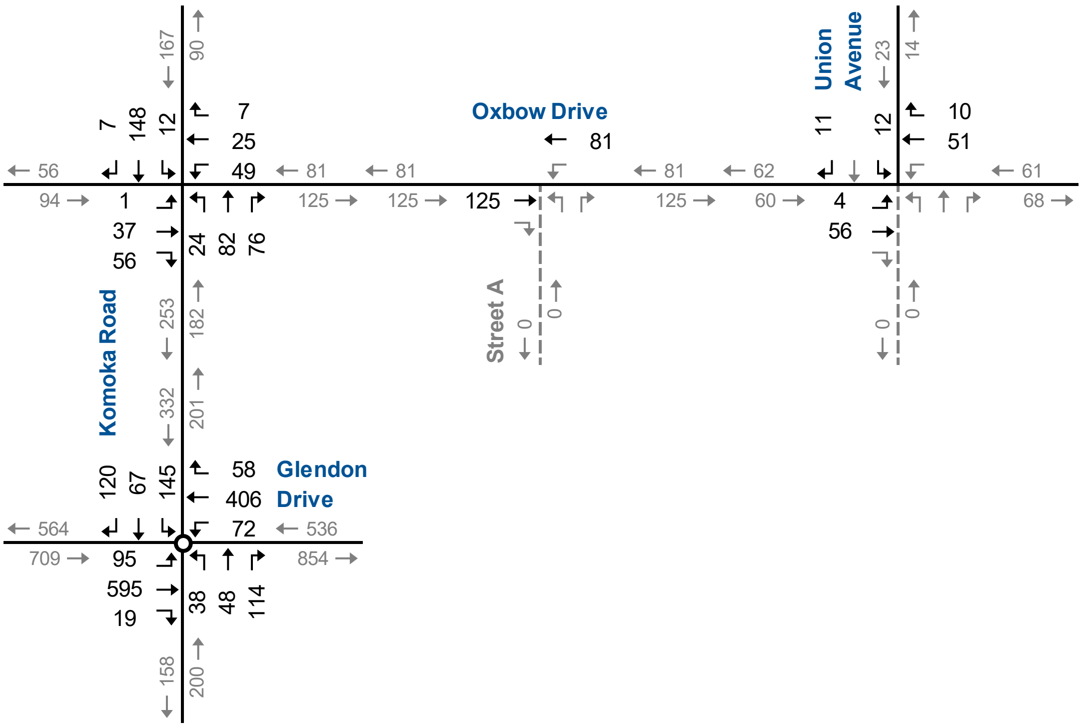
### 4.1.3 Future Glendon Road and Komoka Road Intersection Configuration

Currently, the signalized intersection of Komoka Road and Glendon Drive has left-turn lanes on all intersection legs, separated through and right turn lanes on the east leg, and shared through-right lanes on all other legs as shown in **Figure 2.1**. The Glendon Drive Environmental Assessment (EA)[4] recommends implementing a roundabout at this intersection and widening the east and west legs to accommodate four through lanes within the next five to ten years. As the study was prepared in 2018, it was assumed that the noted roundabout would be implemented by 2029, and is included in the analysis of this study.

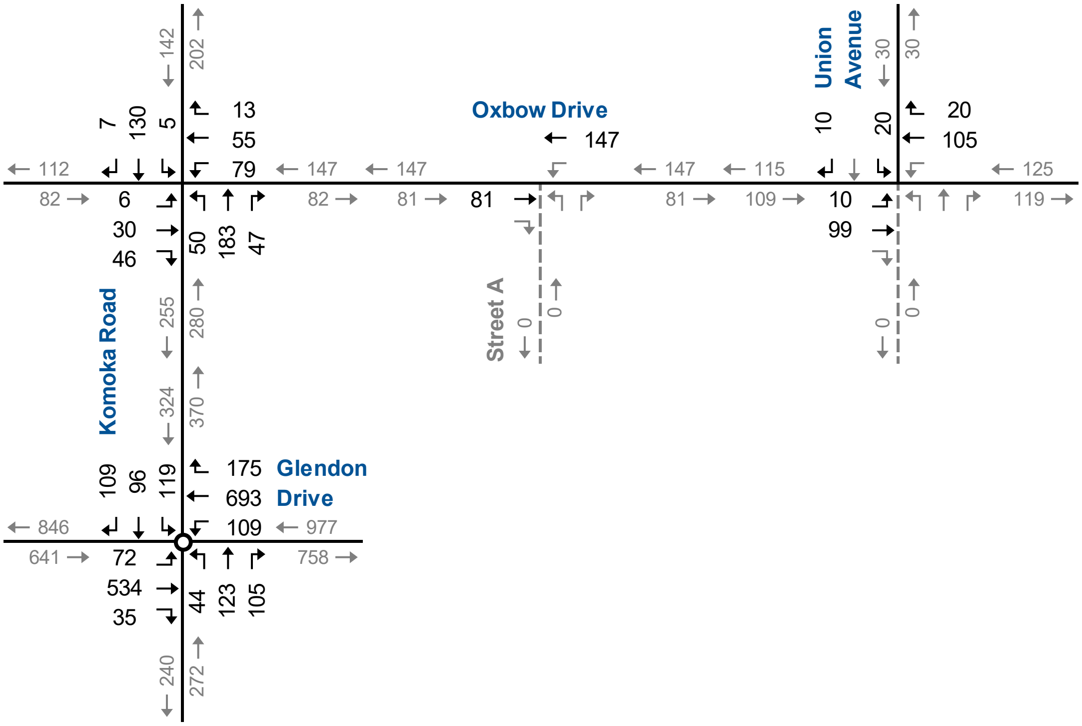
---

[4] *Glendon Drive Streetscape Schedule C Municipal Class Environmental Assessment Report*, Stantec Consulting Limited, August 2018

## AM Peak Hour



## PM Peak Hour

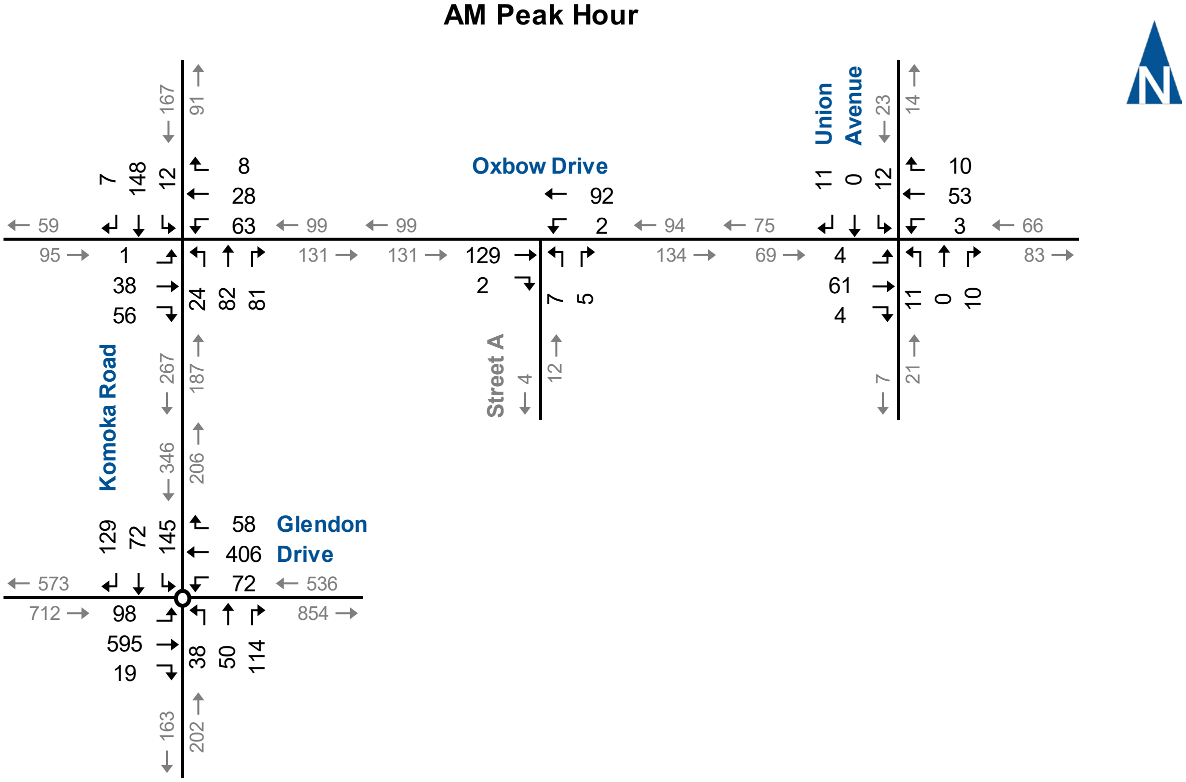


# 2029 Background Traffic

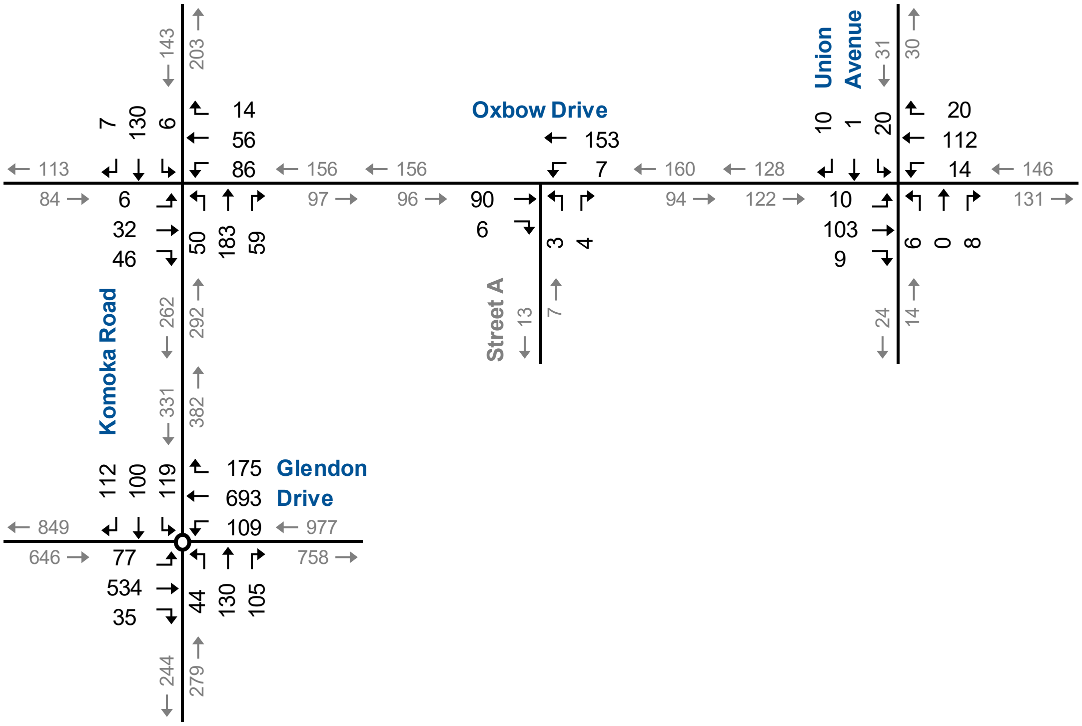
10125 Oxbow Drive TIS
200272

**Figure 4.1**

**AM Peak Hour**



**PM Peak Hour**



paradigm
TRANSPORTATION SOLUTIONS LIMITED

# 2029 Total Traffic

Figure 4.2

## 4.2 Forecast Traffic Operations

### 4.2.1 Background Traffic Operations

The traffic operations of the study area intersections have been assessed using Synchro 9 and Arcady roundabout analysis software. As previously noted, it was assumed that the proposed roundabout at the Komoka Road and Glendon Drive intersection has been implemented but no other traffic control improvements are assumed.

**Table 4.1** summarizes the level of service conditions for the AM and PM peak hours. No critical movements are forecast to occur at the study area intersections and no changes to the existing lane configuration or traffic control are recommended.

**Appendix D** contains the detailed Synchro 9 and Arcady reports.

### 4.2.2 Total Traffic Operations

The study area intersection operations analyses followed the same methodology and lane configuration used for background conditions.

**Table 4.2** summarizes the level of service conditions for the AM and PM peak hours. No critical movements are forecast to occur at the study area intersections and no changes to the existing lane configuration or traffic control are recommended.

**Appendix E** contains the detailed Synchro 9 and Arcady reports.

## TABLE 4.1: BACKGROUND TRAFFIC OPERATIONS

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | OVERALL |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | B | > | **B** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 12 | > | **12** | < | 14 | > | **14** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **1** | |
| | | | V/C | < | 0.15 | > | | < | 0.18 | > | | 0.02 | 0.00 | 0.00 | | 0.01 | 0.00 | 0.00 | | |
| | | | 95th | < | 1 | > | | < | 1 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | - | **A** | - | A | A | **A** | | | | | A | - | > | **A** | |
| | | | Delay | 7 | 0 | - | **0** | - | 0 | 0 | **0** | | | | | 9 | - | > | **9** | |
| | | | V/C | 0.00 | 0.00 | - | | - | 0.00 | 0.00 | | | | | | 0.03 | - | > | | |
| | | | 95th | 0 | 0 | - | | - | 0 | 0 | | | | | | 0 | - | > | | |
| | Glendon Drive & Komoka Road | RBT | LOS | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | **A** |
| | | | Delay | < | 3 | > | **0** | < | 2 | > | **0** | < | 7 | > | **0** | < | 6 | > | **0** | **4** |
| | | | V/C | < | 0.37 | > | | < | 0.28 | > | | < | 0.29 | > | | < | 0.37 | > | | |
| | | | 95th | < | 8 | > | | < | 8 | > | | < | 8 | > | | < | 8 | > | | |
| PM Peak Hour | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | B | > | **B** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 10 | > | **10** | < | 12 | > | **12** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **0** | |
| | | | V/C | < | 0.08 | > | | < | 0.21 | > | | 0.02 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | | |
| | | | 95th | < | 0 | > | | < | 1 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | - | **A** | - | A | A | **A** | | | | | A | - | > | **A** | |
| | | | Delay | 8 | 0 | - | **1** | - | 0 | 0 | **0** | | | | | 10 | - | > | **10** | |
| | | | V/C | 0.01 | 0.00 | - | | - | 0.00 | 0.00 | | | | | | 0.03 | - | > | | |
| | | | 95th | 0 | 0 | - | | - | 0 | 0 | | | | | | 0 | - | > | | |
| | Glendon Drive & Komoka Road | RBT | LOS | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | **A** |
| | | | Delay | < | 3 | > | **0** | < | 3 | > | **0** | < | 6 | > | **0** | < | 8 | > | **0** | **4** |
| | | | V/C | < | 0.34 | > | | < | 0.49 | > | | < | 0.33 | > | | < | 0.43 | > | | |
| | | | 95th | < | 8 | > | | < | 8 | > | | < | 8 | > | | < | 8 | > | | |

*TWSC - Two-Way Stop Control*
*TCS - Traffic Control Signal*
*RBT - Roundabout*
*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*V/C - Volume to Capacity Ratio*
*Avail. - Available Storage (m)*
*> - Shared Right-Turn Lane*
*< - Shared Left-Turn Lane*

# TABLE 4.2: TOTAL TRAFFIC OPERATIONS

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | OVERALL |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | B | > | **B** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 12 | > | **12** | < | 14 | > | **14** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **1** | |
| | | | V/C | < | 0.16 | > | | < | 0.22 | > | | 0.02 | 0.00 | 0.00 | | 0.01 | 0.00 | 0.00 | | |
| | | | 95th | < | 1 | > | | < | 1 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | A | **A** | A | A | A | **A** | < | A | > | **A** | < | A | > | **A** | |
| | | | Delay | 7 | 0 | 0 | **0** | 7 | 0 | 0 | **0** | < | 9 | > | **9** | < | 9 | > | **9** | |
| | | | V/C | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | | < | 0.03 | > | | < | 0.03 | > | | |
| | | | 95th | 0 | 0 | 0 | | 0 | 0 | 0 | | < | 0 | > | | < | 0 | > | | |
| | Glendon Drive & Komoka Road | RBT | LOS | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | **A** |
| | | | Delay | < | 3 | > | **0** | < | 2 | > | **0** | < | 7 | > | **0** | < | 6 | > | **0** | **4** |
| | | | V/C | < | 0.38 | > | | < | 0.28 | > | | < | 0.29 | > | | < | 0.39 | > | | |
| | | | 95th | < | 8 | > | | < | 8 | > | | < | 8 | > | | < | 8 | > | | |
| | Oxbow Drive & Street 'A' | TWSC | LOS | - | A | A | **A** | A | A | - | **A** | A | - | > | **A** | | | | | |
| | | | Delay | - | 0 | 0 | **0** | 8 | 0 | - | **0** | 10 | - | > | **10** | | | | | |
| | | | V/C | - | 0.00 | 0.00 | | 0.00 | 0.00 | - | | 0.02 | - | > | | | | | | |
| | | | 95th | - | 0 | 0 | | 0 | 0 | - | | 0 | - | > | | | | | | |
| PM Peak Hour | Komoka Road & Oxbow Drive | TWSC | LOS | < | B | > | **B** | < | C | > | **C** | A | A | A | **A** | A | A | A | **A** | |
| | | | Delay | < | 12 | > | **12** | < | 19 | > | **19** | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **0** | |
| | | | V/C | < | 0.15 | > | | < | 0.39 | > | | 0.04 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | | |
| | | | 95th | < | 1 | > | | < | 2 | > | | 0 | 0 | 0 | | 0 | 0 | 0 | | |
| | Oxbow Drive & Union Avenue | TWSC | LOS | A | A | A | **A** | A | A | A | **A** | < | A | > | **A** | < | B | > | **B** | |
| | | | Delay | 8 | 0 | 0 | **1** | 8 | 0 | 0 | **1** | < | 10 | > | **10** | < | 11 | > | **11** | |
| | | | V/C | 0.01 | 0.00 | 0.00 | | 0.01 | 0.00 | 0.00 | | < | 0.02 | > | | < | 0.05 | > | | |
| | | | 95th | 0 | 0 | 0 | | 0 | 0 | 0 | | < | 0 | > | | < | 0 | > | | |
| | Glendon Drive & Komoka Road | RBT | LOS | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | < | A | > | **A** | **A** |
| | | | Delay | < | 3 | > | **0** | < | 3 | > | **0** | < | 6 | > | **0** | < | 8 | > | **0** | **4** |
| | | | V/C | < | 0.34 | > | | < | 0.49 | > | | < | 0.34 | > | | < | 0.44 | > | | |
| | | | 95th | < | 8 | > | | < | 8 | > | | < | 8 | > | | < | 8 | > | | |
| | Oxbow Drive & Street 'A' | TWSC | LOS | - | A | A | **A** | A | A | - | **A** | A | - | > | **A** | | | | | |
| | | | Delay | - | 0 | 0 | **0** | 7 | 0 | - | **0** | 9 | - | > | **9** | | | | | |
| | | | V/C | - | 0.00 | 0.00 | | 0.01 | 0.00 | - | | 0.01 | - | > | | | | | | |
| | | | 95th | - | 0 | 0 | | 0 | 0 | - | | 0 | - | > | | | | | | |

*TWSC - Two-Way Stop Control*
*TCS - Traffic Control Signal*
*RBT - Roundabout*

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*V/C - Volume to Capacity Ratio*

*Avail. - Available Storage (m)*
*> - Shared Right-Turn Lane*
*< - Shared Left-Turn Lane*

# 5 Remedial Measures

## 5.1 Left-turn Lanes

The Ministry of Transportation's Design Supplement to the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads[5] provides guidance on the assessment of and/or need for auxiliary left-turn lanes at unsignalized intersections. The warrant nomograph is used to determine if a left-turn lane is needed based on the following criteria:

- Design speed of the road (posted speed + 10 km/h);
- Advancing Volume;
- Opposing Volume; and
- Percent of advancing vehicles performing a left-turn maneuver.

The following minimum thresholds must be met for a left-turn lane to be assessed:

- Greater than 100 vehicles per hour (vph) opposing vehicles; and
- Greater than 2.5% of advancing vehicles making a left-turn maneuver, as the left-turning vehicle percentage is rounded to the nearest 5.0%.

The following movements exceeded the above thresholds and were analyzed using the nomographs for left-turn lanes on two-lane undivided highways at unsignalized intersections:

- Southbound left-turns on Komoka Road at Oxbow Drive;
- Westbound left-turns on Oxbow Drive at Street 'A';
- Eastbound left-turns on Oxbow Drive at Union Avenue; and
- Westbound left-turns on Oxbow Drive at Union Avenue.

The results indicate that left-turn lanes are not warranted at study area intersections. **Appendix F** contains the left-turn lane nomographs.

---

[5] Transportation Association of Canada, *MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads – Appendix 9A*, Ministry of Transportation of Ontario, 2017.

# 6 Conclusions and Recommendations

## 6.1 Conclusions

The main findings and conclusions of this study are as follows:

- **Existing Traffic**: The study area intersections are operating with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are occurring at the study area intersections.
- **Trip Generation**: The site's trip generation is estimated to be approximately 44 AM peak hour vehicle trips and 58 PM peak hour vehicle trips.
- **Background Traffic**: The study area intersections are forecast to continue to operate with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are forecast to occur at the study area intersections.
- **Total Traffic**: The study area intersections are forecast to continue to operate with acceptable levels of service during the weekday AM and PM peak hours. No critical movements are forecast to occur at the study area intersections.
- **Left-Turn Lanes**: Left-turn lanes are not warranted at study area intersections under forecast total conditions.

## 6.2 Recommendations

Based on the findings of this study, it is recommended that the subject development be approved without any external transportation related improvements.

# Appendix A

## Existing Data

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Oxbow Drive
Site Code:
Start Date: 09/13/2018
Page No: 1

# Turning Movement Data

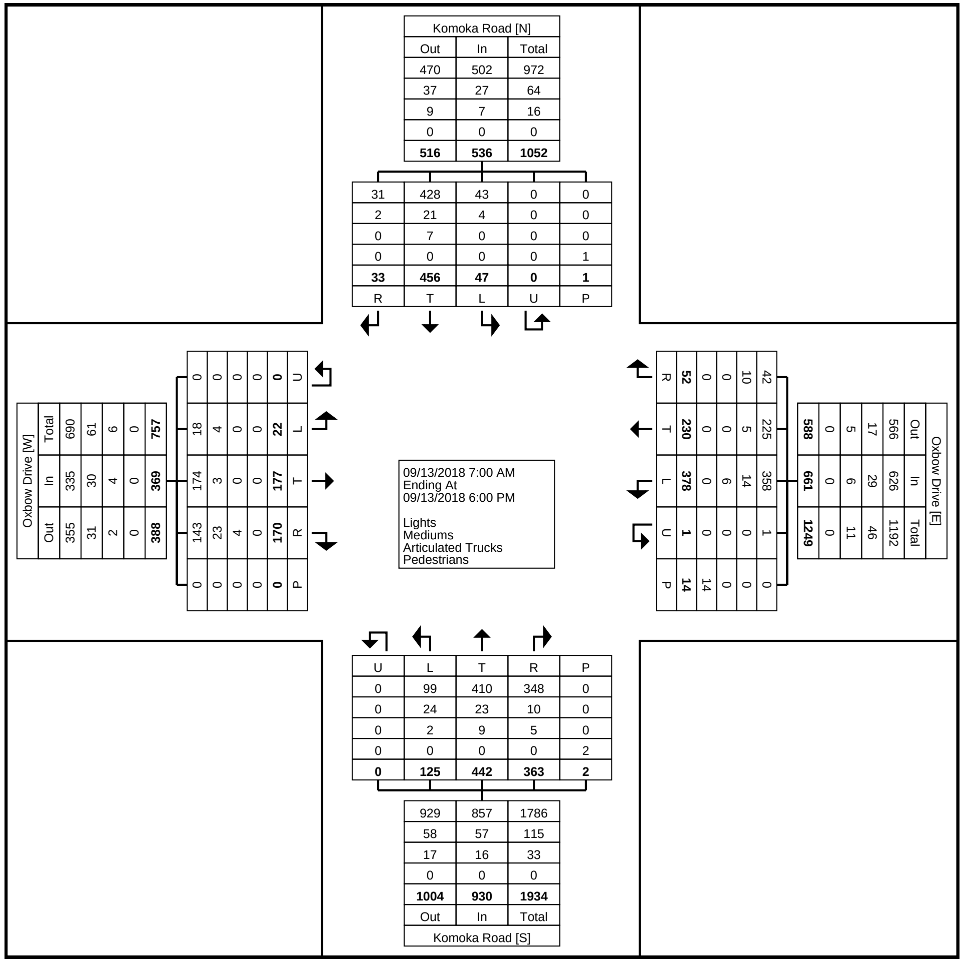
| Start Time | Oxbow Drive |  |  |  |  |  | Oxbow Drive |  |  |  |  |  | Komoka Road |  |  |  |  |  | Komoka Road |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Eastbound |  |  |  |  |  | Westbound |  |  |  |  |  | Northbound |  |  |  |  |  | Southbound |  |  |  |  |  |  |
|  | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:00 AM | 2 | 5 | 8 | 0 | 0 | 15 | 3 | 6 | 1 | 0 | 1 | 10 | 1 | 5 | 13 | 0 | 0 | 19 | 1 | 16 | 0 | 0 | 0 | 17 | 61 |
| 7:15 AM | 0 | 7 | 10 | 0 | 0 | 17 | 10 | 7 | 1 | 0 | 0 | 18 | 1 | 10 | 9 | 0 | 0 | 20 | 4 | 18 | 0 | 0 | 0 | 22 | 77 |
| 7:30 AM | 0 | 4 | 3 | 0 | 0 | 7 | 9 | 7 | 0 | 0 | 0 | 16 | 1 | 11 | 17 | 0 | 0 | 29 | 2 | 23 | 0 | 0 | 0 | 25 | 77 |
| 7:45 AM | 0 | 7 | 4 | 0 | 0 | 11 | 2 | 4 | 2 | 0 | 0 | 8 | 3 | 6 | 12 | 0 | 0 | 21 | 3 | 14 | 2 | 0 | 0 | 19 | 59 |
| Hourly Total | 2 | 23 | 25 | 0 | 0 | 50 | 24 | 24 | 4 | 0 | 1 | 52 | 6 | 32 | 51 | 0 | 0 | 89 | 10 | 71 | 2 | 0 | 0 | 83 | 274 |
| 8:00 AM | 1 | 13 | 5 | 0 | 0 | 19 | 10 | 5 | 0 | 0 | 0 | 15 | 3 | 8 | 13 | 0 | 0 | 24 | 1 | 18 | 3 | 0 | 0 | 22 | 80 |
| 8:15 AM | 0 | 5 | 3 | 0 | 0 | 8 | 7 | 4 | 1 | 0 | 0 | 12 | 4 | 19 | 16 | 0 | 0 | 39 | 3 | 18 | 1 | 0 | 0 | 22 | 81 |
| 8:30 AM | 0 | 7 | 15 | 0 | 0 | 22 | 7 | 6 | 0 | 0 | 0 | 13 | 2 | 14 | 20 | 0 | 0 | 36 | 3 | 19 | 1 | 0 | 0 | 23 | 94 |
| 8:45 AM | 0 | 6 | 7 | 0 | 0 | 13 | 17 | 6 | 5 | 1 | 1 | 29 | 6 | 11 | 15 | 0 | 1 | 32 | 3 | 19 | 1 | 0 | 0 | 23 | 97 |
| Hourly Total | 1 | 31 | 30 | 0 | 0 | 62 | 41 | 21 | 6 | 1 | 1 | 69 | 15 | 52 | 64 | 0 | 1 | 131 | 10 | 74 | 6 | 0 | 0 | 90 | 352 |
| 9:00 AM | 2 | 5 | 5 | 0 | 0 | 12 | 18 | 5 | 3 | 0 | 0 | 26 | 3 | 6 | 12 | 0 | 0 | 21 | 0 | 10 | 1 | 0 | 0 | 11 | 70 |
| 9:15 AM | 0 | 3 | 5 | 0 | 0 | 8 | 7 | 3 | 3 | 0 | 0 | 13 | 4 | 10 | 13 | 0 | 0 | 27 | 0 | 16 | 1 | 0 | 0 | 17 | 65 |
| 9:30 AM | 0 | 3 | 6 | 0 | 0 | 9 | 8 | 2 | 1 | 0 | 0 | 11 | 3 | 12 | 12 | 0 | 0 | 27 | 0 | 13 | 1 | 0 | 0 | 14 | 61 |
| 9:45 AM | 1 | 7 | 4 | 0 | 0 | 12 | 11 | 5 | 0 | 0 | 0 | 16 | 6 | 12 | 8 | 0 | 0 | 26 | 4 | 15 | 0 | 0 | 0 | 19 | 73 |
| Hourly Total | 3 | 18 | 20 | 0 | 0 | 41 | 44 | 15 | 7 | 0 | 0 | 66 | 16 | 40 | 45 | 0 | 0 | 101 | 4 | 54 | 3 | 0 | 0 | 61 | 269 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11:00 AM | 0 | 1 | 2 | 0 | 0 | 3 | 7 | 8 | 2 | 0 | 1 | 17 | 3 | 6 | 6 | 0 | 0 | 15 | 1 | 12 | 0 | 0 | 0 | 13 | 48 |
| 11:15 AM | 0 | 1 | 3 | 0 | 0 | 4 | 9 | 3 | 1 | 0 | 0 | 13 | 6 | 12 | 4 | 0 | 0 | 22 | 3 | 9 | 0 | 0 | 0 | 12 | 51 |
| 11:30 AM | 0 | 4 | 5 | 0 | 0 | 9 | 15 | 1 | 0 | 0 | 0 | 16 | 3 | 17 | 15 | 0 | 0 | 35 | 1 | 12 | 1 | 0 | 0 | 14 | 74 |
| 11:45 AM | 1 | 3 | 4 | 0 | 0 | 8 | 7 | 3 | 3 | 0 | 0 | 13 | 2 | 4 | 13 | 0 | 0 | 19 | 2 | 8 | 0 | 0 | 0 | 10 | 50 |
| Hourly Total | 1 | 9 | 14 | 0 | 0 | 24 | 38 | 15 | 6 | 0 | 1 | 59 | 14 | 39 | 38 | 0 | 0 | 91 | 7 | 41 | 1 | 0 | 0 | 49 | 223 |
| 12:00 PM | 0 | 2 | 3 | 0 | 0 | 5 | 19 | 6 | 0 | 0 | 3 | 25 | 0 | 14 | 13 | 0 | 0 | 27 | 1 | 12 | 1 | 0 | 0 | 14 | 71 |
| 12:15 PM | 1 | 3 | 3 | 0 | 0 | 7 | 15 | 4 | 2 | 0 | 0 | 21 | 3 | 15 | 5 | 0 | 1 | 23 | 1 | 9 | 1 | 0 | 0 | 11 | 62 |
| 12:30 PM | 2 | 3 | 3 | 0 | 0 | 8 | 9 | 5 | 0 | 0 | 0 | 14 | 3 | 9 | 13 | 0 | 0 | 25 | 0 | 14 | 1 | 0 | 0 | 15 | 62 |
| 12:45 PM | 0 | 7 | 3 | 0 | 0 | 10 | 16 | 6 | 0 | 0 | 0 | 22 | 7 | 10 | 8 | 0 | 0 | 25 | 0 | 11 | 2 | 0 | 1 | 13 | 70 |
| Hourly Total | 3 | 15 | 12 | 0 | 0 | 30 | 59 | 21 | 2 | 0 | 3 | 82 | 13 | 48 | 39 | 0 | 1 | 100 | 2 | 46 | 5 | 0 | 1 | 53 | 265 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 1 | 5 | 6 | 0 | 0 | 12 | 7 | 8 | 4 | 0 | 0 | 19 | 5 | 15 | 13 | 0 | 0 | 33 | 2 | 19 | 2 | 0 | 0 | 23 | 87 |
| 3:15 PM | 1 | 3 | 4 | 0 | 0 | 8 | 12 | 11 | 2 | 0 | 1 | 25 | 5 | 11 | 18 | 0 | 0 | 34 | 1 | 8 | 0 | 0 | 0 | 9 | 76 |
| 3:30 PM | 1 | 11 | 6 | 0 | 0 | 18 | 23 | 13 | 5 | 0 | 0 | 41 | 5 | 12 | 7 | 0 | 0 | 24 | 1 | 8 | 0 | 0 | 0 | 9 | 92 |
| 3:45 PM | 0 | 7 | 4 | 0 | 0 | 11 | 11 | 19 | 0 | 0 | 0 | 30 | 1 | 23 | 10 | 0 | 0 | 34 | 3 | 14 | 2 | 0 | 0 | 19 | 94 |
| Hourly Total | 3 | 26 | 20 | 0 | 0 | 49 | 53 | 51 | 11 | 0 | 1 | 115 | 16 | 61 | 48 | 0 | 0 | 125 | 7 | 49 | 4 | 0 | 0 | 60 | 349 |
| 4:00 PM | 1 | 7 | 8 | 0 | 0 | 16 | 13 | 12 | 2 | 0 | 0 | 27 | 5 | 23 | 11 | 0 | 0 | 39 | 1 | 19 | 1 | 0 | 0 | 21 | 103 |
| 4:15 PM | 2 | 6 | 8 | 0 | 0 | 16 | 14 | 9 | 3 | 0 | 2 | 26 | 7 | 22 | 3 | 0 | 0 | 32 | 1 | 19 | 3 | 0 | 0 | 23 | 97 |
| 4:30 PM | 1 | 7 | 4 | 0 | 0 | 12 | 19 | 12 | 3 | 0 | 3 | 34 | 5 | 22 | 8 | 0 | 0 | 35 | 2 | 18 | 1 | 0 | 0 | 21 | 102 |
| 4:45 PM | 1 | 5 | 6 | 0 | 0 | 12 | 20 | 13 | 3 | 0 | 0 | 36 | 4 | 23 | 17 | 0 | 0 | 44 | 0 | 16 | 1 | 0 | 0 | 17 | 109 |
| Hourly Total | 5 | 25 | 26 | 0 | 0 | 56 | 66 | 46 | 11 | 0 | 5 | 123 | 21 | 90 | 39 | 0 | 0 | 150 | 4 | 72 | 6 | 0 | 0 | 82 | 411 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5:00 PM | 1 | 11 | 6 | 0 | 0 | 18 | 15 | 11 | 1 | 0 | 0 | 27 | 7 | 22 | 12 | 0 | 0 | 41 | 2 | 14 | 0 | 0 | 0 | 16 | 102 |
| 5:15 PM | 1 | 6 | 4 | 0 | 0 | 11 | 14 | 5 | 2 | 0 | 2 | 21 | 4 | 17 | 8 | 0 | 0 | 29 | 0 | 15 | 2 | 0 | 0 | 17 | 78 |
| 5:30 PM | 2 | 9 | 8 | 0 | 0 | 19 | 10 | 15 | 1 | 0 | 0 | 26 | 11 | 19 | 10 | 0 | 0 | 40 | 0 | 9 | 1 | 0 | 0 | 10 | 95 |
| 5:45 PM | 0 | 4 | 5 | 0 | 0 | 9 | 14 | 6 | 1 | 0 | 0 | 21 | 2 | 22 | 9 | 0 | 0 | 33 | 1 | 11 | 3 | 0 | 0 | 15 | 78 |
| Hourly Total | 4 | 30 | 23 | 0 | 0 | 57 | 53 | 37 | 5 | 0 | 2 | 95 | 24 | 80 | 39 | 0 | 0 | 143 | 3 | 49 | 6 | 0 | 0 | 58 | 353 |
| Grand Total | 22 | 177 | 170 | 0 | 0 | 369 | 378 | 230 | 52 | 1 | 14 | 661 | 125 | 442 | 363 | 0 | 2 | 930 | 47 | 456 | 33 | 0 | 1 | 536 | 2496 |
| Approach % | 6.0 | 48.0 | 46.1 | 0.0 | - | - | 57.2 | 34.8 | 7.9 | 0.2 | - | - | 13.4 | 47.5 | 39.0 | 0.0 | - | - | 8.8 | 85.1 | 6.2 | 0.0 | - | - | - |
| Total % | 0.9 | 7.1 | 6.8 | 0.0 | - | 14.8 | 15.1 | 9.2 | 2.1 | 0.0 | - | 26.5 | 5.0 | 17.7 | 14.5 | 0.0 | - | 37.3 | 1.9 | 18.3 | 1.3 | 0.0 | - | 21.5 | - |
| Lights | 18 | 174 | 143 | 0 | - | 335 | 358 | 225 | 42 | 1 | - | 626 | 99 | 410 | 348 | 0 | - | 857 | 43 | 428 | 31 | 0 | - | 502 | 2320 |
| % Lights | 81.8 | 98.3 | 84.1 | - | - | 90.8 | 94.7 | 97.8 | 80.8 | 100.0 | - | 94.7 | 79.2 | 92.8 | 95.9 | - | - | 92.2 | 91.5 | 93.9 | 93.9 | - | - | 93.7 | 92.9 |
| Mediums | 4 | 3 | 23 | 0 | - | 30 | 14 | 5 | 10 | 0 | - | 29 | 24 | 23 | 10 | 0 | - | 57 | 4 | 21 | 2 | 0 | - | 27 | 143 |
| % Mediums | 18.2 | 1.7 | 13.5 | - | - | 8.1 | 3.7 | 2.2 | 19.2 | 0.0 | - | 4.4 | 19.2 | 5.2 | 2.8 | - | - | 6.1 | 8.5 | 4.6 | 6.1 | - | - | 5.0 | 5.7 |
| Articulated Trucks | 0 | 0 | 4 | 0 | - | 4 | 6 | 0 | 0 | 0 | - | 6 | 2 | 9 | 5 | 0 | - | 16 | 0 | 7 | 0 | 0 | - | 7 | 33 |
| % Articulated Trucks | 0.0 | 0.0 | 2.4 | - | - | 1.1 | 1.6 | 0.0 | 0.0 | 0.0 | - | 0.9 | 1.6 | 2.0 | 1.4 | - | - | 1.7 | 0.0 | 1.5 | 0.0 | - | - | 1.3 | 1.3 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 14 | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Oxbow Drive
Site Code:
Start Date: 09/13/2018



Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 470 | 502 | 972 |
| 37 | 27 | 64 |
| 9 | 7 | 16 |
| 0 | 0 | 0 |
| **516** | **536** | **1052** |

| R | T | L | U | P |
|---|---|---|---|---|
| 31 | 428 | 43 | 0 | 0 |
| 2 | 21 | 4 | 0 | 0 |
| 0 | 7 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 |
| **33** | **456** | **47** | **0** | **1** |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 355 | 335 | 690 |
| 31 | 30 | 61 |
| 2 | 4 | 6 |
| 0 | 0 | 0 |
| **388** | **369** | **757** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 18 | 174 | 143 | 0 |
| 0 | 4 | 3 | 23 | 0 |
| 0 | 0 | 0 | 4 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **22** | **177** | **170** | **0** |

09/13/2018 7:00 AM
Ending At
09/13/2018 6:00 PM

Lights
Mediums
Articulated Trucks
Pedestrians

| R | T | L | U | P |
|---|---|---|---|---|
| 42 | 225 | 358 | 1 | 0 |
| 10 | 5 | 14 | 0 | 0 |
| 0 | 0 | 6 | 0 | 0 |
| 0 | 0 | 0 | 0 | 14 |
| **52** | **230** | **378** | **1** | **14** |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 566 | 626 | 1192 |
| 17 | 29 | 46 |
| 5 | 6 | 11 |
| 0 | 0 | 0 |
| **588** | **661** | **1249** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 99 | 410 | 348 | 0 |
| 0 | 24 | 23 | 10 | 0 |
| 0 | 2 | 9 | 5 | 0 |
| 0 | 0 | 0 | 0 | 2 |
| **0** | **125** | **442** | **363** | **2** |

| Out | In | Total |
|---|---|---|
| 929 | 857 | 1786 |
| 58 | 57 | 115 |
| 17 | 16 | 33 |
| 0 | 0 | 0 |
| **1004** | **930** | **1934** |

Komoka Road [S]

Turning Movement Data Plot

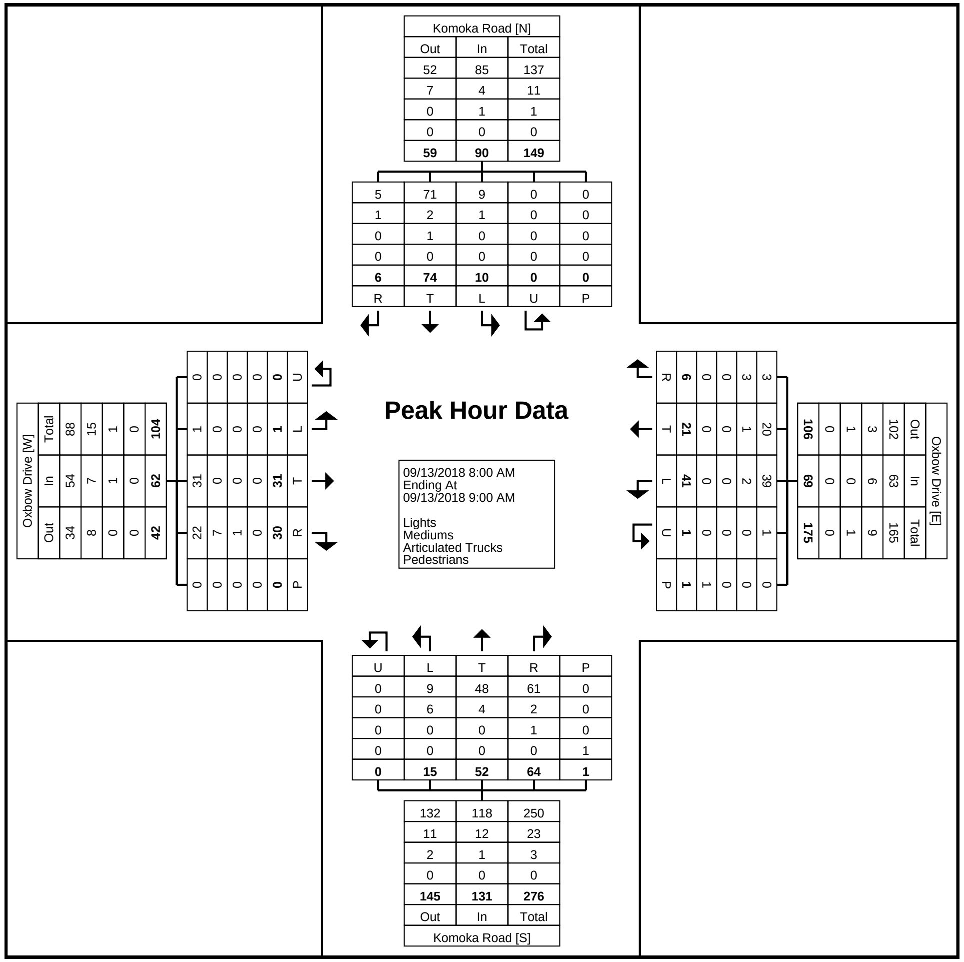
# Turning Movement Peak Hour Data (8:00 AM)

| Start Time | Oxbow Drive Eastbound | | | | | | Oxbow Drive Westbound | | | | | | Komoka Road Northbound | | | | | | Komoka Road Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 8:00 AM | 1 | 13 | 5 | 0 | 0 | 19 | 10 | 5 | 0 | 0 | 0 | 15 | 3 | 8 | 13 | 0 | 0 | 24 | 1 | 18 | 3 | 0 | 0 | 22 | 80 |
| 8:15 AM | 0 | 5 | 3 | 0 | 0 | 8 | 7 | 4 | 1 | 0 | 0 | 12 | 4 | 19 | 16 | 0 | 0 | 39 | 3 | 18 | 1 | 0 | 0 | 22 | 81 |
| 8:30 AM | 0 | 7 | 15 | 0 | 0 | 22 | 7 | 6 | 0 | 0 | 0 | 13 | 2 | 14 | 20 | 0 | 0 | 36 | 3 | 19 | 1 | 0 | 0 | 23 | 94 |
| 8:45 AM | 0 | 6 | 7 | 0 | 0 | 13 | 17 | 6 | 5 | 1 | 1 | 29 | 6 | 11 | 15 | 0 | 1 | 32 | 3 | 19 | 1 | 0 | 0 | 23 | 97 |
| Total | 1 | 31 | 30 | 0 | 0 | 62 | 41 | 21 | 6 | 1 | 1 | 69 | 15 | 52 | 64 | 0 | 1 | 131 | 10 | 74 | 6 | 0 | 0 | 90 | 352 |
| Approach % | 1.6 | 50.0 | 48.4 | 0.0 | - | - | 59.4 | 30.4 | 8.7 | 1.4 | - | - | 11.5 | 39.7 | 48.9 | 0.0 | - | - | 11.1 | 82.2 | 6.7 | 0.0 | - | - | - |
| Total % | 0.3 | 8.8 | 8.5 | 0.0 | - | 17.6 | 11.6 | 6.0 | 1.7 | 0.3 | - | 19.6 | 4.3 | 14.8 | 18.2 | 0.0 | - | 37.2 | 2.8 | 21.0 | 1.7 | 0.0 | - | 25.6 | - |
| PHF | 0.250 | 0.596 | 0.500 | 0.000 | - | 0.705 | 0.603 | 0.875 | 0.300 | 0.250 | - | 0.595 | 0.625 | 0.684 | 0.800 | 0.000 | - | 0.840 | 0.833 | 0.974 | 0.500 | 0.000 | - | 0.978 | 0.907 |
| Lights | 1 | 31 | 22 | 0 | - | 54 | 39 | 20 | 3 | 1 | - | 63 | 9 | 48 | 61 | 0 | - | 118 | 9 | 71 | 5 | 0 | - | 85 | 320 |
| % Lights | 100.0 | 100.0 | 73.3 | - | - | 87.1 | 95.1 | 95.2 | 50.0 | 100.0 | - | 91.3 | 60.0 | 92.3 | 95.3 | - | - | 90.1 | 90.0 | 95.9 | 83.3 | - | - | 94.4 | 90.9 |
| Mediums | 0 | 0 | 7 | 0 | - | 7 | 2 | 1 | 3 | 0 | - | 6 | 6 | 4 | 2 | 0 | - | 12 | 1 | 2 | 1 | 0 | - | 4 | 29 |
| % Mediums | 0.0 | 0.0 | 23.3 | - | - | 11.3 | 4.9 | 4.8 | 50.0 | 0.0 | - | 8.7 | 40.0 | 7.7 | 3.1 | - | - | 9.2 | 10.0 | 2.7 | 16.7 | - | - | 4.4 | 8.2 |
| Articulated Trucks | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 1 | 0 | - | 1 | 0 | 1 | 0 | 0 | - | 1 | 3 |
| % Articulated Trucks | 0.0 | 0.0 | 3.3 | - | - | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 1.6 | - | - | 0.8 | 0.0 | 1.4 | 0.0 | - | - | 1.1 | 0.9 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Oxbow Drive
Site Code:
Start Date: 09/13/2018
Page No: 5



## Peak Hour Data

09/13/2018 8:00 AM
Ending At
09/13/2018 9:00 AM

Lights
Mediums
Articulated Trucks
Pedestrians

**Komoka Road [N]**

| Out | In | Total |
|---|---|---|
| 52 | 85 | 137 |
| 7 | 4 | 11 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |
| **59** | **90** | **149** |

| R | T | L | U | P |
|---|---|---|---|---|
| 5 | 71 | 9 | 0 | 0 |
| 1 | 2 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **6** | **74** | **10** | **0** | **0** |

**Oxbow Drive [W]**

| Out | In | Total |
|---|---|---|
| 34 | 54 | 88 |
| 8 | 7 | 15 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |
| **42** | **62** | **104** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 1 | 31 | 22 | 0 |
| 0 | 0 | 0 | 7 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **1** | **31** | **30** | **0** |

**Oxbow Drive [E]**

| Out | In | Total |
|---|---|---|
| 102 | 63 | 165 |
| 3 | 6 | 9 |
| 1 | 0 | 1 |
| 0 | 0 | 0 |
| **106** | **69** | **175** |

| R | T | L | U | P |
|---|---|---|---|---|
| 3 | 20 | 39 | 1 | 0 |
| 3 | 1 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 |
| **6** | **21** | **41** | **1** | **1** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 9 | 48 | 61 | 0 |
| 0 | 6 | 4 | 2 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 |
| **0** | **15** | **52** | **64** | **1** |

| Out | In | Total |
|---|---|---|
| 132 | 118 | 250 |
| 11 | 12 | 23 |
| 2 | 1 | 3 |
| 0 | 0 | 0 |
| **145** | **131** | **276** |

**Komoka Road [S]**

Turning Movement Peak Hour Data Plot (8:00 AM)

# Turning Movement Peak Hour Data (12:00 PM)

| | Oxbow Drive<br>Eastbound | | | | | | Oxbow Drive<br>Westbound | | | | | | Komoka Road<br>Northbound | | | | | | Komoka Road<br>Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 12:00 PM | 0 | 2 | 3 | 0 | 0 | 5 | 19 | 6 | 0 | 0 | 3 | 25 | 0 | 14 | 13 | 0 | 0 | 27 | 1 | 12 | 1 | 0 | 0 | 14 | 71 |
| 12:15 PM | 1 | 3 | 3 | 0 | 0 | 7 | 15 | 4 | 2 | 0 | 0 | 21 | 3 | 15 | 5 | 0 | 1 | 23 | 1 | 9 | 1 | 0 | 0 | 11 | 62 |
| 12:30 PM | 2 | 3 | 3 | 0 | 0 | 8 | 9 | 5 | 0 | 0 | 0 | 14 | 3 | 9 | 13 | 0 | 0 | 25 | 0 | 14 | 1 | 0 | 0 | 15 | 62 |
| 12:45 PM | 0 | 7 | 3 | 0 | 0 | 10 | 16 | 6 | 0 | 0 | 0 | 22 | 7 | 10 | 8 | 0 | 0 | 25 | 0 | 11 | 2 | 0 | 1 | 13 | 70 |
| Total | 3 | 15 | 12 | 0 | 0 | 30 | 59 | 21 | 2 | 0 | 3 | 82 | 13 | 48 | 39 | 0 | 1 | 100 | 2 | 46 | 5 | 0 | 1 | 53 | 265 |
| Approach % | 10.0 | 50.0 | 40.0 | 0.0 | - | - | 72.0 | 25.6 | 2.4 | 0.0 | - | - | 13.0 | 48.0 | 39.0 | 0.0 | - | - | 3.8 | 86.8 | 9.4 | 0.0 | - | - | - |
| Total % | 1.1 | 5.7 | 4.5 | 0.0 | - | 11.3 | 22.3 | 7.9 | 0.8 | 0.0 | - | 30.9 | 4.9 | 18.1 | 14.7 | 0.0 | - | 37.7 | 0.8 | 17.4 | 1.9 | 0.0 | - | 20.0 | - |
| PHF | 0.375 | 0.536 | 1.000 | 0.000 | - | 0.750 | 0.776 | 0.875 | 0.250 | 0.000 | - | 0.820 | 0.464 | 0.800 | 0.750 | 0.000 | - | 0.926 | 0.500 | 0.821 | 0.625 | 0.000 | - | 0.883 | 0.933 |
| Lights | 2 | 15 | 12 | 0 | - | 29 | 52 | 19 | 2 | 0 | - | 73 | 11 | 45 | 38 | 0 | - | 94 | 2 | 44 | 5 | 0 | - | 51 | 247 |
| % Lights | 66.7 | 100.0 | 100.0 | - | - | 96.7 | 88.1 | 90.5 | 100.0 | - | - | 89.0 | 84.6 | 93.8 | 97.4 | - | - | 94.0 | 100.0 | 95.7 | 100.0 | - | - | 96.2 | 93.2 |
| Mediums | 1 | 0 | 0 | 0 | - | 1 | 5 | 2 | 0 | 0 | - | 7 | 2 | 1 | 0 | 0 | - | 3 | 0 | 2 | 0 | 0 | - | 2 | 13 |
| % Mediums | 33.3 | 0.0 | 0.0 | - | - | 3.3 | 8.5 | 9.5 | 0.0 | - | - | 8.5 | 15.4 | 2.1 | 0.0 | - | - | 3.0 | 0.0 | 4.3 | 0.0 | - | - | 3.8 | 4.9 |
| Articulated Trucks | 0 | 0 | 0 | 0 | - | 0 | 2 | 0 | 0 | 0 | - | 2 | 0 | 2 | 1 | 0 | - | 3 | 0 | 0 | 0 | 0 | - | 0 | 5 |
| % Articulated Trucks | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 3.4 | 0.0 | 0.0 | - | - | 2.4 | 0.0 | 4.2 | 2.6 | - | - | 3.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 1.9 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 3 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
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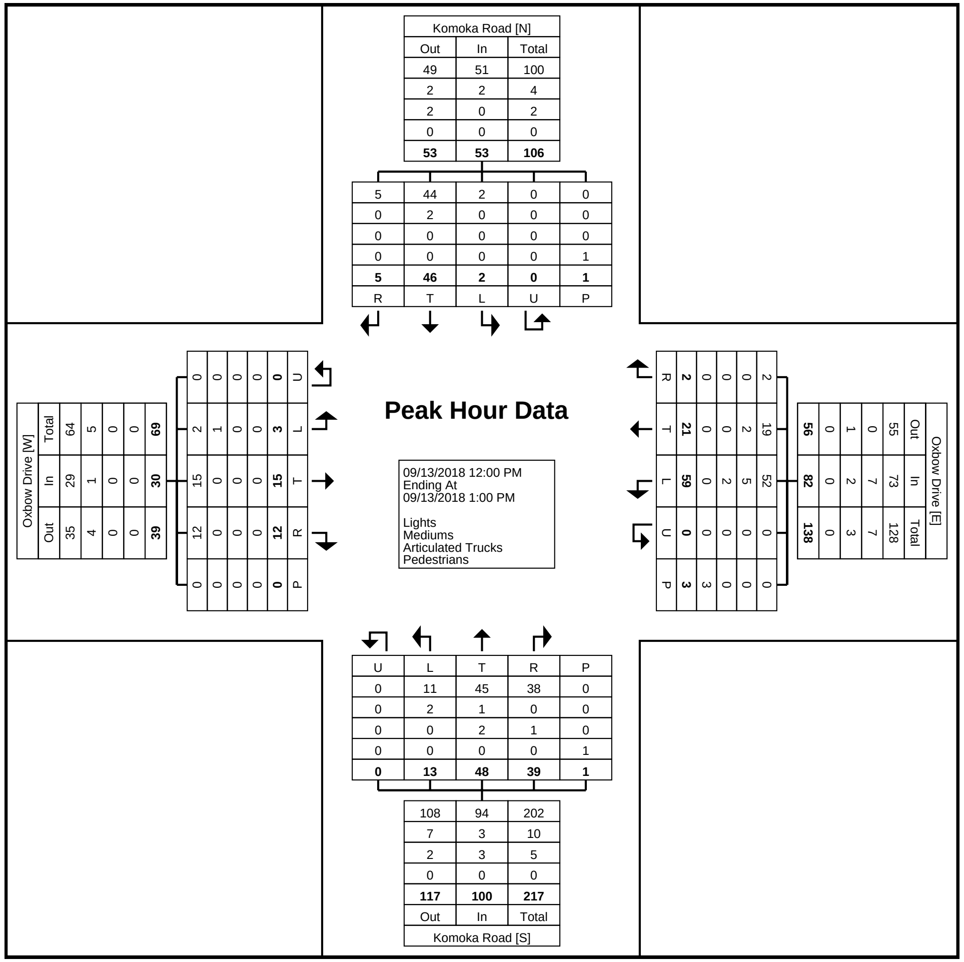
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Oxbow Drive
Site Code:
Start Date: 09/13/2018



## Peak Hour Data

09/13/2018 12:00 PM
Ending At
09/13/2018 1:00 PM

Lights
Mediums
Articulated Trucks
Pedestrians

Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 49 | 51 | 100 |
| 2 | 2 | 4 |
| 2 | 0 | 2 |
| 0 | 0 | 0 |
| **53** | **53** | **106** |

| R | T | L | U | P |
|---|---|---|---|---|
| 5 | 44 | 2 | 0 | 0 |
| 0 | 2 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 |
| **5** | **46** | **2** | **0** | **1** |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 35 | 29 | 64 |
| 4 | 1 | 5 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| **39** | **30** | **69** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 2 | 15 | 12 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **3** | **15** | **12** | **0** |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 55 | 73 | 128 |
| 0 | 7 | 7 |
| 1 | 2 | 3 |
| 0 | 0 | 0 |
| **56** | **82** | **138** |

| R | T | L | U | P |
|---|---|---|---|---|
| 2 | 19 | 52 | 0 | 0 |
| 0 | 2 | 5 | 0 | 0 |
| 0 | 0 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 | 3 |
| **2** | **21** | **59** | **0** | **3** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 11 | 45 | 38 | 0 |
| 0 | 2 | 1 | 0 | 0 |
| 0 | 0 | 2 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 |
| **0** | **13** | **48** | **39** | **1** |

| Out | In | Total |
|---|---|---|
| 108 | 94 | 202 |
| 7 | 3 | 10 |
| 2 | 3 | 5 |
| 0 | 0 | 0 |
| **117** | **100** | **217** |

Komoka Road [S]

Turning Movement Peak Hour Data Plot (12:00 PM)

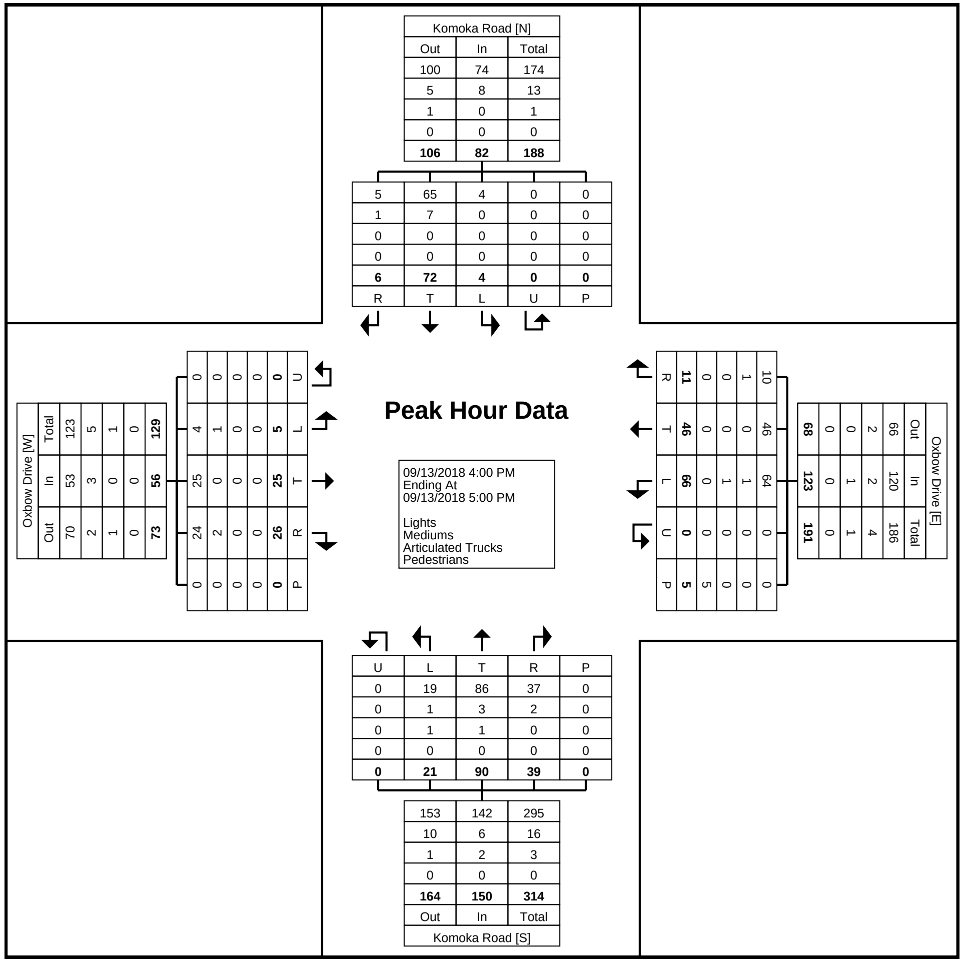
## Turning Movement Peak Hour Data (4:00 PM)

| Start Time | Oxbow Drive | | | | | | Oxbow Drive | | | | | | Komoka Road | | | | | | Komoka Road | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | | | | Westbound | | | | | | Northbound | | | | | | Southbound | | | | | | |
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 4:00 PM | 1 | 7 | 8 | 0 | 0 | 16 | 13 | 12 | 2 | 0 | 0 | 27 | 5 | 23 | 11 | 0 | 0 | 39 | 1 | 19 | 1 | 0 | 0 | 21 | 103 |
| 4:15 PM | 2 | 6 | 8 | 0 | 0 | 16 | 14 | 9 | 3 | 0 | 2 | 26 | 7 | 22 | 3 | 0 | 0 | 32 | 1 | 19 | 3 | 0 | 0 | 23 | 97 |
| 4:30 PM | 1 | 7 | 4 | 0 | 0 | 12 | 19 | 12 | 3 | 0 | 3 | 34 | 5 | 22 | 8 | 0 | 0 | 35 | 2 | 18 | 1 | 0 | 0 | 21 | 102 |
| 4:45 PM | 1 | 5 | 6 | 0 | 0 | 12 | 20 | 13 | 3 | 0 | 0 | 36 | 4 | 23 | 17 | 0 | 0 | 44 | 0 | 16 | 1 | 0 | 0 | 17 | 109 |
| Total | 5 | 25 | 26 | 0 | 0 | 56 | 66 | 46 | 11 | 0 | 5 | 123 | 21 | 90 | 39 | 0 | 0 | 150 | 4 | 72 | 6 | 0 | 0 | 82 | 411 |
| Approach % | 8.9 | 44.6 | 46.4 | 0.0 | - | - | 53.7 | 37.4 | 8.9 | 0.0 | - | - | 14.0 | 60.0 | 26.0 | 0.0 | - | - | 4.9 | 87.8 | 7.3 | 0.0 | - | - | - |
| Total % | 1.2 | 6.1 | 6.3 | 0.0 | - | 13.6 | 16.1 | 11.2 | 2.7 | 0.0 | - | 29.9 | 5.1 | 21.9 | 9.5 | 0.0 | - | 36.5 | 1.0 | 17.5 | 1.5 | 0.0 | - | 20.0 | - |
| PHF | 0.625 | 0.893 | 0.813 | 0.000 | - | 0.875 | 0.825 | 0.885 | 0.917 | 0.000 | - | 0.854 | 0.750 | 0.978 | 0.574 | 0.000 | - | 0.852 | 0.500 | 0.947 | 0.500 | 0.000 | - | 0.891 | 0.943 |
| Lights | 4 | 25 | 24 | 0 | - | 53 | 64 | 46 | 10 | 0 | - | 120 | 19 | 86 | 37 | 0 | - | 142 | 4 | 65 | 5 | 0 | - | 74 | 389 |
| % Lights | 80.0 | 100.0 | 92.3 | - | - | 94.6 | 97.0 | 100.0 | 90.9 | - | - | 97.6 | 90.5 | 95.6 | 94.9 | - | - | 94.7 | 100.0 | 90.3 | 83.3 | - | - | 90.2 | 94.6 |
| Mediums | 1 | 0 | 2 | 0 | - | 3 | 1 | 0 | 1 | 0 | - | 2 | 1 | 3 | 2 | 0 | - | 6 | 0 | 7 | 1 | 0 | - | 8 | 19 |
| % Mediums | 20.0 | 0.0 | 7.7 | - | - | 5.4 | 1.5 | 0.0 | 9.1 | - | - | 1.6 | 4.8 | 3.3 | 5.1 | - | - | 4.0 | 0.0 | 9.7 | 16.7 | - | - | 9.8 | 4.6 |
| Articulated Trucks | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | 0 | - | 1 | 1 | 1 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 3 |
| % Articulated Trucks | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 1.5 | 0.0 | 0.0 | - | - | 0.8 | 4.8 | 1.1 | 0.0 | - | - | 1.3 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.7 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 5 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Oxbow Drive
Site Code:
Start Date: 09/13/2018
Page No: 9



## Peak Hour Data

09/13/2018 4:00 PM
Ending At
09/13/2018 5:00 PM

Lights
Mediums
Articulated Trucks
Pedestrians

Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 100 | 74 | 174 |
| 5 | 8 | 13 |
| 1 | 0 | 1 |
| 0 | 0 | 0 |
| **106** | **82** | **188** |

| | | | | |
|---|---|---|---|---|
| 5 | 65 | 4 | 0 | 0 |
| 1 | 7 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **6** | **72** | **4** | **0** | **0** |
| R | T | L | U | P |

Oxbow Drive [W]

| Total | In | Out |
|---|---|---|
| 123 | 53 | 70 |
| 5 | 3 | 2 |
| 1 | 0 | 1 |
| 0 | 0 | 0 |
| **129** | **56** | **73** |

| | | | | |
|---|---|---|---|---|
| 0 | 4 | 25 | 24 | 0 |
| 0 | 1 | 0 | 2 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **5** | **25** | **26** | **0** |
| U | L | T | R | P |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 66 | 120 | 186 |
| 2 | 2 | 4 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |
| **68** | **123** | **191** |

| | | | | |
|---|---|---|---|---|
| 10 | 46 | 64 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 5 |
| **11** | **46** | **66** | **0** | **5** |
| R | T | L | U | P |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 19 | 86 | 37 | 0 |
| 0 | 1 | 3 | 2 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **21** | **90** | **39** | **0** |

| | | |
|---|---|---|
| 153 | 142 | 295 |
| 10 | 6 | 16 |
| 1 | 2 | 3 |
| 0 | 0 | 0 |
| **164** | **150** | **314** |
| Out | In | Total |

Komoka Road [S]

Turning Movement Peak Hour Data Plot (4:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Union Avenue & Oxbow Drive
Site Code: 200272
Start Date: 06/25/2020
Page No: 1

# Turning Movement Data

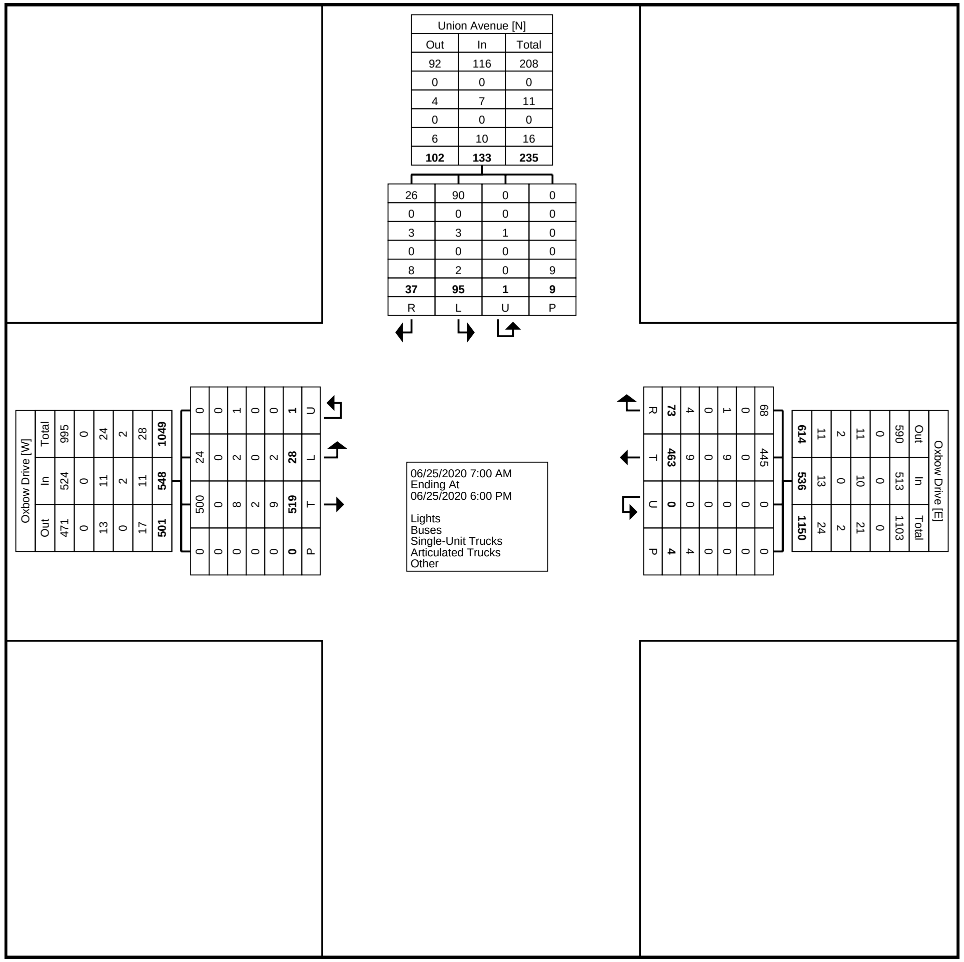
| Start Time | Oxbow Drive Eastbound | | | | | Oxbow Drive Westbound | | | | | Union Avenue Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:00 AM | 0 | 9 | 0 | 0 | 9 | 4 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 3 | 16 |
| 7:15 AM | 1 | 12 | 0 | 0 | 13 | 5 | 0 | 0 | 0 | 5 | 1 | 2 | 0 | 0 | 3 | 21 |
| 7:30 AM | 0 | 10 | 0 | 0 | 10 | 13 | 0 | 0 | 0 | 13 | 6 | 1 | 0 | 0 | 7 | 30 |
| 7:45 AM | 0 | 15 | 0 | 0 | 15 | 12 | 3 | 0 | 0 | 15 | 4 | 0 | 0 | 0 | 4 | 34 |
| Hourly Total | 1 | 46 | 0 | 0 | 47 | 34 | 3 | 0 | 0 | 37 | 14 | 3 | 0 | 0 | 17 | 101 |
| 8:00 AM | 1 | 12 | 0 | 0 | 13 | 5 | 1 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 2 | 21 |
| 8:15 AM | 0 | 13 | 0 | 0 | 13 | 12 | 0 | 0 | 0 | 12 | 1 | 0 | 0 | 0 | 1 | 26 |
| 8:30 AM | 2 | 17 | 1 | 0 | 20 | 4 | 0 | 0 | 0 | 4 | 7 | 0 | 0 | 0 | 7 | 31 |
| 8:45 AM | 0 | 10 | 0 | 0 | 10 | 10 | 1 | 0 | 0 | 11 | 6 | 2 | 0 | 0 | 8 | 29 |
| Hourly Total | 3 | 52 | 1 | 0 | 56 | 31 | 2 | 0 | 0 | 33 | 16 | 2 | 0 | 0 | 18 | 107 |
| 9:00 AM | 2 | 7 | 0 | 0 | 9 | 11 | 1 | 0 | 0 | 12 | 2 | 3 | 0 | 1 | 5 | 26 |
| 9:15 AM | 0 | 13 | 0 | 0 | 13 | 9 | 0 | 0 | 0 | 9 | 2 | 1 | 0 | 0 | 3 | 25 |
| 9:30 AM | 1 | 14 | 0 | 0 | 15 | 13 | 1 | 0 | 1 | 14 | 4 | 2 | 0 | 0 | 6 | 35 |
| 9:45 AM | 0 | 13 | 0 | 0 | 13 | 10 | 6 | 0 | 0 | 16 | 2 | 3 | 1 | 2 | 6 | 35 |
| Hourly Total | 3 | 47 | 0 | 0 | 50 | 43 | 8 | 0 | 1 | 51 | 10 | 9 | 1 | 3 | 20 | 121 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11:00 AM | 3 | 16 | 0 | 0 | 19 | 14 | 2 | 0 | 0 | 16 | 2 | 1 | 0 | 0 | 3 | 38 |
| 11:15 AM | 0 | 11 | 0 | 0 | 11 | 13 | 2 | 0 | 0 | 15 | 4 | 0 | 0 | 1 | 4 | 30 |
| 11:30 AM | 0 | 23 | 0 | 0 | 23 | 9 | 2 | 0 | 0 | 11 | 2 | 0 | 0 | 0 | 2 | 36 |
| 11:45 AM | 0 | 16 | 0 | 0 | 16 | 17 | 3 | 0 | 0 | 20 | 4 | 2 | 0 | 0 | 6 | 42 |
| Hourly Total | 3 | 66 | 0 | 0 | 69 | 53 | 9 | 0 | 0 | 62 | 12 | 3 | 0 | 1 | 15 | 146 |
| 12:00 PM | 1 | 17 | 0 | 0 | 18 | 13 | 5 | 0 | 0 | 18 | 3 | 1 | 0 | 1 | 4 | 40 |
| 12:15 PM | 0 | 29 | 0 | 0 | 29 | 12 | 1 | 0 | 0 | 13 | 4 | 1 | 0 | 0 | 5 | 47 |
| 12:30 PM | 0 | 22 | 0 | 0 | 22 | 20 | 4 | 0 | 0 | 24 | 4 | 0 | 0 | 2 | 4 | 50 |
| 12:45 PM | 1 | 24 | 0 | 0 | 25 | 13 | 3 | 0 | 3 | 16 | 3 | 1 | 0 | 1 | 4 | 45 |
| Hourly Total | 2 | 92 | 0 | 0 | 94 | 58 | 13 | 0 | 3 | 71 | 14 | 3 | 0 | 4 | 17 | 182 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 0 | 7 | 0 | 0 | 7 | 25 | 0 | 0 | 0 | 25 | 2 | 0 | 0 | 0 | 2 | 34 |
| 3:15 PM | 2 | 20 | 0 | 0 | 22 | 19 | 2 | 0 | 0 | 21 | 2 | 0 | 0 | 0 | 2 | 45 |
| 3:30 PM | 0 | 20 | 0 | 0 | 20 | 13 | 1 | 0 | 0 | 14 | 1 | 3 | 0 | 0 | 4 | 38 |
| 3:45 PM | 2 | 22 | 0 | 0 | 24 | 22 | 4 | 0 | 0 | 26 | 3 | 2 | 0 | 0 | 5 | 55 |
| Hourly Total | 4 | 69 | 0 | 0 | 73 | 79 | 7 | 0 | 0 | 86 | 8 | 5 | 0 | 0 | 13 | 172 |
| 4:00 PM | 2 | 21 | 0 | 0 | 23 | 28 | 3 | 0 | 0 | 31 | 5 | 1 | 0 | 0 | 6 | 60 |
| 4:15 PM | 1 | 17 | 0 | 0 | 18 | 19 | 5 | 0 | 0 | 24 | 5 | 4 | 0 | 0 | 9 | 51 |
| 4:30 PM | 3 | 23 | 0 | 0 | 26 | 19 | 5 | 0 | 0 | 24 | 4 | 1 | 0 | 0 | 5 | 55 |
| 4:45 PM | 1 | 13 | 0 | 0 | 14 | 21 | 3 | 0 | 0 | 24 | 3 | 0 | 0 | 0 | 3 | 41 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hourly Total | 7 | 74 | 0 | 0 | 81 | 87 | 16 | 0 | 0 | 103 | 17 | 6 | 0 | 0 | 23 | 207 |
| 5:00 PM | 0 | 21 | 0 | 0 | 21 | 24 | 6 | 0 | 0 | 30 | 0 | 3 | 0 | 0 | 3 | 54 |
| 5:15 PM | 0 | 17 | 0 | 0 | 17 | 17 | 2 | 0 | 0 | 19 | 0 | 1 | 0 | 1 | 1 | 37 |
| 5:30 PM | 2 | 19 | 0 | 0 | 21 | 20 | 4 | 0 | 0 | 24 | 2 | 1 | 0 | 0 | 3 | 48 |
| 5:45 PM | 3 | 16 | 0 | 0 | 19 | 17 | 3 | 0 | 0 | 20 | 2 | 1 | 0 | 0 | 3 | 42 |
| Hourly Total | 5 | 73 | 0 | 0 | 78 | 78 | 15 | 0 | 0 | 93 | 4 | 6 | 0 | 1 | 10 | 181 |
| Grand Total | 28 | 519 | 1 | 0 | 548 | 463 | 73 | 0 | 4 | 536 | 95 | 37 | 1 | 9 | 133 | 1217 |
| Approach % | 5.1 | 94.7 | 0.2 | - | - | 86.4 | 13.6 | 0.0 | - | - | 71.4 | 27.8 | 0.8 | - | - | - |
| Total % | 2.3 | 42.6 | 0.1 | - | 45.0 | 38.0 | 6.0 | 0.0 | - | 44.0 | 7.8 | 3.0 | 0.1 | - | 10.9 | - |
| Lights | 24 | 500 | 0 | - | 524 | 445 | 68 | 0 | - | 513 | 90 | 26 | 0 | - | 116 | 1153 |
| % Lights | 85.7 | 96.3 | 0.0 | - | 95.6 | 96.1 | 93.2 | - | - | 95.7 | 94.7 | 70.3 | 0.0 | - | 87.2 | 94.7 |
| Buses | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Single-Unit Trucks | 2 | 8 | 1 | - | 11 | 9 | 1 | 0 | - | 10 | 3 | 3 | 1 | - | 7 | 28 |
| % Single-Unit Trucks | 7.1 | 1.5 | 100.0 | - | 2.0 | 1.9 | 1.4 | - | - | 1.9 | 3.2 | 8.1 | 100.0 | - | 5.3 | 2.3 |
| Articulated Trucks | 0 | 2 | 0 | - | 2 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Articulated Trucks | 0.0 | 0.4 | 0.0 | - | 0.4 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.2 |
| Bicycles on Road | 2 | 9 | 0 | - | 11 | 9 | 4 | 0 | - | 13 | 2 | 8 | 0 | - | 10 | 34 |
| % Bicycles on Road | 7.1 | 1.7 | 0.0 | - | 2.0 | 1.9 | 5.5 | - | - | 2.4 | 2.1 | 21.6 | 0.0 | - | 7.5 | 2.8 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 2 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | 22.2 | - | - |
| Pedestrians | - | - | - | 0 | - | - | - | - | 4 | - | - | - | - | 7 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | 77.8 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Union Avenue & Oxbow Drive
Site Code: 200272
Start Date: 06/25/2020
Page No: 3



Union Avenue [N]

| Out | In | Total |
|---|---|---|
| 92 | 116 | 208 |
| 0 | 0 | 0 |
| 4 | 7 | 11 |
| 0 | 0 | 0 |
| 6 | 10 | 16 |
| **102** | **133** | **235** |

| R | L | U | P |
|---|---|---|---|
| 26 | 90 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 3 | 3 | 1 | 0 |
| 0 | 0 | 0 | 0 |
| 8 | 2 | 0 | 9 |
| **37** | **95** | **1** | **9** |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 471 | 524 | 995 |
| 0 | 0 | 0 |
| 13 | 11 | 24 |
| 0 | 2 | 2 |
| 17 | 11 | 28 |
| **501** | **548** | **1049** |

| U | L | T | P |
|---|---|---|---|
| 0 | 24 | 500 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 2 | 8 | 0 |
| 0 | 0 | 2 | 0 |
| 0 | 2 | 9 | 0 |
| **1** | **28** | **519** | **0** |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 590 | 513 | 1103 |
| 0 | 0 | 0 |
| 11 | 10 | 21 |
| 2 | 0 | 2 |
| 11 | 13 | 24 |
| **614** | **536** | **1150** |

| R | T | U | P |
|---|---|---|---|
| 68 | 445 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 9 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 4 | 9 | 0 | 4 |
| **73** | **463** | **0** | **4** |

06/25/2020 7:00 AM
Ending At
06/25/2020 6:00 PM

Lights
Buses
Single-Unit Trucks
Articulated Trucks
Other

Turning Movement Data Plot

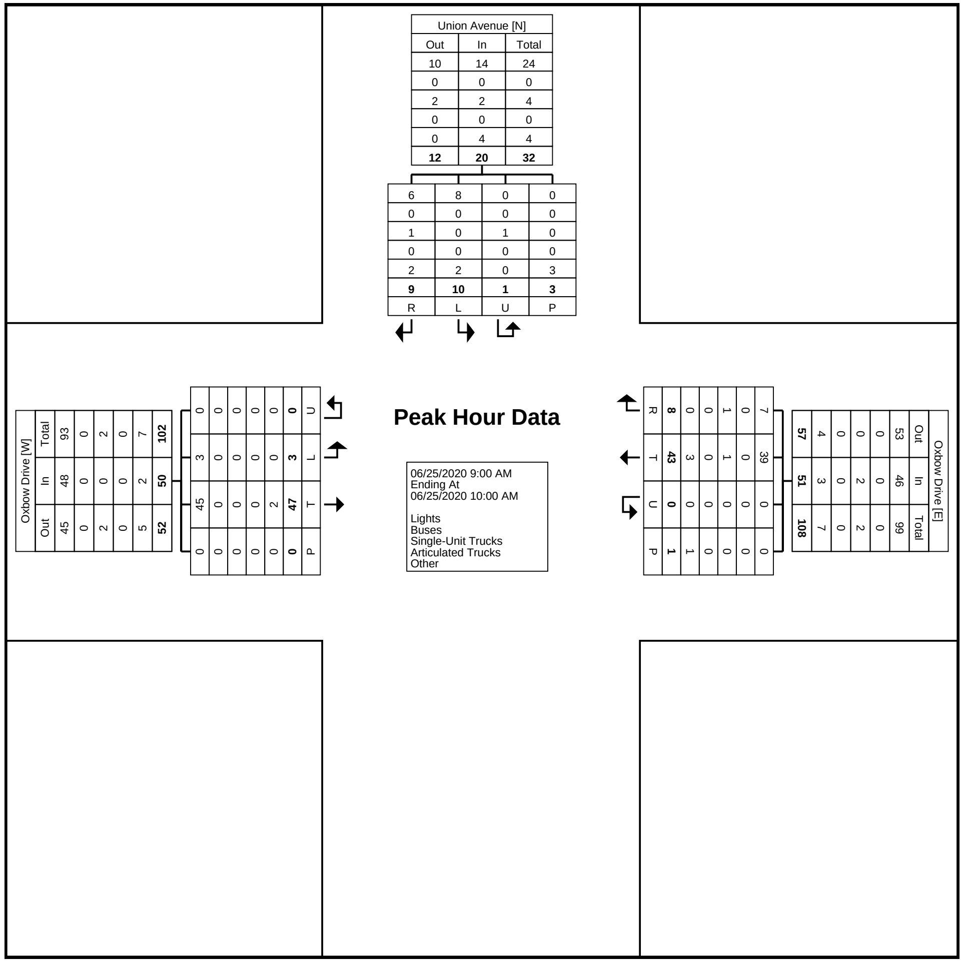
# Turning Movement Peak Hour Data (9:00 AM)

| | Oxbow Drive<br>Eastbound | | | | | Oxbow Drive<br>Westbound | | | | | Union Avenue<br>Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 9:00 AM | 2 | 7 | 0 | 0 | 9 | 11 | 1 | 0 | 0 | 12 | 2 | 3 | 0 | 1 | 5 | 26 |
| 9:15 AM | 0 | 13 | 0 | 0 | 13 | 9 | 0 | 0 | 0 | 9 | 2 | 1 | 0 | 0 | 3 | 25 |
| 9:30 AM | 1 | 14 | 0 | 0 | 15 | 13 | 1 | 0 | 1 | 14 | 4 | 2 | 0 | 0 | 6 | 35 |
| 9:45 AM | 0 | 13 | 0 | 0 | 13 | 10 | 6 | 0 | 0 | 16 | 2 | 3 | 1 | 2 | 6 | 35 |
| Total | 3 | 47 | 0 | 0 | 50 | 43 | 8 | 0 | 1 | 51 | 10 | 9 | 1 | 3 | 20 | 121 |
| Approach % | 6.0 | 94.0 | 0.0 | - | - | 84.3 | 15.7 | 0.0 | - | - | 50.0 | 45.0 | 5.0 | - | - | - |
| Total % | 2.5 | 38.8 | 0.0 | - | 41.3 | 35.5 | 6.6 | 0.0 | - | 42.1 | 8.3 | 7.4 | 0.8 | - | 16.5 | - |
| PHF | 0.375 | 0.839 | 0.000 | - | 0.833 | 0.827 | 0.333 | 0.000 | - | 0.797 | 0.625 | 0.750 | 0.250 | - | 0.833 | 0.864 |
| Lights | 3 | 45 | 0 | - | 48 | 39 | 7 | 0 | - | 46 | 8 | 6 | 0 | - | 14 | 108 |
| % Lights | 100.0 | 95.7 | - | - | 96.0 | 90.7 | 87.5 | - | - | 90.2 | 80.0 | 66.7 | 0.0 | - | 70.0 | 89.3 |
| Buses | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Single-Unit Trucks | 0 | 0 | 0 | - | 0 | 1 | 1 | 0 | - | 2 | 0 | 1 | 1 | - | 2 | 4 |
| % Single-Unit Trucks | 0.0 | 0.0 | - | - | 0.0 | 2.3 | 12.5 | - | - | 3.9 | 0.0 | 11.1 | 100.0 | - | 10.0 | 3.3 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 2 | 0 | - | 2 | 3 | 0 | 0 | - | 3 | 2 | 2 | 0 | - | 4 | 9 |
| % Bicycles on Road | 0.0 | 4.3 | - | - | 4.0 | 7.0 | 0.0 | - | - | 5.9 | 20.0 | 22.2 | 0.0 | - | 20.0 | 7.4 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 0 | - | - | - | - | 1 | - | - | - | - | 3 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Union Avenue & Oxbow Drive
Site Code: 200272
Start Date: 06/25/2020
Page No: 5



Union Avenue [N]

| Out | In | Total |
|---|---|---|
| 10 | 14 | 24 |
| 0 | 0 | 0 |
| 2 | 2 | 4 |
| 0 | 0 | 0 |
| 0 | 4 | 4 |
| **12** | **20** | **32** |

| R | L | U | P |
|---|---|---|---|
| 6 | 8 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 |
| 2 | 2 | 0 | 3 |
| **9** | **10** | **1** | **3** |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 45 | 48 | 93 |
| 0 | 0 | 0 |
| 2 | 0 | 2 |
| 0 | 0 | 0 |
| 5 | 2 | 7 |
| **52** | **50** | **102** |

| P | T | L | U |
|---|---|---|---|
| 0 | 45 | 3 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 2 | 0 | 0 |
| **0** | **47** | **3** | **0** |

**Peak Hour Data**

06/25/2020 9:00 AM
Ending At
06/25/2020 10:00 AM

Lights
Buses
Single-Unit Trucks
Articulated Trucks
Other

| R | T | U | P |
|---|---|---|---|
| 7 | 39 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 3 | 0 | 1 |
| **8** | **43** | **0** | **1** |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 53 | 46 | 99 |
| 0 | 0 | 0 |
| 0 | 2 | 2 |
| 0 | 0 | 0 |
| 4 | 3 | 7 |
| **57** | **51** | **108** |

Turning Movement Peak Hour Data Plot (9:00 AM)

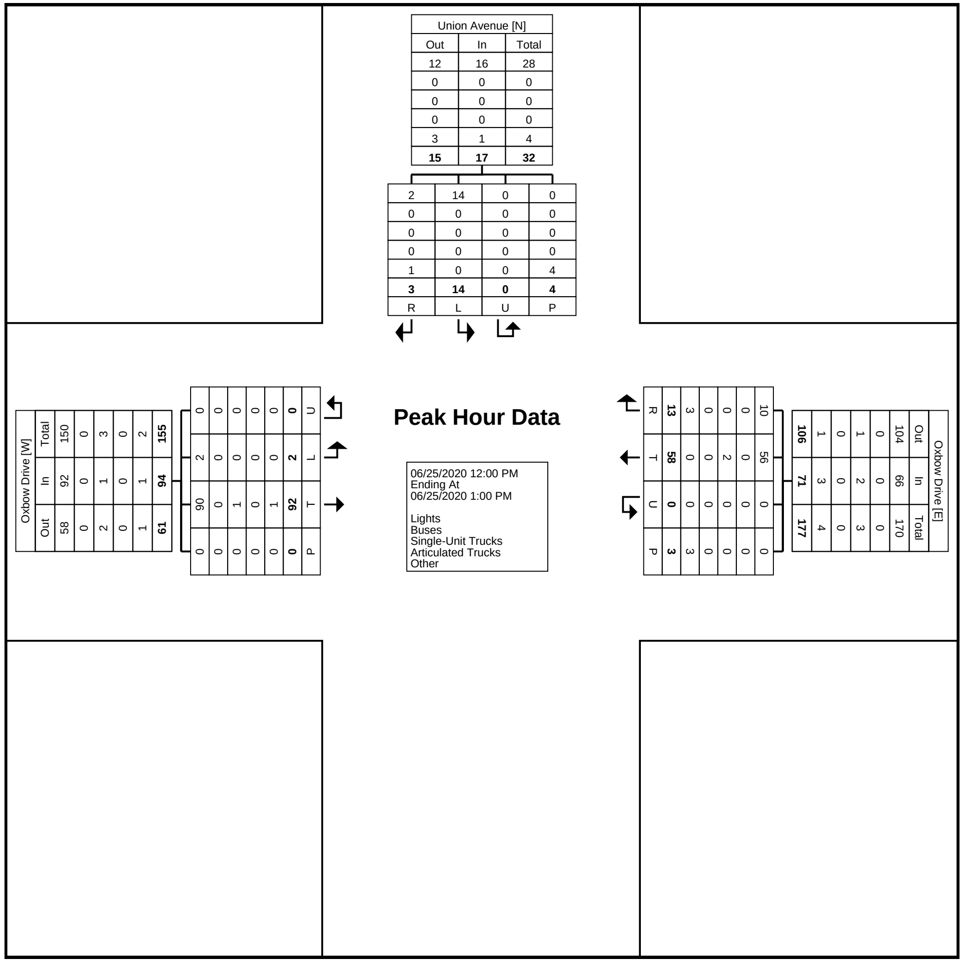
# Turning Movement Peak Hour Data (12:00 PM)

| | Oxbow Drive Eastbound | | | | | Oxbow Drive Westbound | | | | | Union Avenue Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 12:00 PM | 1 | 17 | 0 | 0 | 18 | 13 | 5 | 0 | 0 | 18 | 3 | 1 | 0 | 1 | 4 | 40 |
| 12:15 PM | 0 | 29 | 0 | 0 | 29 | 12 | 1 | 0 | 0 | 13 | 4 | 1 | 0 | 0 | 5 | 47 |
| 12:30 PM | 0 | 22 | 0 | 0 | 22 | 20 | 4 | 0 | 0 | 24 | 4 | 0 | 0 | 2 | 4 | 50 |
| 12:45 PM | 1 | 24 | 0 | 0 | 25 | 13 | 3 | 0 | 3 | 16 | 3 | 1 | 0 | 1 | 4 | 45 |
| Total | 2 | 92 | 0 | 0 | 94 | 58 | 13 | 0 | 3 | 71 | 14 | 3 | 0 | 4 | 17 | 182 |
| Approach % | 2.1 | 97.9 | 0.0 | - | - | 81.7 | 18.3 | 0.0 | - | - | 82.4 | 17.6 | 0.0 | - | - | - |
| Total % | 1.1 | 50.5 | 0.0 | - | 51.6 | 31.9 | 7.1 | 0.0 | - | 39.0 | 7.7 | 1.6 | 0.0 | - | 9.3 | - |
| PHF | 0.500 | 0.793 | 0.000 | - | 0.810 | 0.725 | 0.650 | 0.000 | - | 0.740 | 0.875 | 0.750 | 0.000 | - | 0.850 | 0.910 |
| Lights | 2 | 90 | 0 | - | 92 | 56 | 10 | 0 | - | 66 | 14 | 2 | 0 | - | 16 | 174 |
| % Lights | 100.0 | 97.8 | - | - | 97.9 | 96.6 | 76.9 | - | - | 93.0 | 100.0 | 66.7 | - | - | 94.1 | 95.6 |
| Buses | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Single-Unit Trucks | 0 | 1 | 0 | - | 1 | 2 | 0 | 0 | - | 2 | 0 | 0 | 0 | - | 0 | 3 |
| % Single-Unit Trucks | 0.0 | 1.1 | - | - | 1.1 | 3.4 | 0.0 | - | - | 2.8 | 0.0 | 0.0 | - | - | 0.0 | 1.6 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 1 | 0 | - | 1 | 0 | 3 | 0 | - | 3 | 0 | 1 | 0 | - | 1 | 5 |
| % Bicycles on Road | 0.0 | 1.1 | - | - | 1.1 | 0.0 | 23.1 | - | - | 4.2 | 0.0 | 33.3 | - | - | 5.9 | 2.7 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 2 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | 50.0 | - | - |
| Pedestrians | - | - | - | 0 | - | - | - | - | 3 | - | - | - | - | 2 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | 50.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Union Avenue & Oxbow Drive
Site Code: 200272
Start Date: 06/25/2020
Page No: 7



Union Avenue [N]

| Out | In | Total |
|---|---|---|
| 12 | 16 | 28 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 3 | 1 | 4 |
| **15** | **17** | **32** |

| R | L | U | P |
|---|---|---|---|
| 2 | 14 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 4 |
| **3** | **14** | **0** | **4** |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 58 | 92 | 150 |
| 0 | 0 | 0 |
| 2 | 1 | 3 |
| 0 | 0 | 0 |
| 1 | 1 | 2 |
| **61** | **94** | **155** |

| U | L | T | P |
|---|---|---|---|
| 0 | 2 | 90 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| **0** | **2** | **92** | **0** |

Peak Hour Data

06/25/2020 12:00 PM
Ending At
06/25/2020 1:00 PM

Lights
Buses
Single-Unit Trucks
Articulated Trucks
Other

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 104 | 66 | 170 |
| 0 | 0 | 0 |
| 1 | 2 | 3 |
| 0 | 0 | 0 |
| 1 | 3 | 4 |
| **106** | **71** | **177** |

| R | T | U | P |
|---|---|---|---|
| 10 | 56 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 3 |
| **13** | **58** | **0** | **3** |

Turning Movement Peak Hour Data Plot (12:00 PM)

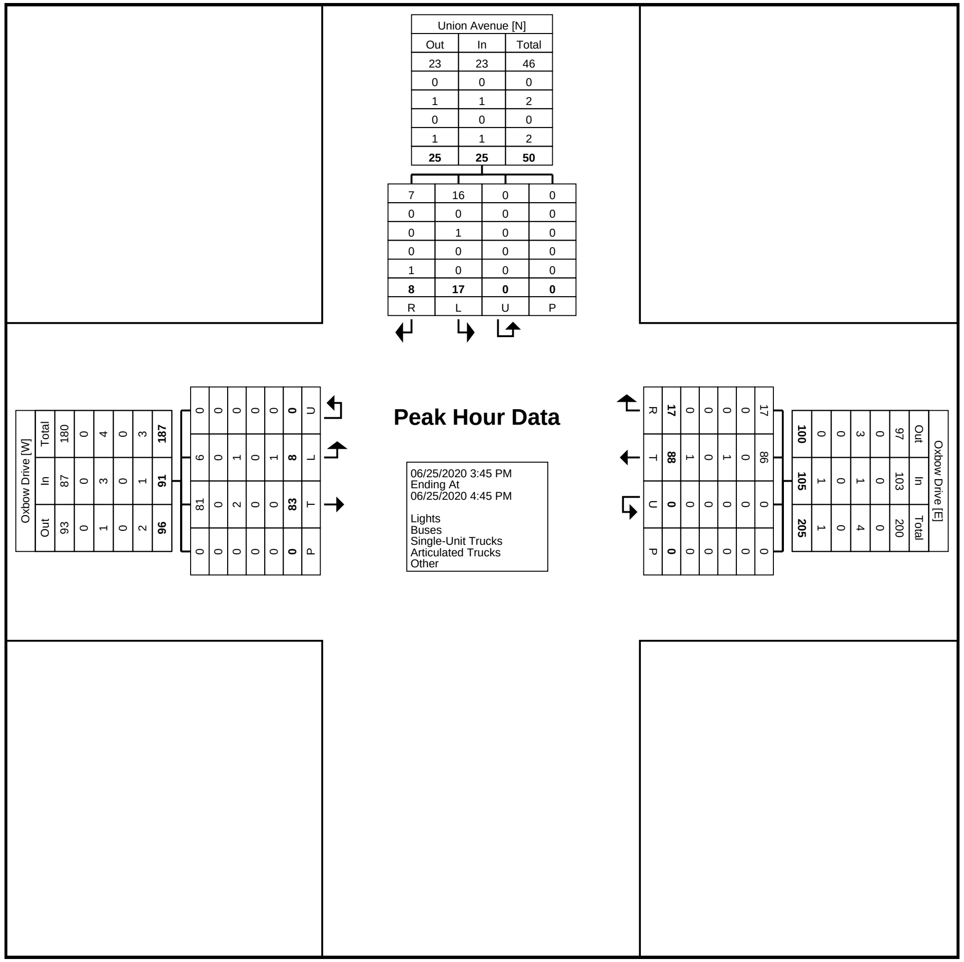
# Turning Movement Peak Hour Data (3:45 PM)

| | Oxbow Drive | | | | | Oxbow Drive | | | | | Union Avenue | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | | | Westbound | | | | | Southbound | | | | | |
| Start Time | Left | Thru | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 3:45 PM | 2 | 22 | 0 | 0 | 24 | 22 | 4 | 0 | 0 | 26 | 3 | 2 | 0 | 0 | 5 | 55 |
| 4:00 PM | 2 | 21 | 0 | 0 | 23 | 28 | 3 | 0 | 0 | 31 | 5 | 1 | 0 | 0 | 6 | 60 |
| 4:15 PM | 1 | 17 | 0 | 0 | 18 | 19 | 5 | 0 | 0 | 24 | 5 | 4 | 0 | 0 | 9 | 51 |
| 4:30 PM | 3 | 23 | 0 | 0 | 26 | 19 | 5 | 0 | 0 | 24 | 4 | 1 | 0 | 0 | 5 | 55 |
| Total | 8 | 83 | 0 | 0 | 91 | 88 | 17 | 0 | 0 | 105 | 17 | 8 | 0 | 0 | 25 | 221 |
| Approach % | 8.8 | 91.2 | 0.0 | - | - | 83.8 | 16.2 | 0.0 | - | - | 68.0 | 32.0 | 0.0 | - | - | - |
| Total % | 3.6 | 37.6 | 0.0 | - | 41.2 | 39.8 | 7.7 | 0.0 | - | 47.5 | 7.7 | 3.6 | 0.0 | - | 11.3 | - |
| PHF | 0.667 | 0.902 | 0.000 | - | 0.875 | 0.786 | 0.850 | 0.000 | - | 0.847 | 0.850 | 0.500 | 0.000 | - | 0.694 | 0.921 |
| Lights | 6 | 81 | 0 | - | 87 | 86 | 17 | 0 | - | 103 | 16 | 7 | 0 | - | 23 | 213 |
| % Lights | 75.0 | 97.6 | - | - | 95.6 | 97.7 | 100.0 | - | - | 98.1 | 94.1 | 87.5 | - | - | 92.0 | 96.4 |
| Buses | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Single-Unit Trucks | 1 | 2 | 0 | - | 3 | 1 | 0 | 0 | - | 1 | 1 | 0 | 0 | - | 1 | 5 |
| % Single-Unit Trucks | 12.5 | 2.4 | - | - | 3.3 | 1.1 | 0.0 | - | - | 1.0 | 5.9 | 0.0 | - | - | 4.0 | 2.3 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 1 | 0 | 0 | - | 1 | 1 | 0 | 0 | - | 1 | 0 | 1 | 0 | - | 1 | 3 |
| % Bicycles on Road | 12.5 | 0.0 | - | - | 1.1 | 1.1 | 0.0 | - | - | 1.0 | 0.0 | 12.5 | - | - | 4.0 | 1.4 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Union Avenue & Oxbow Drive
Site Code: 200272
Start Date: 06/25/2020
Page No: 9



Union Avenue [N]

| Out | In | Total |
|---|---|---|
| 23 | 23 | 46 |
| 0 | 0 | 0 |
| 1 | 1 | 2 |
| 0 | 0 | 0 |
| 1 | 1 | 2 |
| **25** | **25** | **50** |

| | | | |
|---|---|---|---|
| 7 | 16 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| **8** | **17** | **0** | **0** |
| R | L | U | P |

Oxbow Drive [W]

| Out | In | Total |
|---|---|---|
| 93 | 87 | 180 |
| 0 | 0 | 0 |
| 1 | 3 | 4 |
| 0 | 0 | 0 |
| 2 | 1 | 3 |
| **96** | **91** | **187** |

| U | L | T | P |
|---|---|---|---|
| 0 | 6 | 81 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 2 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| **0** | **8** | **83** | **0** |

## Peak Hour Data

06/25/2020 3:45 PM
Ending At
06/25/2020 4:45 PM

Lights
Buses
Single-Unit Trucks
Articulated Trucks
Other

| R | T | U | P |
|---|---|---|---|
| 17 | 86 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 |
| **17** | **88** | **0** | **0** |

Oxbow Drive [E]

| Out | In | Total |
|---|---|---|
| 97 | 103 | 200 |
| 0 | 0 | 0 |
| 3 | 1 | 4 |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| **100** | **105** | **205** |

Turning Movement Peak Hour Data Plot (3:45 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Glendon Drive
Site Code:
Start Date: 09/13/2018
Page No: 1

# Turning Movement Data

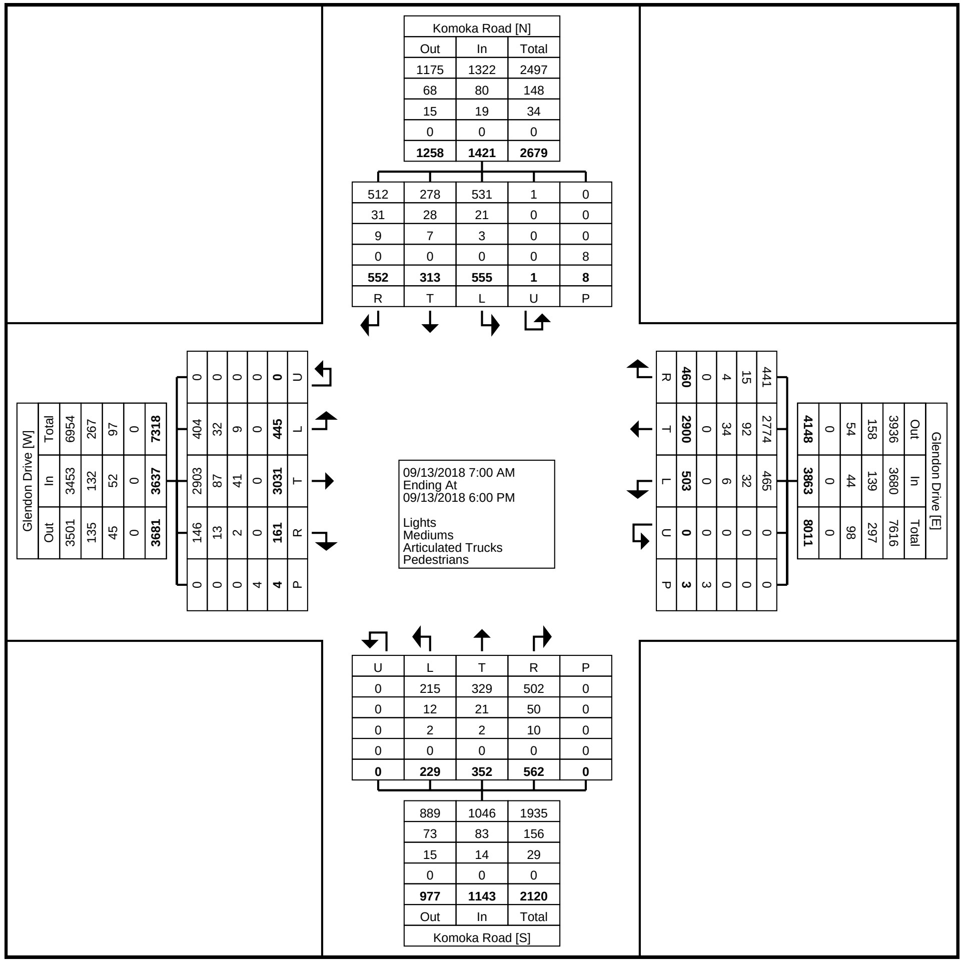
| | Glendon Drive<br>Eastbound | | | | | | Glendon Drive<br>Westbound | | | | | | Komoka Road<br>Northbound | | | | | | Komoka Road<br>Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:00 AM | 12 | 99 | 6 | 0 | 0 | 117 | 5 | 64 | 4 | 0 | 0 | 73 | 3 | 7 | 18 | 0 | 0 | 28 | 24 | 7 | 15 | 0 | 0 | 46 | 264 |
| 7:15 AM | 9 | 131 | 6 | 0 | 0 | 146 | 10 | 83 | 7 | 0 | 0 | 100 | 2 | 4 | 6 | 0 | 0 | 12 | 19 | 8 | 19 | 0 | 0 | 46 | 304 |
| 7:30 AM | 17 | 136 | 2 | 0 | 0 | 155 | 11 | 85 | 11 | 0 | 0 | 107 | 9 | 10 | 29 | 0 | 0 | 48 | 24 | 10 | 28 | 0 | 0 | 62 | 372 |
| 7:45 AM | 15 | 128 | 5 | 0 | 0 | 148 | 13 | 84 | 9 | 0 | 0 | 106 | 4 | 7 | 19 | 0 | 0 | 30 | 24 | 9 | 16 | 0 | 0 | 49 | 333 |
| Hourly Total | 53 | 494 | 19 | 0 | 0 | 566 | 39 | 316 | 31 | 0 | 0 | 386 | 18 | 28 | 72 | 0 | 0 | 118 | 91 | 34 | 78 | 0 | 0 | 203 | 1273 |
| 8:00 AM | 20 | 111 | 5 | 0 | 0 | 136 | 12 | 77 | 6 | 0 | 0 | 95 | 13 | 4 | 26 | 0 | 0 | 43 | 17 | 9 | 20 | 0 | 0 | 46 | 320 |
| 8:15 AM | 24 | 123 | 4 | 0 | 0 | 151 | 24 | 94 | 11 | 0 | 0 | 129 | 6 | 13 | 21 | 0 | 0 | 40 | 21 | 8 | 25 | 0 | 0 | 54 | 374 |
| 8:30 AM | 15 | 103 | 6 | 0 | 0 | 124 | 19 | 75 | 9 | 0 | 0 | 103 | 10 | 19 | 12 | 0 | 0 | 41 | 25 | 8 | 21 | 0 | 0 | 54 | 322 |
| 8:45 AM | 12 | 95 | 7 | 0 | 1 | 114 | 15 | 67 | 12 | 0 | 0 | 94 | 9 | 7 | 24 | 0 | 0 | 40 | 20 | 12 | 27 | 0 | 1 | 59 | 307 |
| Hourly Total | 71 | 432 | 22 | 0 | 1 | 525 | 70 | 313 | 38 | 0 | 0 | 421 | 38 | 43 | 83 | 0 | 0 | 164 | 83 | 37 | 93 | 0 | 1 | 213 | 1323 |
| 9:00 AM | 14 | 88 | 2 | 0 | 1 | 104 | 10 | 67 | 8 | 0 | 0 | 85 | 4 | 5 | 8 | 0 | 0 | 17 | 18 | 12 | 17 | 0 | 0 | 47 | 253 |
| 9:15 AM | 10 | 96 | 5 | 0 | 0 | 111 | 13 | 72 | 13 | 0 | 0 | 98 | 7 | 8 | 14 | 0 | 0 | 29 | 17 | 7 | 15 | 0 | 0 | 39 | 277 |
| 9:30 AM | 20 | 90 | 2 | 0 | 0 | 112 | 4 | 74 | 4 | 0 | 1 | 82 | 5 | 4 | 23 | 0 | 0 | 32 | 16 | 6 | 22 | 0 | 0 | 44 | 270 |
| 9:45 AM | 14 | 84 | 2 | 0 | 0 | 100 | 7 | 70 | 9 | 0 | 1 | 86 | 6 | 12 | 12 | 0 | 0 | 30 | 15 | 5 | 16 | 0 | 0 | 36 | 252 |
| Hourly Total | 58 | 358 | 11 | 0 | 1 | 427 | 34 | 283 | 34 | 0 | 2 | 351 | 22 | 29 | 57 | 0 | 0 | 108 | 66 | 30 | 70 | 0 | 0 | 166 | 1052 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11:00 AM | 12 | 75 | 4 | 0 | 0 | 91 | 18 | 50 | 8 | 0 | 0 | 76 | 4 | 8 | 8 | 0 | 0 | 20 | 8 | 8 | 7 | 0 | 0 | 23 | 210 |
| 11:15 AM | 15 | 71 | 2 | 0 | 0 | 88 | 11 | 59 | 14 | 0 | 1 | 84 | 6 | 4 | 11 | 0 | 0 | 21 | 9 | 8 | 6 | 0 | 2 | 23 | 216 |
| 11:30 AM | 14 | 79 | 2 | 0 | 0 | 95 | 16 | 61 | 11 | 0 | 0 | 88 | 6 | 9 | 16 | 0 | 0 | 31 | 15 | 8 | 24 | 0 | 0 | 47 | 261 |
| 11:45 AM | 11 | 70 | 3 | 0 | 0 | 84 | 15 | 67 | 11 | 0 | 0 | 93 | 10 | 10 | 11 | 0 | 0 | 31 | 7 | 10 | 8 | 0 | 0 | 25 | 233 |
| Hourly Total | 52 | 295 | 11 | 0 | 0 | 358 | 60 | 237 | 44 | 0 | 1 | 341 | 26 | 31 | 46 | 0 | 0 | 103 | 39 | 34 | 45 | 0 | 2 | 118 | 920 |
| 12:00 PM | 8 | 80 | 3 | 0 | 2 | 91 | 10 | 55 | 9 | 0 | 0 | 74 | 4 | 14 | 18 | 0 | 0 | 36 | 11 | 11 | 19 | 0 | 2 | 41 | 242 |
| 12:15 PM | 10 | 66 | 6 | 0 | 0 | 82 | 9 | 70 | 14 | 0 | 0 | 93 | 3 | 9 | 16 | 0 | 0 | 28 | 20 | 7 | 9 | 0 | 0 | 36 | 239 |
| 12:30 PM | 8 | 81 | 7 | 0 | 0 | 96 | 20 | 89 | 11 | 0 | 0 | 120 | 4 | 6 | 17 | 0 | 0 | 27 | 11 | 11 | 15 | 0 | 0 | 37 | 280 |
| 12:45 PM | 22 | 70 | 3 | 0 | 0 | 95 | 19 | 58 | 14 | 0 | 0 | 91 | 9 | 3 | 17 | 0 | 0 | 29 | 7 | 20 | 10 | 0 | 0 | 37 | 252 |
| Hourly Total | 48 | 297 | 19 | 0 | 2 | 364 | 58 | 272 | 48 | 0 | 0 | 378 | 20 | 32 | 68 | 0 | 0 | 120 | 49 | 49 | 53 | 0 | 2 | 151 | 1013 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 12 | 72 | 6 | 0 | 0 | 90 | 13 | 95 | 20 | 0 | 0 | 128 | 9 | 15 | 16 | 0 | 0 | 40 | 12 | 7 | 16 | 0 | 0 | 35 | 293 |
| 3:15 PM | 12 | 82 | 1 | 0 | 0 | 95 | 23 | 93 | 20 | 0 | 0 | 136 | 6 | 9 | 9 | 0 | 0 | 24 | 24 | 4 | 10 | 0 | 0 | 38 | 293 |
| 3:30 PM | 15 | 77 | 4 | 0 | 0 | 96 | 25 | 121 | 6 | 0 | 0 | 152 | 11 | 11 | 23 | 0 | 0 | 45 | 14 | 10 | 21 | 0 | 0 | 45 | 338 |
| 3:45 PM | 16 | 95 | 5 | 0 | 0 | 116 | 17 | 116 | 24 | 0 | 0 | 157 | 5 | 17 | 21 | 0 | 0 | 43 | 20 | 7 | 12 | 0 | 1 | 39 | 355 |
| Hourly Total | 55 | 326 | 16 | 0 | 0 | 397 | 78 | 425 | 70 | 0 | 0 | 573 | 31 | 52 | 69 | 0 | 0 | 152 | 70 | 28 | 59 | 0 | 1 | 157 | 1279 |
| 4:00 PM | 9 | 89 | 10 | 0 | 0 | 108 | 20 | 111 | 21 | 0 | 0 | 152 | 9 | 14 | 25 | 0 | 0 | 48 | 26 | 11 | 17 | 0 | 0 | 54 | 362 |
| 4:15 PM | 19 | 94 | 11 | 0 | 0 | 124 | 22 | 142 | 24 | 0 | 0 | 188 | 10 | 19 | 20 | 0 | 0 | 49 | 21 | 10 | 22 | 0 | 0 | 53 | 414 |
| 4:30 PM | 18 | 99 | 4 | 0 | 0 | 121 | 22 | 134 | 25 | 0 | 0 | 181 | 12 | 13 | 17 | 0 | 0 | 42 | 21 | 15 | 22 | 0 | 0 | 58 | 402 |
| 4:45 PM | 12 | 123 | 8 | 0 | 0 | 143 | 22 | 157 | 28 | 0 | 0 | 207 | 4 | 18 | 17 | 0 | 0 | 39 | 18 | 14 | 23 | 0 | 0 | 55 | 444 |
| Hourly Total | 58 | 405 | 33 | 0 | 0 | 496 | 86 | 544 | 98 | 0 | 0 | 728 | 35 | 64 | 79 | 0 | 0 | 178 | 86 | 50 | 84 | 0 | 0 | 220 | 1622 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5:00 PM | 9 | 112 | 11 | 0 | 0 | 132 | 21 | 140 | 32 | 0 | 0 | 193 | 10 | 24 | 27 | 0 | 0 | 61 | 24 | 20 | 21 | 0 | 0 | 65 | 451 |
| 5:15 PM | 13 | 113 | 6 | 0 | 0 | 132 | 26 | 149 | 18 | 0 | 0 | 193 | 11 | 16 | 27 | 0 | 0 | 54 | 11 | 12 | 20 | 0 | 0 | 43 | 422 |
| 5:30 PM | 16 | 113 | 8 | 0 | 0 | 137 | 13 | 120 | 22 | 0 | 0 | 155 | 10 | 14 | 19 | 0 | 0 | 43 | 21 | 11 | 13 | 1 | 2 | 46 | 381 |
| 5:45 PM | 12 | 86 | 5 | 0 | 0 | 103 | 18 | 101 | 25 | 0 | 0 | 144 | 8 | 19 | 15 | 0 | 0 | 42 | 15 | 8 | 16 | 0 | 0 | 39 | 328 |
| Hourly Total | 50 | 424 | 30 | 0 | 0 | 504 | 78 | 510 | 97 | 0 | 0 | 685 | 39 | 73 | 88 | 0 | 0 | 200 | 71 | 51 | 70 | 1 | 2 | 193 | 1582 |
| Grand Total | 445 | 3031 | 161 | 0 | 4 | 3637 | 503 | 2900 | 460 | 0 | 3 | 3863 | 229 | 352 | 562 | 0 | 0 | 1143 | 555 | 313 | 552 | 1 | 8 | 1421 | 10064 |
| Approach % | 12.2 | 83.3 | 4.4 | 0.0 | - | - | 13.0 | 75.1 | 11.9 | 0.0 | - | - | 20.0 | 30.8 | 49.2 | 0.0 | - | - | 39.1 | 22.0 | 38.8 | 0.1 | - | - | - |
| Total % | 4.4 | 30.1 | 1.6 | 0.0 | - | 36.1 | 5.0 | 28.8 | 4.6 | 0.0 | - | 38.4 | 2.3 | 3.5 | 5.6 | 0.0 | - | 11.4 | 5.5 | 3.1 | 5.5 | 0.0 | - | 14.1 | - |
| Lights | 404 | 2903 | 146 | 0 | - | 3453 | 465 | 2774 | 441 | 0 | - | 3680 | 215 | 329 | 502 | 0 | - | 1046 | 531 | 278 | 512 | 1 | - | 1322 | 9501 |
| % Lights | 90.8 | 95.8 | 90.7 | - | - | 94.9 | 92.4 | 95.7 | 95.9 | - | - | 95.3 | 93.9 | 93.5 | 89.3 | - | - | 91.5 | 95.7 | 88.8 | 92.8 | 100.0 | - | 93.0 | 94.4 |
| Mediums | 32 | 87 | 13 | 0 | - | 132 | 32 | 92 | 15 | 0 | - | 139 | 12 | 21 | 50 | 0 | - | 83 | 21 | 28 | 31 | 0 | - | 80 | 434 |
| % Mediums | 7.2 | 2.9 | 8.1 | - | - | 3.6 | 6.4 | 3.2 | 3.3 | - | - | 3.6 | 5.2 | 6.0 | 8.9 | - | - | 7.3 | 3.8 | 8.9 | 5.6 | 0.0 | - | 5.6 | 4.3 |
| Articulated Trucks | 9 | 41 | 2 | 0 | - | 52 | 6 | 34 | 4 | 0 | - | 44 | 2 | 2 | 10 | 0 | - | 14 | 3 | 7 | 9 | 0 | - | 19 | 129 |
| % Articulated Trucks | 2.0 | 1.4 | 1.2 | - | - | 1.4 | 1.2 | 1.2 | 0.9 | - | - | 1.1 | 0.9 | 0.6 | 1.8 | - | - | 1.2 | 0.5 | 2.2 | 1.6 | 0.0 | - | 1.3 | 1.3 |
| Pedestrians | - | - | - | - | 4 | - | - | - | - | - | 3 | - | - | - | - | - | 0 | - | - | - | - | - | 8 | - | - |
| % Pedestrians | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Glendon Drive
Site Code:
Start Date: 09/13/2018
Page No: 3



Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 1175 | 1322 | 2497 |
| 68 | 80 | 148 |
| 15 | 19 | 34 |
| 0 | 0 | 0 |
| **1258** | **1421** | **2679** |

| R | T | L | U | P |
|---|---|---|---|---|
| 512 | 278 | 531 | 1 | 0 |
| 31 | 28 | 21 | 0 | 0 |
| 9 | 7 | 3 | 0 | 0 |
| 0 | 0 | 0 | 0 | 8 |
| **552** | **313** | **555** | **1** | **8** |

Glendon Drive [W]

| Out | In | Total |
|---|---|---|
| 3501 | 3453 | 6954 |
| 135 | 132 | 267 |
| 45 | 52 | 97 |
| 0 | 0 | 0 |
| **3681** | **3637** | **7318** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 404 | 2903 | 146 | 0 |
| 0 | 32 | 87 | 13 | 0 |
| 0 | 9 | 41 | 2 | 0 |
| 0 | 0 | 0 | 0 | 4 |
| **0** | **445** | **3031** | **161** | **4** |

Glendon Drive [E]

| Out | In | Total |
|---|---|---|
| 3936 | 3680 | 7616 |
| 158 | 139 | 297 |
| 54 | 44 | 98 |
| 0 | 0 | 0 |
| **4148** | **3863** | **8011** |

| R | T | L | U | P |
|---|---|---|---|---|
| 441 | 2774 | 465 | 0 | 0 |
| 15 | 92 | 32 | 0 | 0 |
| 4 | 34 | 6 | 0 | 0 |
| 0 | 0 | 0 | 0 | 3 |
| **460** | **2900** | **503** | **0** | **3** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 215 | 329 | 502 | 0 |
| 0 | 12 | 21 | 50 | 0 |
| 0 | 2 | 2 | 10 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **229** | **352** | **562** | **0** |

| Out | In | Total |
|---|---|---|
| 889 | 1046 | 1935 |
| 73 | 83 | 156 |
| 15 | 14 | 29 |
| 0 | 0 | 0 |
| **977** | **1143** | **2120** |

Komoka Road [S]

09/13/2018 7:00 AM
Ending At
09/13/2018 6:00 PM

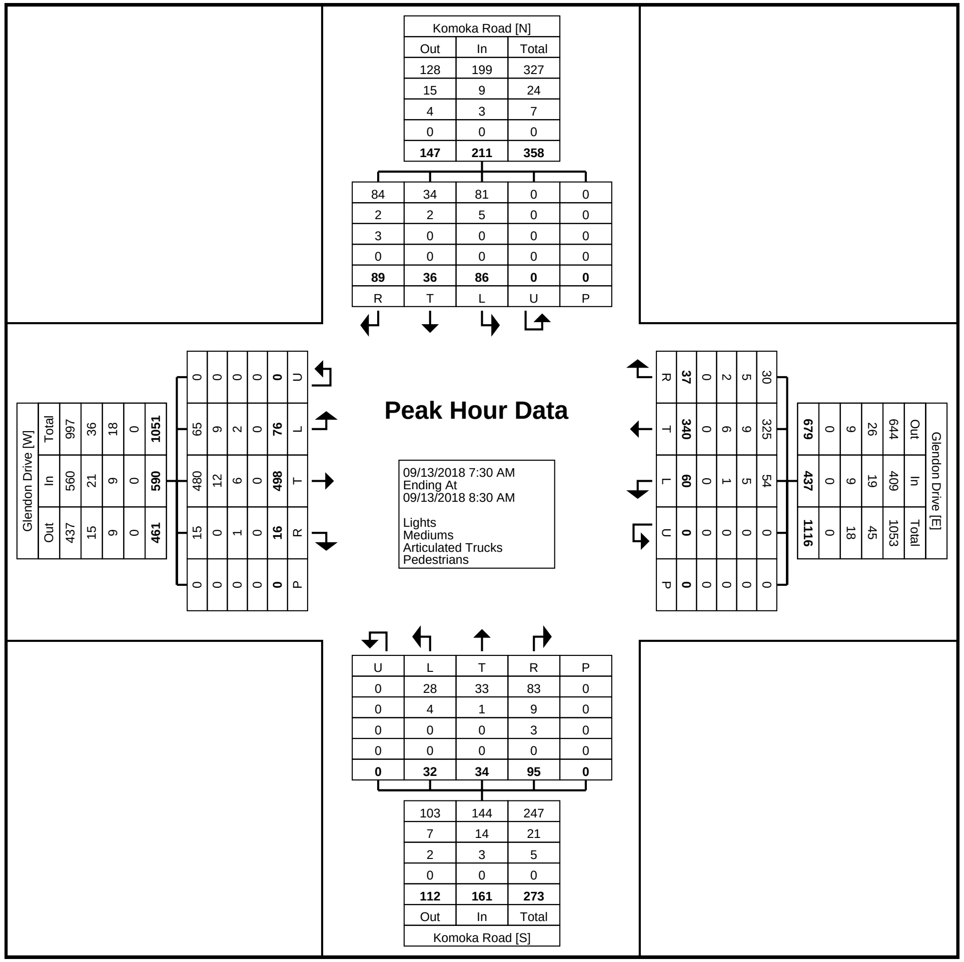
Lights
Mediums
Articulated Trucks
Pedestrians

Turning Movement Data Plot

# Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Glendon Drive | | | | | | Glendon Drive | | | | | | Komoka Road | | | | | | Komoka Road | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | | | | Westbound | | | | | | Northbound | | | | | | Southbound | | | | | | |
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:30 AM | 17 | 136 | 2 | 0 | 0 | 155 | 11 | 85 | 11 | 0 | 0 | 107 | 9 | 10 | 29 | 0 | 0 | 48 | 24 | 10 | 28 | 0 | 0 | 62 | 372 |
| 7:45 AM | 15 | 128 | 5 | 0 | 0 | 148 | 13 | 84 | 9 | 0 | 0 | 106 | 4 | 7 | 19 | 0 | 0 | 30 | 24 | 9 | 16 | 0 | 0 | 49 | 333 |
| 8:00 AM | 20 | 111 | 5 | 0 | 0 | 136 | 12 | 77 | 6 | 0 | 0 | 95 | 13 | 4 | 26 | 0 | 0 | 43 | 17 | 9 | 20 | 0 | 0 | 46 | 320 |
| 8:15 AM | 24 | 123 | 4 | 0 | 0 | 151 | 24 | 94 | 11 | 0 | 0 | 129 | 6 | 13 | 21 | 0 | 0 | 40 | 21 | 8 | 25 | 0 | 0 | 54 | 374 |
| Total | 76 | 498 | 16 | 0 | 0 | 590 | 60 | 340 | 37 | 0 | 0 | 437 | 32 | 34 | 95 | 0 | 0 | 161 | 86 | 36 | 89 | 0 | 0 | 211 | 1399 |
| Approach % | 12.9 | 84.4 | 2.7 | 0.0 | - | - | 13.7 | 77.8 | 8.5 | 0.0 | - | - | 19.9 | 21.1 | 59.0 | 0.0 | - | - | 40.8 | 17.1 | 42.2 | 0.0 | - | - | - |
| Total % | 5.4 | 35.6 | 1.1 | 0.0 | - | 42.2 | 4.3 | 24.3 | 2.6 | 0.0 | - | 31.2 | 2.3 | 2.4 | 6.8 | 0.0 | - | 11.5 | 6.1 | 2.6 | 6.4 | 0.0 | - | 15.1 | - |
| PHF | 0.792 | 0.915 | 0.800 | 0.000 | - | 0.952 | 0.625 | 0.904 | 0.841 | 0.000 | - | 0.847 | 0.615 | 0.654 | 0.819 | 0.000 | - | 0.839 | 0.896 | 0.900 | 0.795 | 0.000 | - | 0.851 | 0.935 |
| Lights | 65 | 480 | 15 | 0 | - | 560 | 54 | 325 | 30 | 0 | - | 409 | 28 | 33 | 83 | 0 | - | 144 | 81 | 34 | 84 | 0 | - | 199 | 1312 |
| % Lights | 85.5 | 96.4 | 93.8 | - | - | 94.9 | 90.0 | 95.6 | 81.1 | - | - | 93.6 | 87.5 | 97.1 | 87.4 | - | - | 89.4 | 94.2 | 94.4 | 94.4 | - | - | 94.3 | 93.8 |
| Mediums | 9 | 12 | 0 | 0 | - | 21 | 5 | 9 | 5 | 0 | - | 19 | 4 | 1 | 9 | 0 | - | 14 | 5 | 2 | 2 | 0 | - | 9 | 63 |
| % Mediums | 11.8 | 2.4 | 0.0 | - | - | 3.6 | 8.3 | 2.6 | 13.5 | - | - | 4.3 | 12.5 | 2.9 | 9.5 | - | - | 8.7 | 5.8 | 5.6 | 2.2 | - | - | 4.3 | 4.5 |
| Articulated Trucks | 2 | 6 | 1 | 0 | - | 9 | 1 | 6 | 2 | 0 | - | 9 | 0 | 0 | 3 | 0 | - | 3 | 0 | 0 | 3 | 0 | - | 3 | 24 |
| % Articulated Trucks | 2.6 | 1.2 | 6.3 | - | - | 1.5 | 1.7 | 1.8 | 5.4 | - | - | 2.1 | 0.0 | 0.0 | 3.2 | - | - | 1.9 | 0.0 | 0.0 | 3.4 | - | - | 1.4 | 1.7 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Count Name: Komoka Road & Glendon Drive
Site Code:
Start Date: 09/13/2018
Page No: 5



Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 128 | 199 | 327 |
| 15 | 9 | 24 |
| 4 | 3 | 7 |
| 0 | 0 | 0 |
| **147** | **211** | **358** |

| | | | | |
|---|---|---|---|---|
| 84 | 34 | 81 | 0 | 0 |
| 2 | 2 | 5 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **89** | **36** | **86** | **0** | **0** |
| R | T | L | U | P |

Glendon Drive [W]

| Out | In | Total |
|---|---|---|
| 437 | 560 | 997 |
| 15 | 21 | 36 |
| 9 | 9 | 18 |
| 0 | 0 | 0 |
| **461** | **590** | **1051** |

| | | | | |
|---|---|---|---|---|
| 0 | 15 | 480 | 65 | 0 |
| 0 | 0 | 12 | 9 | 0 |
| 0 | 1 | 6 | 2 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **16** | **498** | **76** | **0** |
| P | R | T | L | U |

## Peak Hour Data

09/13/2018 7:30 AM
Ending At
09/13/2018 8:30 AM

Lights
Mediums
Articulated Trucks
Pedestrians

| | | | | |
|---|---|---|---|---|
| 30 | 325 | 54 | 0 | 0 |
| 5 | 9 | 5 | 0 | 0 |
| 2 | 6 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **37** | **340** | **60** | **0** | **0** |
| R | T | L | U | P |

Glendon Drive [E]

| Out | In | Total |
|---|---|---|
| 644 | 409 | 1053 |
| 26 | 19 | 45 |
| 9 | 9 | 18 |
| 0 | 0 | 0 |
| **679** | **437** | **1116** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 28 | 33 | 83 | 0 |
| 0 | 4 | 1 | 9 | 0 |
| 0 | 0 | 0 | 3 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **32** | **34** | **95** | **0** |

| | | |
|---|---|---|
| 103 | 144 | 247 |
| 7 | 14 | 21 |
| 2 | 3 | 5 |
| 0 | 0 | 0 |
| **112** | **161** | **273** |
| Out | In | Total |

Komoka Road [S]

Turning Movement Peak Hour Data Plot (7:30 AM)

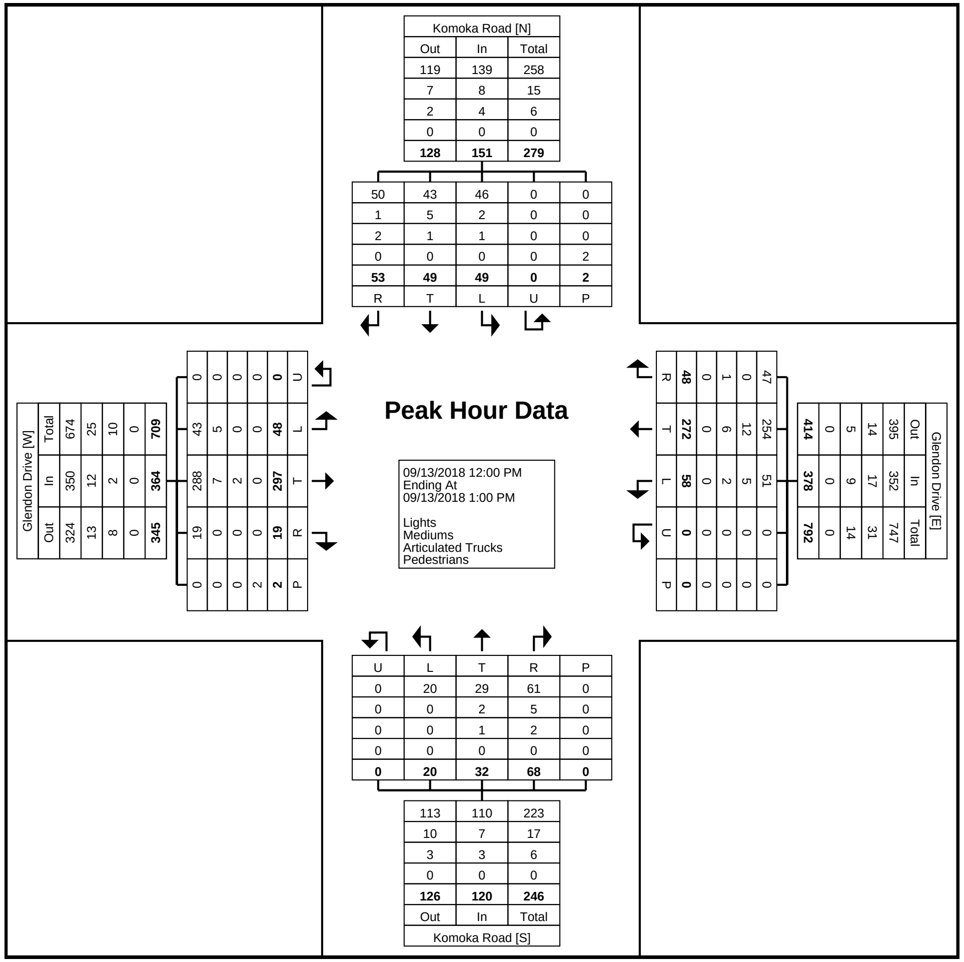
## Turning Movement Peak Hour Data (12:00 PM)

| Start Time | Glendon Drive Eastbound | | | | | | Glendon Drive Westbound | | | | | | Komoka Road Northbound | | | | | | Komoka Road Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 12:00 PM | 8 | 80 | 3 | 0 | 2 | 91 | 10 | 55 | 9 | 0 | 0 | 74 | 4 | 14 | 18 | 0 | 0 | 36 | 11 | 11 | 19 | 0 | 2 | 41 | 242 |
| 12:15 PM | 10 | 66 | 6 | 0 | 0 | 82 | 9 | 70 | 14 | 0 | 0 | 93 | 3 | 9 | 16 | 0 | 0 | 28 | 20 | 7 | 9 | 0 | 0 | 36 | 239 |
| 12:30 PM | 8 | 81 | 7 | 0 | 0 | 96 | 20 | 89 | 11 | 0 | 0 | 120 | 4 | 6 | 17 | 0 | 0 | 27 | 11 | 11 | 15 | 0 | 0 | 37 | 280 |
| 12:45 PM | 22 | 70 | 3 | 0 | 0 | 95 | 19 | 58 | 14 | 0 | 0 | 91 | 9 | 3 | 17 | 0 | 0 | 29 | 7 | 20 | 10 | 0 | 0 | 37 | 252 |
| Total | 48 | 297 | 19 | 0 | 2 | 364 | 58 | 272 | 48 | 0 | 0 | 378 | 20 | 32 | 68 | 0 | 0 | 120 | 49 | 49 | 53 | 0 | 2 | 151 | 1013 |
| Approach % | 13.2 | 81.6 | 5.2 | 0.0 | - | - | 15.3 | 72.0 | 12.7 | 0.0 | - | - | 16.7 | 26.7 | 56.7 | 0.0 | - | - | 32.5 | 32.5 | 35.1 | 0.0 | - | - | - |
| Total % | 4.7 | 29.3 | 1.9 | 0.0 | - | 35.9 | 5.7 | 26.9 | 4.7 | 0.0 | - | 37.3 | 2.0 | 3.2 | 6.7 | 0.0 | - | 11.8 | 4.8 | 4.8 | 5.2 | 0.0 | - | 14.9 | - |
| PHF | 0.545 | 0.917 | 0.679 | 0.000 | - | 0.948 | 0.725 | 0.764 | 0.857 | 0.000 | - | 0.788 | 0.556 | 0.571 | 0.944 | 0.000 | - | 0.833 | 0.613 | 0.613 | 0.697 | 0.000 | - | 0.921 | 0.904 |
| Lights | 43 | 288 | 19 | 0 | - | 350 | 51 | 254 | 47 | 0 | - | 352 | 20 | 29 | 61 | 0 | - | 110 | 46 | 43 | 50 | 0 | - | 139 | 951 |
| % Lights | 89.6 | 97.0 | 100.0 | - | - | 96.2 | 87.9 | 93.4 | 97.9 | - | - | 93.1 | 100.0 | 90.6 | 89.7 | - | - | 91.7 | 93.9 | 87.8 | 94.3 | - | - | 92.1 | 93.9 |
| Mediums | 5 | 7 | 0 | 0 | - | 12 | 5 | 12 | 0 | 0 | - | 17 | 0 | 2 | 5 | 0 | - | 7 | 2 | 5 | 1 | 0 | - | 8 | 44 |
| % Mediums | 10.4 | 2.4 | 0.0 | - | - | 3.3 | 8.6 | 4.4 | 0.0 | - | - | 4.5 | 0.0 | 6.3 | 7.4 | - | - | 5.8 | 4.1 | 10.2 | 1.9 | - | - | 5.3 | 4.3 |
| Articulated Trucks | 0 | 2 | 0 | 0 | - | 2 | 2 | 6 | 1 | 0 | - | 9 | 0 | 1 | 2 | 0 | - | 3 | 1 | 1 | 2 | 0 | - | 4 | 18 |
| % Articulated Trucks | 0.0 | 0.7 | 0.0 | - | - | 0.5 | 3.4 | 2.2 | 2.1 | - | - | 2.4 | 0.0 | 3.1 | 2.9 | - | - | 2.5 | 2.0 | 2.0 | 3.8 | - | - | 2.6 | 1.8 |
| Pedestrians | - | - | - | - | 2 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 2 | - | - |
| % Pedestrians | - | - | - | - | 100.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Glendon Drive
Site Code:
Start Date: 09/13/2018



## Peak Hour Data

09/13/2018 12:00 PM
Ending At
09/13/2018 1:00 PM

Lights
Mediums
Articulated Trucks
Pedestrians

Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 119 | 139 | 258 |
| 7 | 8 | 15 |
| 2 | 4 | 6 |
| 0 | 0 | 0 |
| **128** | **151** | **279** |

| R | T | L | U | P |
|---|---|---|---|---|
| 50 | 43 | 46 | 0 | 0 |
| 1 | 5 | 2 | 0 | 0 |
| 2 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 2 |
| **53** | **49** | **49** | **0** | **2** |

Glendon Drive [W]

| Out | In | Total |
|---|---|---|
| 324 | 350 | 674 |
| 13 | 12 | 25 |
| 8 | 2 | 10 |
| 0 | 0 | 0 |
| **345** | **364** | **709** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 43 | 288 | 19 | 0 |
| 0 | 5 | 7 | 0 | 0 |
| 0 | 0 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 | 2 |
| **0** | **48** | **297** | **19** | **2** |

Glendon Drive [E]

| Out | In | Total |
|---|---|---|
| 395 | 352 | 747 |
| 14 | 17 | 31 |
| 5 | 9 | 14 |
| 0 | 0 | 0 |
| **414** | **378** | **792** |

| R | T | L | U | P |
|---|---|---|---|---|
| 47 | 254 | 51 | 0 | 0 |
| 0 | 12 | 5 | 0 | 0 |
| 1 | 6 | 2 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **48** | **272** | **58** | **0** | **0** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 20 | 29 | 61 | 0 |
| 0 | 0 | 2 | 5 | 0 |
| 0 | 0 | 1 | 2 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **20** | **32** | **68** | **0** |

| Out | In | Total |
|---|---|---|
| 113 | 110 | 223 |
| 10 | 7 | 17 |
| 3 | 3 | 6 |
| 0 | 0 | 0 |
| **126** | **120** | **246** |

Komoka Road [S]

Turning Movement Peak Hour Data Plot (12:00 PM)

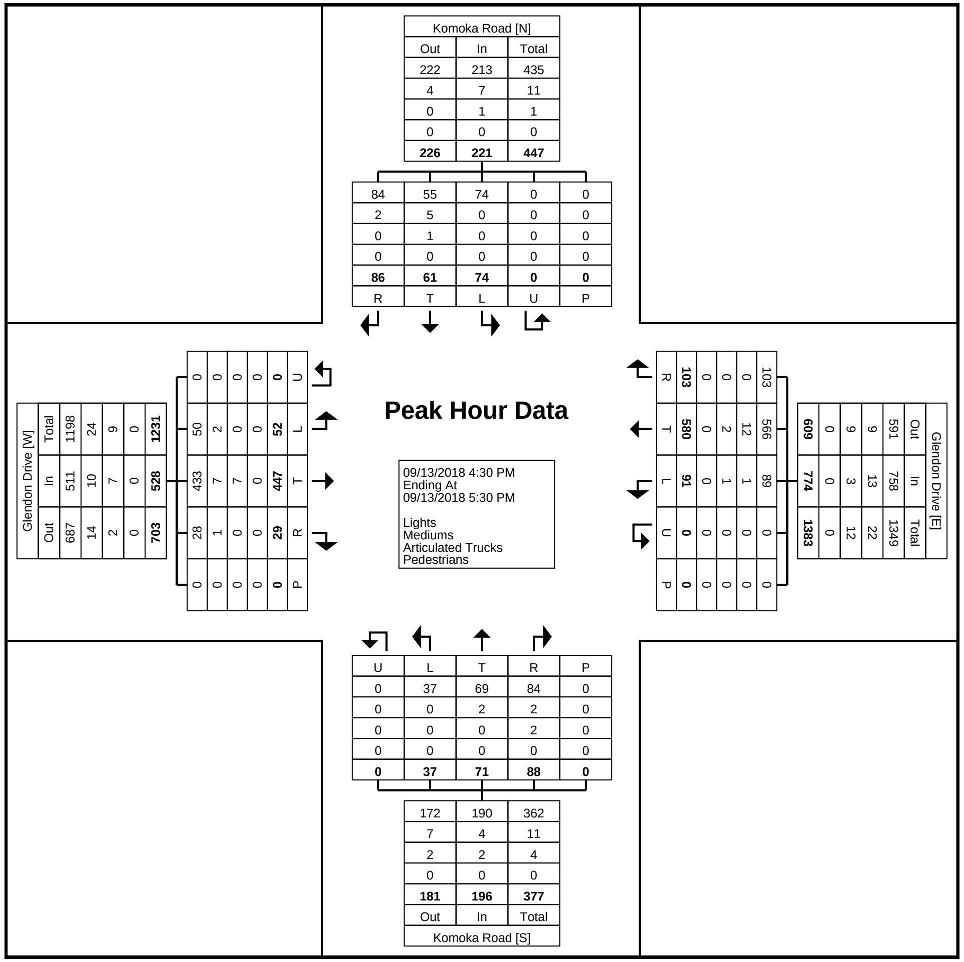
## Turning Movement Peak Hour Data (4:30 PM)

| Start Time | Glendon Drive Eastbound | | | | | | Glendon Drive Westbound | | | | | | Komoka Road Northbound | | | | | | Komoka Road Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 4:30 PM | 18 | 99 | 4 | 0 | 0 | 121 | 22 | 134 | 25 | 0 | 0 | 181 | 12 | 13 | 17 | 0 | 0 | 42 | 21 | 15 | 22 | 0 | 0 | 58 | 402 |
| 4:45 PM | 12 | 123 | 8 | 0 | 0 | 143 | 22 | 157 | 28 | 0 | 0 | 207 | 4 | 18 | 17 | 0 | 0 | 39 | 18 | 14 | 23 | 0 | 0 | 55 | 444 |
| 5:00 PM | 9 | 112 | 11 | 0 | 0 | 132 | 21 | 140 | 32 | 0 | 0 | 193 | 10 | 24 | 27 | 0 | 0 | 61 | 24 | 20 | 21 | 0 | 0 | 65 | 451 |
| 5:15 PM | 13 | 113 | 6 | 0 | 0 | 132 | 26 | 149 | 18 | 0 | 0 | 193 | 11 | 16 | 27 | 0 | 0 | 54 | 11 | 12 | 20 | 0 | 0 | 43 | 422 |
| Total | 52 | 447 | 29 | 0 | 0 | 528 | 91 | 580 | 103 | 0 | 0 | 774 | 37 | 71 | 88 | 0 | 0 | 196 | 74 | 61 | 86 | 0 | 0 | 221 | 1719 |
| Approach % | 9.8 | 84.7 | 5.5 | 0.0 | - | - | 11.8 | 74.9 | 13.3 | 0.0 | - | - | 18.9 | 36.2 | 44.9 | 0.0 | - | - | 33.5 | 27.6 | 38.9 | 0.0 | - | - | - |
| Total % | 3.0 | 26.0 | 1.7 | 0.0 | - | 30.7 | 5.3 | 33.7 | 6.0 | 0.0 | - | 45.0 | 2.2 | 4.1 | 5.1 | 0.0 | - | 11.4 | 4.3 | 3.5 | 5.0 | 0.0 | - | 12.9 | - |
| PHF | 0.722 | 0.909 | 0.659 | 0.000 | - | 0.923 | 0.875 | 0.924 | 0.805 | 0.000 | - | 0.935 | 0.771 | 0.740 | 0.815 | 0.000 | - | 0.803 | 0.771 | 0.763 | 0.935 | 0.000 | - | 0.850 | 0.953 |
| Lights | 50 | 433 | 28 | 0 | - | 511 | 89 | 566 | 103 | 0 | - | 758 | 37 | 69 | 84 | 0 | - | 190 | 74 | 55 | 84 | 0 | - | 213 | 1672 |
| % Lights | 96.2 | 96.9 | 96.6 | - | - | 96.8 | 97.8 | 97.6 | 100.0 | - | - | 97.9 | 100.0 | 97.2 | 95.5 | - | - | 96.9 | 100.0 | 90.2 | 97.7 | - | - | 96.4 | 97.3 |
| Mediums | 2 | 7 | 1 | 0 | - | 10 | 1 | 12 | 0 | 0 | - | 13 | 0 | 2 | 2 | 0 | - | 4 | 0 | 5 | 2 | 0 | - | 7 | 34 |
| % Mediums | 3.8 | 1.6 | 3.4 | - | - | 1.9 | 1.1 | 2.1 | 0.0 | - | - | 1.7 | 0.0 | 2.8 | 2.3 | - | - | 2.0 | 0.0 | 8.2 | 2.3 | - | - | 3.2 | 2.0 |
| Articulated Trucks | 0 | 7 | 0 | 0 | - | 7 | 1 | 2 | 0 | 0 | - | 3 | 0 | 0 | 2 | 0 | - | 2 | 0 | 1 | 0 | 0 | - | 1 | 13 |
| % Articulated Trucks | 0.0 | 1.6 | 0.0 | - | - | 1.3 | 1.1 | 0.3 | 0.0 | - | - | 0.4 | 0.0 | 0.0 | 2.3 | - | - | 1.0 | 0.0 | 1.6 | 0.0 | - | - | 0.5 | 0.8 |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada  N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Komoka Road & Glendon Drive
Site Code:
Start Date: 09/13/2018
Page No: 9



## Peak Hour Data

09/13/2018 4:30 PM
Ending At
09/13/2018 5:30 PM

Lights
Mediums
Articulated Trucks
Pedestrians

Komoka Road [N]

| Out | In | Total |
|---|---|---|
| 222 | 213 | 435 |
| 4 | 7 | 11 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |
| **226** | **221** | **447** |

| R | T | L | U | P |
|---|---|---|---|---|
| 84 | 55 | 74 | 0 | 0 |
| 2 | 5 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **86** | **61** | **74** | **0** | **0** |

Glendon Drive [W]

| Out | In | Total |
|---|---|---|
| 687 | 511 | 1198 |
| 14 | 10 | 24 |
| 2 | 7 | 9 |
| 0 | 0 | 0 |
| **703** | **528** | **1231** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 50 | 433 | 28 | 0 |
| 0 | 2 | 7 | 1 | 0 |
| 0 | 0 | 7 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **52** | **447** | **29** | **0** |

Glendon Drive [E]

| Out | In | Total |
|---|---|---|
| 591 | 758 | 1349 |
| 9 | 13 | 22 |
| 9 | 3 | 12 |
| 0 | 0 | 0 |
| **609** | **774** | **1383** |

| R | T | L | U | P |
|---|---|---|---|---|
| 103 | 566 | 89 | 0 | 0 |
| 0 | 12 | 1 | 0 | 0 |
| 0 | 2 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **103** | **580** | **91** | **0** | **0** |

| U | L | T | R | P |
|---|---|---|---|---|
| 0 | 37 | 69 | 84 | 0 |
| 0 | 0 | 2 | 2 | 0 |
| 0 | 0 | 0 | 2 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| **0** | **37** | **71** | **88** | **0** |

| Out | In | Total |
|---|---|---|
| 172 | 190 | 362 |
| 7 | 4 | 11 |
| 2 | 2 | 4 |
| 0 | 0 | 0 |
| **181** | **196** | **377** |

Komoka Road [S]

Turning Movement Peak Hour Data Plot (4:30 PM)

# Appendix B

## Base Year Traffic Operations Reports

## Lanes, Volumes, Timings
## 1: Komoka Road & Oxbow Drive

200272
Existing AM Peak Hour

|  | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  | ✥ |  |  | ✥ |  |  | ✥ |  |  | ✥ |  |
| Traffic Volume (vph) | 1 | 31 | 30 | 41 | 21 | 6 | 15 | 52 | 64 | 10 | 74 | 6 |
| Future Volume (vph) | 1 | 31 | 30 | 41 | 21 | 6 | 15 | 52 | 64 | 10 | 74 | 6 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor |  |  |  |  |  |  |  |  |  |  |  |  |
| Frt |  | 0.934 |  |  | 0.987 |  |  | 0.934 |  |  | 0.990 |  |
| Flt Protected |  | 0.999 |  |  | 0.971 |  |  | 0.994 |  |  | 0.994 |  |
| Satd. Flow (prot) | 0 | 1550 | 0 | 0 | 1649 | 0 | 0 | 1584 | 0 | 0 | 1751 | 0 |
| Flt Permitted |  | 0.999 |  |  | 0.971 |  |  | 0.994 |  |  | 0.994 |  |
| Satd. Flow (perm) | 0 | 1550 | 0 | 0 | 1649 | 0 | 0 | 1584 | 0 | 0 | 1751 | 0 |
| Link Speed (k/h) |  | 50 |  |  | 50 |  |  | 50 |  |  | 50 |  |
| Link Distance (m) |  | 192.1 |  |  | 753.9 |  |  | 1367.0 |  |  | 206.1 |  |
| Travel Time (s) |  | 13.8 |  |  | 54.3 |  |  | 98.4 |  |  | 14.8 |  |
| Confl. Peds. (#/hr) |  |  | 1 | 1 |  |  |  |  | 1 | 1 |  |  |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 27% | 5% | 5% | 50% | 40% | 8% | 5% | 10% | 4% | 17% |
| Adj. Flow (vph) | 1 | 34 | 33 | 45 | 23 | 7 | 16 | 57 | 70 | 11 | 80 | 7 |
| Shared Lane Traffic (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| Lane Group Flow (vph) | 0 | 68 | 0 | 0 | 75 | 0 | 0 | 143 | 0 | 0 | 98 | 0 |
| Sign Control |  | Stop |  |  | Stop |  |  | Free |  |  | Free |  |

| Intersection Summary | |
|---|---|
| Area Type: Other | |
| Control Type: Unsignalized | |
| Intersection Capacity Utilization 27.3% | ICU Level of Service A |
| Analysis Period (min) 15 | |

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## HCM 2010 TWSC
## 1: Komoka Road & Oxbow Drive

200272
Existing AM Peak Hour

| Intersection | |
|---|---|
| Int Delay, s/veh | 4.6 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations |  | ✥ |  |  | ✥ |  |  | ✥ |  |  | ✥ |  |
| Traffic Vol, veh/h | 1 | 31 | 30 | 41 | 21 | 6 | 15 | 52 | 64 | 10 | 74 | 6 |
| Future Vol, veh/h | 1 | 31 | 30 | 41 | 21 | 6 | 15 | 52 | 64 | 10 | 74 | 6 |
| Conflicting Peds, #/hr | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 27 | 5 | 5 | 50 | 40 | 8 | 5 | 10 | 4 | 17 |
| Mvmt Flow | 1 | 34 | 33 | 45 | 23 | 7 | 16 | 57 | 70 | 11 | 80 | 7 |

| Major/Minor | Minor2 |  |  | Minor1 |  |  | Major1 |  |  | Major2 |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 245 | 266 | 85 | 265 | 234 | 93 | 87 | 0 | 0 | 128 | 0 | 0 |
| Stage 1 | 106 | 106 | - | 125 | 125 | - | - | - | - | - | - | - |
| Stage 2 | 139 | 160 | - | 140 | 109 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.1 | 6.5 | 6.47 | 7.15 | 6.55 | 6.7 | 4.5 | - | - | 4.2 | - | - |
| Critical Hdwy Stg 1 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.5 | 4 | 3.543 | 3.545 | 4.045 | 3.75 | 2.56 | - | - | 2.29 | - | - |
| Pot Cap-1 Maneuver | 713 | 643 | 909 | 682 | 661 | 847 | 1301 | - | - | 1410 | - | - |
| Stage 1 | 905 | 811 | - | 872 | 787 | - | - | - | - | - | - | - |
| Stage 2 | 869 | 769 | - | 856 | 799 | - | - | - | - | - | - | - |
| Platoon blocked, % |  |  |  |  |  |  |  | - | - |  | - | - |
| Mov Cap-1 Maneuver | 677 | 629 | 908 | 619 | 646 | 846 | 1301 | - | - | 1409 | - | - |
| Mov Cap-2 Maneuver | 677 | 629 | - | 619 | 646 | - | - | - | - | - | - | - |
| Stage 1 | 893 | 805 | - | 860 | 776 | - | - | - | - | - | - | - |
| Stage 2 | 826 | 758 | - | 784 | 793 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 10.4 | 11.3 | 0.9 | 0.8 |
| HCM LOS | B | B |  |  |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1301 | - | - | 740 | 643 | 1409 | - | - |
| HCM Lane V/C Ratio | 0.013 | - | - | 0.091 | 0.115 | 0.008 | - | - |
| HCM Control Delay (s) | 7.8 | 0 | - | 10.4 | 11.3 | 7.6 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | 0.3 | 0.4 | 0 | - | - |

| | ↗ | → | ← | ↖ | ↘ | ↙ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
| Lane Configurations | | ↰ | ↱ | | Y | |
| Traffic Volume (vph) | 3 | 47 | 43 | 8 | 10 | 9 |
| Future Volume (vph) | 3 | 47 | 43 | 8 | 10 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | | | 0.978 | | 0.936 | |
| Flt Protected | | 0.997 | | | 0.974 | |
| Satd. Flow (prot) | 0 | 1873 | 1771 | 0 | 1628 | 0 |
| Flt Permitted | | 0.997 | | | 0.974 | |
| Satd. Flow (perm) | 0 | 1873 | 1771 | 0 | 1628 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 156.3 | 219.4 | | 163.7 | |
| Travel Time (s) | | 11.3 | 15.8 | | 11.8 | |
| Confl. Peds. (#/hr) | 1 | | | 1 | 1 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 13% | 0% | 11% |
| Adj. Flow (vph) | 3 | 51 | 47 | 9 | 11 | 10 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 54 | 56 | 0 | 21 | 0 |
| Sign Control | | Free | Free | | Stop | |

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 14.9% ICU Level of Service A
Analysis Period (min) 15

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| Intersection | |
|---|---|
| Int Delay, s/veh | 1.6 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↰ | ↱ | | Y | |
| Traffic Vol, veh/h | 3 | 47 | 43 | 8 | 10 | 9 |
| Future Vol, veh/h | 3 | 47 | 43 | 8 | 10 | 9 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 1 | 1 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 2 | 13 | 0 | 11 |
| Mvmt Flow | 3 | 51 | 47 | 9 | 11 | 10 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 57 | 0 | - | 0 | 111 | 53 |
| Stage 1 | - | - | - | - | 53 | - |
| Stage 2 | - | - | - | - | 58 | - |
| Critical Hdwy | 4.1 | - | - | - | 6.4 | 6.31 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.4 | - |
| Follow-up Hdwy | 2.2 | - | - | - | 3.5 | 3.399 |
| Pot Cap-1 Maneuver | 1560 | - | - | - | 891 | 990 |
| Stage 1 | - | - | - | - | 975 | - |
| Stage 2 | - | - | - | - | 970 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1559 | - | - | - | 887 | 989 |
| Mov Cap-2 Maneuver | - | - | - | - | 887 | - |
| Stage 1 | - | - | - | - | 972 | - |
| Stage 2 | - | - | - | - | 969 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0 | 8.9 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1559 | - | - | - | 933 |
| HCM Lane V/C Ratio | 0.002 | - | - | - | 0.022 |
| HCM Control Delay (s) | 7.3 | 0 | - | - | 8.9 |
| HCM Lane LOS | A | A | - | - | A |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.1 |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↱ |  | ↰ | ↑ | ↱ | ↰ | ↱ |  | ↰ | ↱ |  |
| Traffic Volume (vph) | 76 | 498 | 16 | 60 | 340 | 37 | 32 | 34 | 95 | 86 | 36 | 89 |
| Future Volume (vph) | 76 | 498 | 16 | 60 | 340 | 37 | 32 | 34 | 95 | 86 | 36 | 89 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 30.0 |  | 0.0 | 40.0 |  | 50.0 | 25.0 |  | 0.0 | 25.0 |  | 0.0 |
| Storage Lanes | 1 |  | 0 | 1 |  | 1 | 1 |  | 0 | 1 |  | 0 |
| Taper Length (m) | 5.0 |  |  | 5.0 |  |  | 5.0 |  |  | 5.0 |  |  |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt |  | 0.995 |  |  |  | 0.850 |  | 0.890 |  |  | 0.893 |  |
| Flt Protected | 0.950 |  |  | 0.950 |  |  | 0.950 |  |  | 0.950 |  |  |
| Satd. Flow (prot) | 1566 | 1797 | 0 | 1623 | 1807 | 1342 | 1580 | 1515 | 0 | 1684 | 1583 | 0 |
| Flt Permitted | 0.511 |  |  | 0.364 |  |  | 0.670 |  |  | 0.668 |  |  |
| Satd. Flow (perm) | 842 | 1797 | 0 | 622 | 1807 | 1342 | 1114 | 1515 | 0 | 1184 | 1583 | 0 |
| Right Turn on Red |  |  | Yes |  |  | Yes |  |  | Yes |  |  | Yes |
| Satd. Flow (RTOR) |  | 4 |  |  |  | 42 |  | 103 |  |  | 97 |  |
| Link Speed (k/h) |  | 50 |  |  | 50 |  |  | 50 |  |  | 50 |  |
| Link Distance (m) |  | 269.3 |  |  | 221.8 |  |  | 490.1 |  |  | 1367.0 |  |
| Travel Time (s) |  | 19.4 |  |  | 16.0 |  |  | 35.3 |  |  | 98.4 |  |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 14% | 4% | 6% | 10% | 4% | 19% | 13% | 3% | 13% | 6% | 6% | 6% |
| Adj. Flow (vph) | 83 | 541 | 17 | 65 | 370 | 40 | 35 | 37 | 103 | 93 | 39 | 97 |
| Shared Lane Traffic (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| Lane Group Flow (vph) | 83 | 558 | 0 | 65 | 370 | 40 | 35 | 140 | 0 | 93 | 136 | 0 |
| Turn Type | Perm | NA |  | Perm | NA | Perm | Perm | NA |  | Perm | NA |  |
| Protected Phases |  | 4 |  |  | 8 |  |  | 2 |  |  | 6 |  |
| Permitted Phases | 4 |  |  | 8 |  | 8 | 2 |  |  | 6 |  |  |
| Detector Phase | 4 | 4 |  | 8 | 8 | 8 | 2 | 2 |  | 6 | 6 |  |
| Switch Phase |  |  |  |  |  |  |  |  |  |  |  |  |
| Minimum Initial (s) | 20.0 | 20.0 |  | 20.0 | 20.0 | 20.0 | 15.0 | 15.0 |  | 15.0 | 15.0 |  |
| Minimum Split (s) | 26.0 | 26.0 |  | 26.0 | 26.0 | 26.0 | 21.0 | 21.0 |  | 21.0 | 21.0 |  |
| Total Split (s) | 51.0 | 51.0 |  | 51.0 | 51.0 | 51.0 | 27.0 | 27.0 |  | 27.0 | 27.0 |  |
| Total Split (%) | 65.4% | 65.4% |  | 65.4% | 65.4% | 65.4% | 34.6% | 34.6% |  | 34.6% | 34.6% |  |
| Yellow Time (s) | 4.0 | 4.0 |  | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |  | 4.0 | 4.0 |  |
| All-Red Time (s) | 2.0 | 2.0 |  | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |  | 2.0 | 2.0 |  |
| Lost Time Adjust (s) | -2.0 | -2.0 |  | -2.0 | -2.0 | -2.0 | -2.0 | -2.0 |  | -2.0 | -2.0 |  |
| Total Lost Time (s) | 4.0 | 4.0 |  | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |  | 4.0 | 4.0 |  |
| Lead/Lag |  |  |  |  |  |  |  |  |  |  |  |  |
| Lead-Lag Optimize? |  |  |  |  |  |  |  |  |  |  |  |  |
| Recall Mode | Ped | Ped |  | Ped | Ped | Ped | None | None |  | None | None |  |
| Act Effct Green (s) | 29.6 | 29.6 |  | 29.6 | 29.6 | 29.6 | 17.3 | 17.3 |  | 17.3 | 17.3 |  |
| Actuated g/C Ratio | 0.60 | 0.60 |  | 0.60 | 0.60 | 0.60 | 0.35 | 0.35 |  | 0.35 | 0.35 |  |
| v/c Ratio | 0.16 | 0.51 |  | 0.17 | 0.34 | 0.05 | 0.09 | 0.23 |  | 0.22 | 0.22 |  |
| Control Delay | 7.7 | 10.2 |  | 8.1 | 8.2 | 2.4 | 14.0 | 6.9 |  | 15.2 | 7.0 |  |
| Queue Delay | 0.0 | 0.0 |  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |  | 0.0 | 0.0 |  |
| Total Delay | 7.7 | 10.2 |  | 8.1 | 8.2 | 2.4 | 14.0 | 6.9 |  | 15.2 | 7.0 |  |
| LOS | A | B |  | A | A | A | B | A |  | B | A |  |
| Approach Delay |  | 9.9 |  |  | 7.7 |  |  | 8.3 |  |  | 10.3 |  |
| Approach LOS |  | A |  |  | A |  |  | A |  |  | B |  |
| Queue Length 50th (m) | 3.7 | 31.7 |  | 2.9 | 18.5 | 0.0 | 1.8 | 1.9 |  | 5.1 | 2.0 |  |

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| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Queue Length 95th (m) | 9.1 | 53.7 |  | 8.0 | 31.7 | 2.8 | 8.3 | 13.5 |  | 17.6 | 13.4 |  |
| Internal Link Dist (m) |  | 245.3 |  |  | 197.8 |  |  | 466.1 |  |  | 1343.0 |  |
| Turn Bay Length (m) | 30.0 |  |  | 40.0 |  | 50.0 | 25.0 |  |  | 25.0 |  |  |
| Base Capacity (vph) | 795 | 1697 |  | 587 | 1707 | 1270 | 530 | 775 |  | 564 | 805 |  |
| Starvation Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Spillback Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Storage Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Reduced v/c Ratio | 0.10 | 0.33 |  | 0.11 | 0.22 | 0.03 | 0.07 | 0.18 |  | 0.16 | 0.17 |  |

Intersection Summary

Area Type: Other
Cycle Length: 78
Actuated Cycle Length: 49
Natural Cycle: 50
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 9.1 Intersection LOS: A
Intersection Capacity Utilization 82.2% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Komoka Road & Glendon Drive

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ✥ | | | ✥ | | | ✥ | | | ✥ | |
| Traffic Volume (vph) | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Future Volume (vph) | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.937 | | | 0.988 | | | 0.965 | | | 0.989 | |
| Flt Protected | | 0.996 | | | 0.974 | | | 0.993 | | | 0.998 | |
| Satd. Flow (prot) | 0 | 1664 | 0 | 0 | 1765 | 0 | 0 | 1713 | 0 | 0 | 1684 | 0 |
| Flt Permitted | | 0.996 | | | 0.974 | | | 0.993 | | | 0.998 | |
| Satd. Flow (perm) | 0 | 1664 | 0 | 0 | 1765 | 0 | 0 | 1713 | 0 | 0 | 1684 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 192.1 | | | 753.9 | | | 1367.0 | | | 206.1 | |
| Travel Time (s) | | 13.8 | | | 54.3 | | | 98.4 | | | 14.8 | |
| Confl. Peds. (#/hr) | | | | | | | | | 5 | 5 | | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 20% | 0% | 8% | 3% | 0% | 9% | 10% | 4% | 5% | 0% | 10% | 17% |
| Adj. Flow (vph) | 5 | 27 | 28 | 72 | 50 | 12 | 23 | 98 | 42 | 4 | 78 | 7 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 60 | 0 | 0 | 134 | 0 | 0 | 163 | 0 | 0 | 89 | 0 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 35.2% ICU Level of Service A
Analysis Period (min) 15

## 1: Komoka Road & Oxbow Drive

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Vol, veh/h | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Future Vol, veh/h | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 20 | 0 | 8 | 3 | 0 | 9 | 10 | 4 | 5 | 0 | 10 | 17 |
| Mvmt Flow | 5 | 27 | 28 | 72 | 50 | 12 | 23 | 98 | 42 | 4 | 78 | 7 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 286 | 281 | 82 | 287 | 263 | 124 | 85 | 0 | 0 | 145 | 0 | 0 |
| Stage 1 | 90 | 90 | - | 170 | 170 | - | - | - | - | - | - | - |
| Stage 2 | 196 | 191 | - | 117 | 93 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.3 | 6.5 | 6.28 | 7.13 | 6.5 | 6.29 | 4.2 | - | - | 4.1 | - | - |
| Critical Hdwy Stg 1 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.68 | 4 | 3.372 | 3.527 | 4 | 3.381 | 2.29 | - | - | 2.2 | - | - |
| Pot Cap-1 Maneuver | 632 | 631 | 961 | 663 | 646 | 908 | 1462 | - | - | 1450 | - | - |
| Stage 1 | 875 | 824 | - | 830 | 762 | - | - | - | - | - | - | - |
| Stage 2 | 766 | 746 | - | 885 | 822 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 577 | 616 | 961 | 610 | 630 | 904 | 1462 | - | - | 1444 | - | - |
| Mov Cap-2 Maneuver | 577 | 616 | - | 610 | 630 | - | - | - | - | - | - | - |
| Stage 1 | 860 | 822 | - | 813 | 746 | - | - | - | - | - | - | - |
| Stage 2 | 693 | 730 | - | 828 | 820 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 10.3 | 12.2 | 1.1 | 0.4 |
| HCM LOS | B | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1462 | - | - | 734 | 636 | 1444 | - | - |
| HCM Lane V/C Ratio | 0.016 | - | - | 0.083 | 0.21 | 0.003 | - | - |
| HCM Control Delay (s) | 7.5 | 0 | - | 10.3 | 12.2 | 7.5 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | 0.3 | 0.8 | 0 | - | - |

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## 2: Oxbow Drive & Union Avenue

| | ↗ | → | ← | ↖ | ↘ | ↙ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
| Lane Configurations | | ↰ | ↱ | | ⋎ | |
| Traffic Volume (vph) | 8 | 83 | 88 | 17 | 17 | 8 |
| Future Volume (vph) | 8 | 83 | 88 | 17 | 17 | 8 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | | | 0.979 | | 0.955 | |
| Flt Protected | | 0.995 | | | 0.968 | |
| Satd. Flow (prot) | 0 | 1815 | 1824 | 0 | 1670 | 0 |
| Flt Permitted | | 0.995 | | | 0.968 | |
| Satd. Flow (perm) | 0 | 1815 | 1824 | 0 | 1670 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 156.3 | 219.4 | | 163.7 | |
| Travel Time (s) | | 11.3 | 15.8 | | 11.8 | |
| Confl. Peds. (#/hr) | 1 | | | 1 | 1 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 13% | 2% | 1% | 0% | 6% | 0% |
| Adj. Flow (vph) | 9 | 90 | 96 | 18 | 18 | 9 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 99 | 114 | 0 | 27 | 0 |
| Sign Control | | Free | Free | | Stop | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 21.0% ICU Level of Service A

Analysis Period (min) 15

## HCM 2010 TWSC
## 2: Oxbow Drive & Union Avenue

200272
Existing PM Peak Hour

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.4 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑ | ↑↱ | | ↰↱ | |
| Traffic Vol, veh/h | 8 | 83 | 88 | 17 | 17 | 8 |
| Future Vol, veh/h | 8 | 83 | 88 | 17 | 17 | 8 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 1 | 1 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 13 | 2 | 1 | 0 | 6 | 0 |
| Mvmt Flow | 9 | 90 | 96 | 18 | 18 | 9 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 115 | 0 | - | 0 | 215 | 106 |
| Stage 1 | - | - | - | - | 106 | - |
| Stage 2 | - | - | - | - | 109 | - |
| Critical Hdwy | 4.23 | - | - | - | 6.46 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.46 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.46 | - |
| Follow-up Hdwy | 2.317 | - | - | - | 3.554 | 3.3 |
| Pot Cap-1 Maneuver | 1408 | - | - | - | 764 | 954 |
| Stage 1 | - | - | - | - | 908 | - |
| Stage 2 | - | - | - | - | 906 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1407 | - | - | - | 757 | 953 |
| Mov Cap-2 Maneuver | - | - | - | - | 757 | - |
| Stage 1 | - | - | - | - | 901 | - |
| Stage 2 | - | - | - | - | 905 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.7 | 0 | 9.6 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1407 | - | - | - | 810 |
| HCM Lane V/C Ratio | 0.006 | - | - | - | 0.034 |
| HCM Control Delay (s) | 7.6 | 0 | - | - | 9.6 |
| HCM Lane LOS | A | A | - | - | A |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.1 |

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## Lanes, Volumes, Timings
## 3: Komoka Road & Glendon Drive

200272
Existing PM Peak Hour

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | ↰ | ↑↱ | | ↰ | ↑ | ↱ | ↰ | ↑↱ | | ↰ | ↑↱ | |
| Traffic Volume (vph) | 52 | 447 | 29 | 91 | 580 | 103 | 37 | 71 | 88 | 74 | 61 | 86 |
| Future Volume (vph) | 52 | 447 | 29 | 91 | 580 | 103 | 37 | 71 | 88 | 74 | 61 | 86 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 30.0 | | 0.0 | 40.0 | | 50.0 | 25.0 | | 0.0 | 25.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 5.0 | | | 5.0 | | | 5.0 | | | 5.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.991 | | | | 0.850 | | 0.917 | | | 0.912 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1716 | 1808 | 0 | 1750 | 1842 | 1597 | 1785 | 1655 | 0 | 1785 | 1627 | 0 |
| Flt Permitted | 0.290 | | | 0.375 | | | 0.656 | | | 0.646 | | |
| Satd. Flow (perm) | 524 | 1808 | 0 | 691 | 1842 | 1597 | 1233 | 1655 | 0 | 1214 | 1627 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 8 | | | | 112 | | 82 | | | 92 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 269.3 | | | 221.8 | | | 490.1 | | | 1367.0 | |
| Travel Time (s) | | 19.4 | | | 16.0 | | | 35.3 | | | 98.4 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 4% | 3% | 3% | 2% | 2% | 0% | 0% | 3% | 5% | 0% | 10% | 2% |
| Adj. Flow (vph) | 57 | 486 | 32 | 99 | 630 | 112 | 40 | 77 | 96 | 80 | 66 | 93 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 57 | 518 | 0 | 99 | 630 | 112 | 40 | 173 | 0 | 80 | 159 | 0 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | 8 | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 15.0 | 15.0 | | 15.0 | 15.0 | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 21.0 | 21.0 | | 21.0 | 21.0 | |
| Total Split (s) | 51.0 | 51.0 | | 51.0 | 51.0 | 51.0 | 27.0 | 27.0 | | 27.0 | 27.0 | |
| Total Split (%) | 65.4% | 65.4% | | 65.4% | 65.4% | 65.4% | 34.6% | 34.6% | | 34.6% | 34.6% | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | -2.0 | -2.0 | | -2.0 | -2.0 | -2.0 | -2.0 | -2.0 | | -2.0 | -2.0 | |
| Total Lost Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Recall Mode | Ped | Ped | | Ped | Ped | Ped | None | None | | None | None | |
| Act Effct Green (s) | 30.0 | 30.0 | | 30.0 | 30.0 | 30.0 | 17.2 | 17.2 | | 17.2 | 17.2 | |
| Actuated g/C Ratio | 0.54 | 0.54 | | 0.54 | 0.54 | 0.54 | 0.31 | 0.31 | | 0.31 | 0.31 | |
| v/c Ratio | 0.20 | 0.53 | | 0.26 | 0.63 | 0.12 | 0.10 | 0.30 | | 0.21 | 0.28 | |
| Control Delay | 8.2 | 10.0 | | 8.7 | 12.0 | 1.7 | 16.3 | 10.7 | | 17.3 | 9.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 8.2 | 10.0 | | 8.7 | 12.0 | 1.7 | 16.3 | 10.7 | | 17.3 | 9.3 | |
| LOS | A | B | | A | B | A | B | B | | B | A | |
| Approach Delay | | 9.9 | | | 10.2 | | | 11.7 | | | 12.0 | |
| Approach LOS | | A | | | B | | | B | | | B | |
| Queue Length 50th (m) | 2.6 | 28.1 | | 4.6 | 37.9 | 0.0 | 2.4 | 5.6 | | 5.0 | 4.1 | |

## 3: Komoka Road & Glendon Drive

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Queue Length 95th (m) | 7.2 | 46.4 |  | 11.1 | 61.8 | 4.5 | 10.1 | 22.1 |  | 17.3 | 18.8 |  |
| Internal Link Dist (m) |  | 245.3 |  |  | 197.8 |  |  | 466.1 |  |  | 1343.0 |  |
| Turn Bay Length (m) | 30.0 |  |  | 40.0 |  | 50.0 | 25.0 |  |  | 25.0 |  |  |
| Base Capacity (vph) | 450 | 1556 |  | 594 | 1584 | 1389 | 518 | 744 |  | 511 | 738 |  |
| Starvation Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Spillback Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Storage Cap Reductn | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |  |
| Reduced v/c Ratio | 0.13 | 0.33 |  | 0.17 | 0.40 | 0.08 | 0.08 | 0.23 |  | 0.16 | 0.22 |  |

Intersection Summary

Area Type: Other
Cycle Length: 78
Actuated Cycle Length: 55.3
Natural Cycle: 50
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 10.5 Intersection LOS: B
Intersection Capacity Utilization 85.5% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Komoka Road & Glendon Drive

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## 4: Street A & Oxbow Drive

| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↱ |  |  | ↰ | Y |  |
| Traffic Volume (vph) | 68 | 0 | 0 | 123 | 0 | 0 |
| Future Volume (vph) | 68 | 0 | 0 | 123 | 0 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt |  |  |  |  |  |  |
| Flt Protected |  |  |  |  |  |  |
| Satd. Flow (prot) | 1842 | 0 | 0 | 1842 | 1842 | 0 |
| Flt Permitted |  |  |  |  |  |  |
| Satd. Flow (perm) | 1842 | 0 | 0 | 1842 | 1842 | 0 |
| Link Speed (k/h) | 50 |  |  | 50 | 50 |  |
| Link Distance (m) | 753.9 |  |  | 156.3 | 136.8 |  |
| Travel Time (s) | 54.3 |  |  | 11.3 | 9.8 |  |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 74 | 0 | 0 | 134 | 0 | 0 |
| Shared Lane Traffic (%) |  |  |  |  |  |  |
| Lane Group Flow (vph) | 74 | 0 | 0 | 134 | 0 | 0 |
| Sign Control | Free |  |  | Free | Stop |  |

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 9.8% ICU Level of Service A
Analysis Period (min) 15

| Intersection | |
|---|---|
| Int Delay, s/veh | 0 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↱ | | | ↰ | Y | |
| Traffic Vol, veh/h | 68 | 0 | 0 | 123 | 0 | 0 |
| Future Vol, veh/h | 68 | 0 | 0 | 123 | 0 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 74 | 0 | 0 | 134 | 0 | 0 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 74 | 0 | 208 | 74 |
| Stage 1 | - | - | - | - | 74 | - |
| Stage 2 | - | - | - | - | 134 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1526 | - | 780 | 988 |
| Stage 1 | - | - | - | - | 949 | - |
| Stage 2 | - | - | - | - | 892 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1526 | - | 780 | 988 |
| Mov Cap-2 Maneuver | - | - | - | - | 780 | - |
| Stage 1 | - | - | - | - | 949 | - |
| Stage 2 | - | - | - | - | 892 | - |

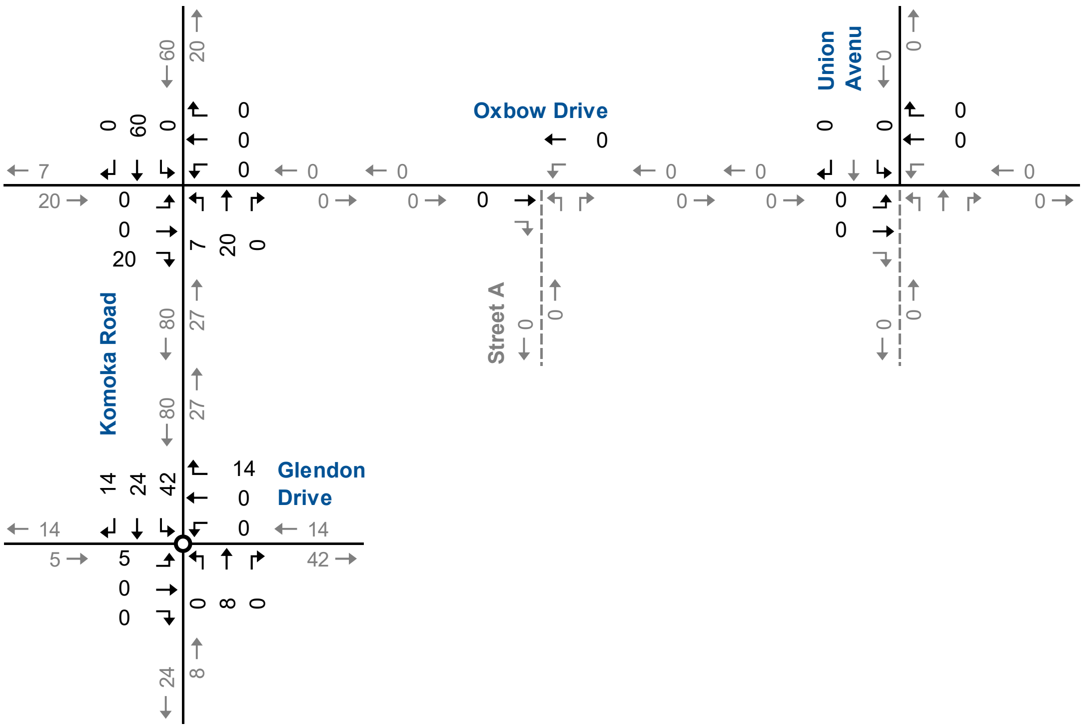
| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | 0 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | - | 1526 | - |
| HCM Lane V/C Ratio | - | - | - | - | - |
| HCM Control Delay (s) | 0 | - | - | 0 | - |
| HCM Lane LOS | A | - | - | A | - |
| HCM 95th %tile Q(veh) | - | - | - | 0 | - |

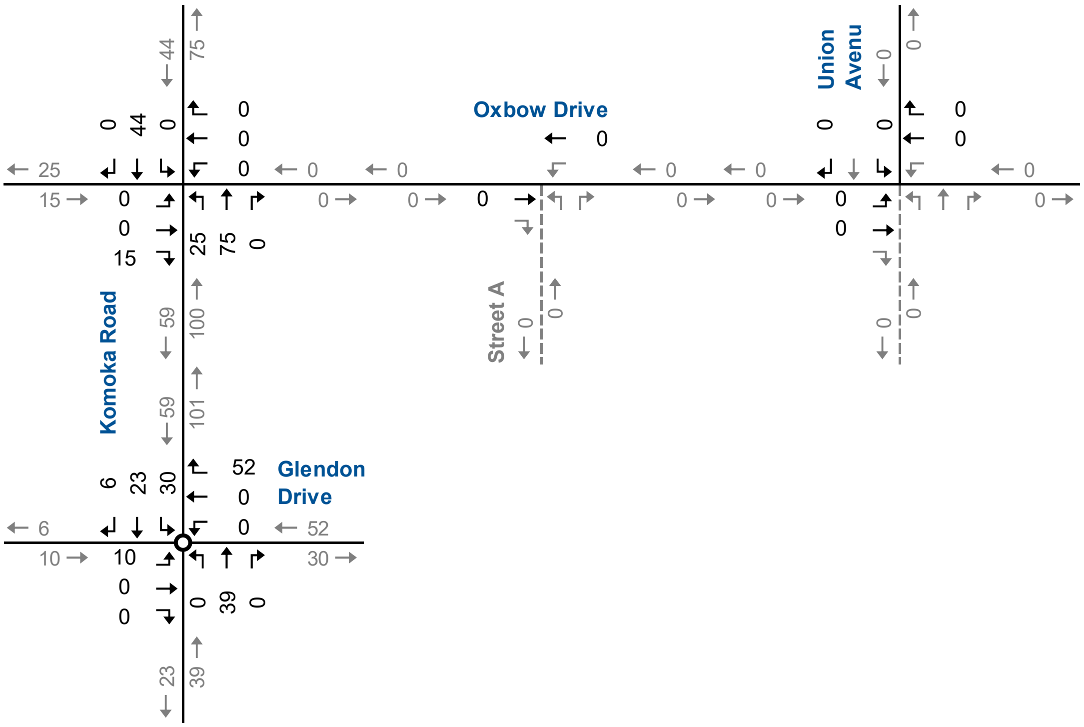
# Appendix C

## Background Development Traffic Forecasts

### AM Peak Hour



### PM Peak Hour



## Background Development Traffic

**Appendix C**

# Appendix D

## Year 2029 Background Traffic Operations Reports

|  | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  | ✣ |  |  | ✣ |  |  | ✣ |  |  | ✣ |  |
| Traffic Volume (vph) | 1 | 37 | 55 | 48 | 25 | 7 | 24 | 81 | 76 | 11 | 148 | 7 |
| Future Volume (vph) | 1 | 37 | 55 | 48 | 25 | 7 | 24 | 81 | 76 | 11 | 148 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor |  |  |  |  |  |  |  |  |  |  |  |  |
| Frt |  | 0.920 |  |  | 0.988 |  |  | 0.943 |  |  | 0.994 |  |
| Flt Protected |  |  |  |  | 0.971 |  |  | 0.993 |  |  | 0.997 |  |
| Satd. Flow (prot) | 0 | 1490 | 0 | 0 | 1652 | 0 | 0 | 1586 | 0 | 0 | 1774 | 0 |
| Flt Permitted |  |  |  |  | 0.971 |  |  | 0.993 |  |  | 0.997 |  |
| Satd. Flow (perm) | 0 | 1490 | 0 | 0 | 1652 | 0 | 0 | 1586 | 0 | 0 | 1774 | 0 |
| Link Speed (k/h) |  | 50 |  |  | 50 |  |  | 50 |  |  | 50 |  |
| Link Distance (m) |  | 192.1 |  |  | 753.9 |  |  | 1367.0 |  |  | 206.1 |  |
| Travel Time (s) |  | 13.8 |  |  | 54.3 |  |  | 98.4 |  |  | 14.8 |  |
| Confl. Peds. (#/hr) |  |  | 1 | 1 |  |  |  |  | 1 | 1 |  |  |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 27% | 5% | 5% | 50% | 40% | 8% | 5% | 10% | 4% | 17% |
| Adj. Flow (vph) | 1 | 40 | 60 | 52 | 27 | 8 | 26 | 88 | 83 | 12 | 161 | 8 |
| Shared Lane Traffic (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| Lane Group Flow (vph) | 0 | 101 | 0 | 0 | 87 | 0 | 0 | 197 | 0 | 0 | 181 | 0 |
| Sign Control |  | Stop |  |  | Stop |  |  | Free |  |  | Free |  |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 34.5% ICU Level of Service A

Analysis Period (min) 15

---

| Intersection |  |
|---|---|
| Int Delay, s/veh | 4.7 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations |  | ✣ |  |  | ✣ |  |  | ✣ |  |  | ✣ |  |
| Traffic Vol, veh/h | 1 | 37 | 55 | 48 | 25 | 7 | 24 | 81 | 76 | 11 | 148 | 7 |
| Future Vol, veh/h | 1 | 37 | 55 | 48 | 25 | 7 | 24 | 81 | 76 | 11 | 148 | 7 |
| Conflicting Peds, #/hr | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 27 | 5 | 5 | 50 | 40 | 8 | 5 | 10 | 4 | 17 |
| Mvmt Flow | 1 | 40 | 60 | 52 | 27 | 8 | 26 | 88 | 83 | 12 | 161 | 8 |

| Major/Minor | Minor2 |  |  | Minor1 |  |  | Major1 |  |  | Major2 |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 388 | 413 | 166 | 423 | 376 | 131 | 169 | 0 | 0 | 172 | 0 | 0 |
| Stage 1 | 189 | 189 | - | 183 | 183 | - | - | - | - | - | - | - |
| Stage 2 | 199 | 224 | - | 240 | 193 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.1 | 6.5 | 6.47 | 7.15 | 6.55 | 6.7 | 4.5 | - | - | 4.2 | - | - |
| Critical Hdwy Stg 1 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.5 | 4 | 3.543 | 3.545 | 4.045 | 3.75 | 2.56 | - | - | 2.29 | - | - |
| Pot Cap-1 Maneuver | 574 | 532 | 817 | 536 | 551 | 805 | 1208 | - | - | 1358 | - | - |
| Stage 1 | 817 | 748 | - | 812 | 743 | - | - | - | - | - | - | - |
| Stage 2 | 807 | 722 | - | 757 | 735 | - | - | - | - | - | - | - |
| Platoon blocked, % |  |  |  |  |  |  |  | - | - |  | - | - |
| Mov Cap-1 Maneuver | 533 | 513 | 816 | 455 | 532 | 804 | 1208 | - | - | 1357 | - | - |
| Mov Cap-2 Maneuver | 533 | 513 | - | 455 | 532 | - | - | - | - | - | - | - |
| Stage 1 | 797 | 741 | - | 792 | 724 | - | - | - | - | - | - | - |
| Stage 2 | 751 | 704 | - | 656 | 728 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 11.5 | 13.8 | 1.1 | 0.5 |
| HCM LOS | B | B |  |  |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1208 | - | - | 658 | 496 | 1357 | - | - |
| HCM Lane V/C Ratio | 0.022 | - | - | 0.154 | 0.175 | 0.009 | - | - |
| HCM Control Delay (s) | 8 | 0 | - | 11.5 | 13.8 | 7.7 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0.1 | - | - | 0.5 | 0.6 | 0 | - | - |

## Lanes, Volumes, Timings
## 2: Oxbow Drive & Union Avenue

200272
2029 Background AM Peak Hour

| | ↗ | → | ← | ↖ | ↘ | ↙ |
|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
| Lane Configurations | | ↰ | ↱ | | Y | |
| Traffic Volume (vph) | 3 | 56 | 51 | 9 | 11 | 10 |
| Future Volume (vph) | 3 | 56 | 51 | 9 | 11 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | | | 0.979 | | 0.935 | |
| Flt Protected | | 0.998 | | | 0.975 | |
| Satd. Flow (prot) | 0 | 1875 | 1774 | 0 | 1627 | 0 |
| Flt Permitted | | 0.998 | | | 0.975 | |
| Satd. Flow (perm) | 0 | 1875 | 1774 | 0 | 1627 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 156.3 | 219.4 | | 163.7 | |
| Travel Time (s) | | 11.3 | 15.8 | | 11.8 | |
| Confl. Peds. (#/hr) | 1 | | | 1 | 1 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 13% | 0% | 11% |
| Adj. Flow (vph) | 3 | 61 | 55 | 10 | 12 | 11 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 64 | 65 | 0 | 23 | 0 |
| Sign Control | | Free | Free | | Stop | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.4% ICU Level of Service A

Analysis Period (min) 15

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## HCM 2010 TWSC
## 2: Oxbow Drive & Union Avenue

200272
2029 Background AM Peak Hour

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.5 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↰ | ↱ | | Y | |
| Traffic Vol, veh/h | 3 | 56 | 51 | 9 | 11 | 10 |
| Future Vol, veh/h | 3 | 56 | 51 | 9 | 11 | 10 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 1 | 1 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 2 | 13 | 0 | 11 |
| Mvmt Flow | 3 | 61 | 55 | 10 | 12 | 11 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 66 | 0 | - | 0 | 129 | 61 |
| Stage 1 | - | - | - | - | 61 | - |
| Stage 2 | - | - | - | - | 68 | - |
| Critical Hdwy | 4.1 | - | - | - | 6.4 | 6.31 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.4 | - |
| Follow-up Hdwy | 2.2 | - | - | - | 3.5 | 3.399 |
| Pot Cap-1 Maneuver | 1549 | - | - | - | 870 | 979 |
| Stage 1 | - | - | - | - | 967 | - |
| Stage 2 | - | - | - | - | 960 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1548 | - | - | - | 867 | 978 |
| Mov Cap-2 Maneuver | - | - | - | - | 867 | - |
| Stage 1 | - | - | - | - | 964 | - |
| Stage 2 | - | - | - | - | 959 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.4 | 0 | 9 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1548 | - | - | - | 917 |
| HCM Lane V/C Ratio | 0.002 | - | - | - | 0.025 |
| HCM Control Delay (s) | 7.3 | 0 | - | - | 9 |
| HCM Lane LOS | A | A | - | - | A |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.1 |

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Volume (vph) | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Future Volume (vph) | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.937 | | | 0.988 | | | 0.965 | | | 0.989 | |
| Flt Protected | | 0.996 | | | 0.974 | | | 0.993 | | | 0.998 | |
| Satd. Flow (prot) | 0 | 1664 | 0 | 0 | 1765 | 0 | 0 | 1713 | 0 | 0 | 1684 | 0 |
| Flt Permitted | | 0.996 | | | 0.974 | | | 0.993 | | | 0.998 | |
| Satd. Flow (perm) | 0 | 1664 | 0 | 0 | 1765 | 0 | 0 | 1713 | 0 | 0 | 1684 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 192.1 | | | 753.9 | | | 1367.0 | | | 206.1 | |
| Travel Time (s) | | 13.8 | | | 54.3 | | | 98.4 | | | 14.8 | |
| Confl. Peds. (#/hr) | | | | | | | | | 5 | 5 | | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 20% | 0% | 8% | 3% | 0% | 9% | 10% | 4% | 5% | 0% | 10% | 17% |
| Adj. Flow (vph) | 5 | 27 | 28 | 72 | 50 | 12 | 23 | 98 | 42 | 4 | 78 | 7 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 60 | 0 | 0 | 134 | 0 | 0 | 163 | 0 | 0 | 89 | 0 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

## Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 35.2% ICU Level of Service A

Analysis Period (min) 15

---

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Vol, veh/h | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Future Vol, veh/h | 5 | 25 | 26 | 66 | 46 | 11 | 21 | 90 | 39 | 4 | 72 | 6 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 20 | 0 | 8 | 3 | 0 | 9 | 10 | 4 | 5 | 0 | 10 | 17 |
| Mvmt Flow | 5 | 27 | 28 | 72 | 50 | 12 | 23 | 98 | 42 | 4 | 78 | 7 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 286 | 281 | 82 | 287 | 263 | 124 | 85 | 0 | 0 | 145 | 0 | 0 |
| Stage 1 | 90 | 90 | - | 170 | 170 | - | - | - | - | - | - | - |
| Stage 2 | 196 | 191 | - | 117 | 93 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.3 | 6.5 | 6.28 | 7.13 | 6.5 | 6.29 | 4.2 | - | - | 4.1 | - | - |
| Critical Hdwy Stg 1 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.68 | 4 | 3.372 | 3.527 | 4 | 3.381 | 2.29 | - | - | 2.2 | - | - |
| Pot Cap-1 Maneuver | 632 | 631 | 961 | 663 | 646 | 908 | 1462 | - | - | 1450 | - | - |
| Stage 1 | 875 | 824 | - | 830 | 762 | - | - | - | - | - | - | - |
| Stage 2 | 766 | 746 | - | 885 | 822 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 577 | 616 | 961 | 610 | 630 | 904 | 1462 | - | - | 1444 | - | - |
| Mov Cap-2 Maneuver | 577 | 616 | - | 610 | 630 | - | - | - | - | - | - | - |
| Stage 1 | 860 | 822 | - | 813 | 746 | - | - | - | - | - | - | - |
| Stage 2 | 693 | 730 | - | 828 | 820 | - | - | - | - | - | - | - |

| Approach | EB | | | WB | | | NB | | | SB |
|---|---|---|---|---|---|---|---|---|---|---|
| HCM Control Delay, s | 10.3 | | | 12.2 | | | 1.1 | | | 0.4 |
| HCM LOS | B | | | B | | | | | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1462 | - | - | 734 | 636 | 1444 | - | - |
| HCM Lane V/C Ratio | 0.016 | - | - | 0.083 | 0.21 | 0.003 | - | - |
| HCM Control Delay (s) | 7.5 | 0 | - | 10.3 | 12.2 | 7.5 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | 0.3 | 0.8 | 0 | - | - |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↰ | ↱ | | ↲↳ | |
| Traffic Volume (vph) | 8 | 83 | 88 | 17 | 17 | 8 |
| Future Volume (vph) | 8 | 83 | 88 | 17 | 17 | 8 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | | | 0.979 | | 0.955 | |
| Flt Protected | | 0.995 | | | 0.968 | |
| Satd. Flow (prot) | 0 | 1815 | 1824 | 0 | 1670 | 0 |
| Flt Permitted | | 0.995 | | | 0.968 | |
| Satd. Flow (perm) | 0 | 1815 | 1824 | 0 | 1670 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 156.3 | 219.4 | | 163.7 | |
| Travel Time (s) | | 11.3 | 15.8 | | 11.8 | |
| Confl. Peds. (#/hr) | 1 | | | 1 | 1 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 13% | 2% | 1% | 0% | 6% | 0% |
| Adj. Flow (vph) | 9 | 90 | 96 | 18 | 18 | 9 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 99 | 114 | 0 | 27 | 0 |
| Sign Control | | Free | Free | | Stop | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 21.0% ICU Level of Service A

Analysis Period (min) 15

---

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.4 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↰ | ↱ | | ↲↳ | |
| Traffic Vol, veh/h | 8 | 83 | 88 | 17 | 17 | 8 |
| Future Vol, veh/h | 8 | 83 | 88 | 17 | 17 | 8 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 1 | 1 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 0 | 0 | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 13 | 2 | 1 | 0 | 6 | 0 |
| Mvmt Flow | 9 | 90 | 96 | 18 | 18 | 9 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 115 | 0 | - | 0 | 215 | 106 |
| Stage 1 | - | - | - | - | 106 | - |
| Stage 2 | - | - | - | - | 109 | - |
| Critical Hdwy | 4.23 | - | - | - | 6.46 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.46 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.46 | - |
| Follow-up Hdwy | 2.317 | - | - | - | 3.554 | 3.3 |
| Pot Cap-1 Maneuver | 1408 | - | - | - | 764 | 954 |
| Stage 1 | - | - | - | - | 908 | - |
| Stage 2 | - | - | - | - | 906 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 1407 | - | - | - | 757 | 953 |
| Mov Cap-2 Maneuver | - | - | - | - | 757 | - |
| Stage 1 | - | - | - | - | 901 | - |
| Stage 2 | - | - | - | - | 905 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.7 | 0 | 9.6 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1407 | - | - | - | 810 |
| HCM Lane V/C Ratio | 0.006 | - | - | - | 0.034 |
| HCM Control Delay (s) | 7.6 | 0 | - | - | 9.6 |
| HCM Lane LOS | A | A | - | - | A |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0.1 |

# Appendix E

## Year 2029 Total Traffic Operations Reports

| | ↰ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Volume (vph) | 1 | 38 | 55 | 62 | 28 | 8 | 24 | 81 | 81 | 11 | 148 | 7 |
| Future Volume (vph) | 1 | 38 | 55 | 62 | 28 | 8 | 24 | 81 | 81 | 11 | 148 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.921 | | | 0.989 | | | 0.941 | | | 0.994 | |
| Flt Protected | | | | | 0.969 | | | 0.994 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1493 | 0 | 0 | 1655 | 0 | 0 | 1586 | 0 | 0 | 1774 | 0 |
| Flt Permitted | | | | | 0.969 | | | 0.994 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1493 | 0 | 0 | 1655 | 0 | 0 | 1586 | 0 | 0 | 1774 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 192.1 | | | 753.9 | | | 1367.0 | | | 206.1 | |
| Travel Time (s) | | 13.8 | | | 54.3 | | | 98.4 | | | 14.8 | |
| Confl. Peds. (#/hr) | | | 1 | 1 | | | | | 1 | 1 | | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 27% | 5% | 5% | 50% | 40% | 8% | 5% | 10% | 4% | 17% |
| Adj. Flow (vph) | 1 | 41 | 60 | 67 | 30 | 9 | 26 | 88 | 88 | 12 | 161 | 8 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 102 | 0 | 0 | 106 | 0 | 0 | 202 | 0 | 0 | 181 | 0 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 35.8% ICU Level of Service A
Analysis Period (min) 15

---

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Vol, veh/h | 1 | 38 | 55 | 62 | 28 | 8 | 24 | 81 | 81 | 11 | 148 | 7 |
| Future Vol, veh/h | 1 | 38 | 55 | 62 | 28 | 8 | 24 | 81 | 81 | 11 | 148 | 7 |
| Conflicting Peds, #/hr | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 27 | 5 | 5 | 50 | 40 | 8 | 5 | 10 | 4 | 17 |
| Mvmt Flow | 1 | 41 | 60 | 67 | 30 | 9 | 26 | 88 | 88 | 12 | 161 | 8 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 393 | 418 | 166 | 426 | 378 | 133 | 169 | 0 | 0 | 177 | 0 | 0 |
| Stage 1 | 189 | 189 | - | 185 | 185 | - | - | - | - | - | - | - |
| Stage 2 | 204 | 229 | - | 241 | 193 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.1 | 6.5 | 6.47 | 7.15 | 6.55 | 6.7 | 4.5 | - | - | 4.2 | - | - |
| Critical Hdwy Stg 1 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.1 | 5.5 | - | 6.15 | 5.55 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.5 | 4 | 3.543 | 3.545 | 4.045 | 3.75 | 2.56 | - | - | 2.29 | - | - |
| Pot Cap-1 Maneuver | 570 | 529 | 817 | 534 | 549 | 803 | 1208 | - | - | 1352 | - | - |
| Stage 1 | 817 | 748 | - | 810 | 741 | - | - | - | - | - | - | - |
| Stage 2 | 803 | 718 | - | 756 | 735 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 526 | 510 | 816 | 452 | 530 | 802 | 1208 | - | - | 1351 | - | - |
| Mov Cap-2 Maneuver | 526 | 510 | - | 452 | 530 | - | - | - | - | - | - | - |
| Stage 1 | 797 | 741 | - | 790 | 722 | - | - | - | - | - | - | - |
| Stage 2 | 743 | 700 | - | 654 | 728 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 11.5 | 14.4 | 1 | 0.5 |
| HCM LOS | B | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1208 | - | - | 654 | 490 | 1351 | - | - |
| HCM Lane V/C Ratio | 0.022 | - | - | 0.156 | 0.217 | 0.009 | - | - |
| HCM Control Delay (s) | 8 | 0 | - | 11.5 | 14.4 | 7.7 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0.1 | - | - | 0.6 | 0.8 | 0 | - | - |

|  | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  | ✣ |  |  | ✣ |  |  | ✣ |  |  | ✣ |  |
| Traffic Volume (vph) | 3 | 61 | 4 | 3 | 53 | 9 | 11 | 0 | 10 | 11 | 0 | 10 |
| Future Volume (vph) | 3 | 61 | 4 | 3 | 53 | 9 | 11 | 0 | 10 | 11 | 0 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor |  |  |  |  |  |  |  |  |  |  |  |  |
| Frt |  | 0.993 |  |  | 0.981 |  |  | 0.935 |  |  | 0.935 |  |
| Flt Protected |  | 0.998 |  |  | 0.998 |  |  | 0.975 |  |  | 0.975 |  |
| Satd. Flow (prot) | 0 | 1860 | 0 | 0 | 1776 | 0 | 0 | 1679 | 0 | 0 | 1627 | 0 |
| Flt Permitted |  | 0.998 |  |  | 0.998 |  |  | 0.975 |  |  | 0.975 |  |
| Satd. Flow (perm) | 0 | 1860 | 0 | 0 | 1776 | 0 | 0 | 1679 | 0 | 0 | 1627 | 0 |
| Link Speed (k/h) |  | 50 |  |  | 50 |  |  | 50 |  |  | 50 |  |
| Link Distance (m) |  | 156.3 |  |  | 219.4 |  |  | 156.3 |  |  | 163.7 |  |
| Travel Time (s) |  | 11.3 |  |  | 15.8 |  |  | 11.3 |  |  | 11.8 |  |
| Confl. Peds. (#/hr) | 1 |  |  |  |  | 1 |  |  | 1 | 1 |  |  |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 13% | 2% | 2% | 2% | 0% | 2% | 11% |
| Adj. Flow (vph) | 3 | 66 | 4 | 3 | 58 | 10 | 12 | 0 | 11 | 12 | 0 | 11 |
| Shared Lane Traffic (%) |  |  |  |  |  |  |  |  |  |  |  |  |
| Lane Group Flow (vph) | 0 | 73 | 0 | 0 | 71 | 0 | 0 | 23 | 0 | 0 | 23 | 0 |
| Sign Control |  | Free |  |  | Free |  |  | Stop |  |  | Stop |  |

| Intersection Summary |  |
|---|---|
| Area Type: Other |  |
| Control Type: Unsignalized |  |
| Intersection Capacity Utilization 15.1% | ICU Level of Service A |
| Analysis Period (min) 15 |  |

---

| Intersection |  |
|---|---|
| Int Delay, s/veh | 2.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations |  | ✣ |  |  | ✣ |  |  | ✣ |  |  | ✣ |  |
| Traffic Vol, veh/h | 3 | 61 | 4 | 3 | 53 | 9 | 11 | 0 | 10 | 11 | 0 | 10 |
| Future Vol, veh/h | 3 | 61 | 4 | 3 | 53 | 9 | 11 | 0 | 10 | 11 | 0 | 10 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 0 | 0 | 2 | 2 | 2 | 13 | 2 | 2 | 2 | 0 | 2 | 11 |
| Mvmt Flow | 3 | 66 | 4 | 3 | 58 | 10 | 12 | 0 | 11 | 12 | 0 | 11 |

| Major/Minor | Major1 |  |  | Major2 |  |  | Minor1 |  |  | Minor2 |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 69 | 0 | 0 | 70 | 0 | 0 | 149 | 149 | 69 | 151 | 146 | 64 |
| Stage 1 | - | - | - | - | - | - | 74 | 74 | - | 70 | 70 | - |
| Stage 2 | - | - | - | - | - | - | 75 | 75 | - | 81 | 76 | - |
| Critical Hdwy | 4.1 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.1 | 6.52 | 6.31 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.1 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.1 | 5.52 | - |
| Follow-up Hdwy | 2.2 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.5 | 4.018 | 3.399 |
| Pot Cap-1 Maneuver | 1545 | - | - | 1531 | - | - | 819 | 743 | 994 | 821 | 745 | 976 |
| Stage 1 | - | - | - | - | - | - | 935 | 833 | - | 945 | 837 | - |
| Stage 2 | - | - | - | - | - | - | 934 | 833 | - | 932 | 832 | - |
| Platoon blocked, % |  | - | - |  | - | - |  |  |  |  |  |  |
| Mov Cap-1 Maneuver | 1544 | - | - | 1531 | - | - | 808 | 739 | 993 | 808 | 741 | 975 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 808 | 739 | - | 808 | 741 | - |
| Stage 1 | - | - | - | - | - | - | 933 | 831 | - | 942 | 834 | - |
| Stage 2 | - | - | - | - | - | - | 922 | 831 | - | 919 | 830 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.3 | 0.3 | 9.2 | 9.2 |
| HCM LOS |  |  | A | A |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 887 | 1544 | - | - | 1531 | - | - | 880 |
| HCM Lane V/C Ratio | 0.026 | 0.002 | - | - | 0.002 | - | - | 0.026 |
| HCM Control Delay (s) | 9.2 | 7.3 | 0 | - | 7.4 | 0 | - | 9.2 |
| HCM Lane LOS | A | A | A | - | A | A | - | A |
| HCM 95th %tile Q(veh) | 0.1 | 0 | - | - | 0 | - | - | 0.1 |

## Lanes, Volumes, Timings
## 4: Street A & Oxbow Drive

200272

2029 Total AM Peak Hour

| | → | ↘ | ↙ | ← | ↖ | ↗ |
|---|---|---|---|---|---|---|
| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↱ | | | ↰ | ↰↱ | |
| Traffic Volume (vph) | 129 | 2 | 2 | 92 | 7 | 5 |
| Future Volume (vph) | 129 | 2 | 2 | 92 | 7 | 5 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.998 | | | | 0.948 | |
| Flt Protected | | | | 0.999 | 0.970 | |
| Satd. Flow (prot) | 1838 | 0 | 0 | 1840 | 1694 | 0 |
| Flt Permitted | | | | 0.999 | 0.970 | |
| Satd. Flow (perm) | 1838 | 0 | 0 | 1840 | 1694 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 753.9 | | | 156.3 | 136.8 | |
| Travel Time (s) | 54.3 | | | 11.3 | 9.8 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 140 | 2 | 2 | 100 | 8 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 142 | 0 | 0 | 102 | 13 | 0 |
| Sign Control | Free | | | Free | Stop | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 16.9% ICU Level of Service A

Analysis Period (min) 15

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## HCM 2010 TWSC
## 4: Street A & Oxbow Drive

200272

2029 Total AM Peak Hour

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.6 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↱ | | | ↰ | ↰↱ | |
| Traffic Vol, veh/h | 129 | 2 | 2 | 92 | 7 | 5 |
| Future Vol, veh/h | 129 | 2 | 2 | 92 | 7 | 5 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 140 | 2 | 2 | 100 | 8 | 5 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 142 | 0 | 245 | 141 |
| Stage 1 | - | - | - | - | 141 | - |
| Stage 2 | - | - | - | - | 104 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1441 | - | 743 | 907 |
| Stage 1 | - | - | - | - | 886 | - |
| Stage 2 | - | - | - | - | 920 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1441 | - | 742 | 907 |
| Mov Cap-2 Maneuver | - | - | - | - | 742 | - |
| Stage 1 | - | - | - | - | 886 | - |
| Stage 2 | - | - | - | - | 919 | - |

| Approach | EB | | WB | | NB |
|---|---|---|---|---|---|
| HCM Control Delay, s | 0 | | 0.2 | | 9.6 |
| HCM LOS | | | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 803 | - | - | 1441 | - |
| HCM Lane V/C Ratio | 0.016 | - | - | 0.002 | - |
| HCM Control Delay (s) | 9.6 | - | - | 7.5 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0.1 | - | - | 0 | - |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Volume (vph) | 5 | 31 | 45 | 85 | 55 | 14 | 50 | 182 | 58 | 5 | 130 | 7 |
| Future Volume (vph) | 5 | 31 | 45 | 85 | 55 | 14 | 50 | 182 | 58 | 5 | 130 | 7 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.925 | | | 0.988 | | | 0.973 | | | 0.993 | |
| Flt Protected | | 0.997 | | | 0.973 | | | 0.992 | | | 0.998 | |
| Satd. Flow (prot) | 0 | 1641 | 0 | 0 | 1763 | 0 | 0 | 1723 | 0 | 0 | 1692 | 0 |
| Flt Permitted | | 0.997 | | | 0.973 | | | 0.992 | | | 0.998 | |
| Satd. Flow (perm) | 0 | 1641 | 0 | 0 | 1763 | 0 | 0 | 1723 | 0 | 0 | 1692 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 192.1 | | | 753.9 | | | 1367.0 | | | 206.1 | |
| Travel Time (s) | | 13.8 | | | 54.3 | | | 98.4 | | | 14.8 | |
| Confl. Peds. (#/hr) | | | | | | | | | 5 | 5 | | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 20% | 0% | 8% | 3% | 0% | 9% | 10% | 4% | 5% | 0% | 10% | 17% |
| Adj. Flow (vph) | 5 | 34 | 49 | 92 | 60 | 15 | 54 | 198 | 63 | 5 | 141 | 8 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 88 | 0 | 0 | 167 | 0 | 0 | 315 | 0 | 0 | 154 | 0 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 48.6% ICU Level of Service A

Analysis Period (min) 15

---

| Intersection | |
|---|---|
| Int Delay, s/veh | 6.5 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Vol, veh/h | 5 | 31 | 45 | 85 | 55 | 14 | 50 | 182 | 58 | 5 | 130 | 7 |
| Future Vol, veh/h | 5 | 31 | 45 | 85 | 55 | 14 | 50 | 182 | 58 | 5 | 130 | 7 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 20 | 0 | 8 | 3 | 0 | 9 | 10 | 4 | 5 | 0 | 10 | 17 |
| Mvmt Flow | 5 | 34 | 49 | 92 | 60 | 15 | 54 | 198 | 63 | 5 | 141 | 8 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 530 | 529 | 145 | 540 | 502 | 235 | 149 | 0 | 0 | 266 | 0 | 0 |
| Stage 1 | 155 | 155 | - | 343 | 343 | - | - | - | - | - | - | - |
| Stage 2 | 375 | 374 | - | 197 | 159 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.3 | 6.5 | 6.28 | 7.13 | 6.5 | 6.29 | 4.2 | - | - | 4.1 | - | - |
| Critical Hdwy Stg 1 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.3 | 5.5 | - | 6.13 | 5.5 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3.68 | 4 | 3.372 | 3.527 | 4 | 3.381 | 2.29 | - | - | 2.2 | - | - |
| Pot Cap-1 Maneuver | 433 | 458 | 887 | 451 | 474 | 787 | 1385 | - | - | 1310 | - | - |
| Stage 1 | 806 | 773 | - | 670 | 641 | - | - | - | - | - | - | - |
| Stage 2 | 611 | 621 | - | 803 | 770 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 367 | 433 | 887 | 384 | 448 | 784 | 1385 | - | - | 1304 | - | - |
| Mov Cap-2 Maneuver | 367 | 433 | - | 384 | 448 | - | - | - | - | - | - | - |
| Stage 1 | 769 | 770 | - | 637 | 609 | - | - | - | - | - | - | - |
| Stage 2 | 515 | 590 | - | 723 | 767 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 12.1 | 18.9 | 1.3 | 0.3 |
| HCM LOS | B | C | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1385 | - | - | 596 | 425 | 1304 | - | - |
| HCM Lane V/C Ratio | 0.039 | - | - | 0.148 | 0.394 | 0.004 | - | - |
| HCM Control Delay (s) | 7.7 | 0 | - | 12.1 | 18.9 | 7.8 | 0 | - |
| HCM Lane LOS | A | A | - | B | C | A | A | - |
| HCM 95th %tile Q(veh) | 0.1 | - | - | 0.5 | 1.8 | 0 | - | - |

| | ↗ | → | ↘ | ↙ | ← | ↖ | ↖ | ↑ | ↗ | ↘ | ↓ | ↙ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | | ✥ | | | ✥ | | | ✥ | | | ✥ | |
| Traffic Volume (vph) | 9 | 103 | 9 | 14 | 112 | 20 | 6 | 0 | 8 | 20 | 1 | 9 |
| Future Volume (vph) | 9 | 103 | 9 | 14 | 112 | 20 | 6 | 0 | 8 | 20 | 1 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.990 | | | 0.981 | | | 0.924 | | | 0.959 | |
| Flt Protected | | 0.996 | | | 0.995 | | | 0.979 | | | 0.968 | |
| Satd. Flow (prot) | 0 | 1802 | 0 | 0 | 1817 | 0 | 0 | 1666 | 0 | 0 | 1676 | 0 |
| Flt Permitted | | 0.996 | | | 0.995 | | | 0.979 | | | 0.968 | |
| Satd. Flow (perm) | 0 | 1802 | 0 | 0 | 1817 | 0 | 0 | 1666 | 0 | 0 | 1676 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 156.3 | | | 219.4 | | | 100.1 | | | 163.7 | |
| Travel Time (s) | | 11.3 | | | 15.8 | | | 7.2 | | | 11.8 | |
| Confl. Peds. (#/hr) | 1 | | | | | 1 | | | | 1 | | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 13% | 2% | 2% | 2% | 1% | 0% | 2% | 2% | 2% | 6% | 2% | 0% |
| Adj. Flow (vph) | 10 | 112 | 10 | 15 | 122 | 22 | 7 | 0 | 9 | 22 | 1 | 10 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 132 | 0 | 0 | 159 | 0 | 0 | 16 | 0 | 0 | 33 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 21.1% ICU Level of Service A

Analysis Period (min) 15

---

| Intersection | |
|---|---|
| Int Delay, s/veh | 2 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✥ | | | ✥ | | | ✥ | | | ✥ | |
| Traffic Vol, veh/h | 9 | 103 | 9 | 14 | 112 | 20 | 6 | 0 | 8 | 20 | 1 | 9 |
| Future Vol, veh/h | 9 | 103 | 9 | 14 | 112 | 20 | 6 | 0 | 8 | 20 | 1 | 9 |
| Conflicting Peds, #/hr | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 13 | 2 | 2 | 2 | 1 | 0 | 2 | 2 | 2 | 6 | 2 | 0 |
| Mvmt Flow | 10 | 112 | 10 | 15 | 122 | 22 | 7 | 0 | 9 | 22 | 1 | 10 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 145 | 0 | 0 | 122 | 0 | 0 | 306 | 312 | 118 | 307 | 306 | 134 |
| Stage 1 | - | - | - | - | - | - | 137 | 137 | - | 164 | 164 | - |
| Stage 2 | - | - | - | - | - | - | 169 | 175 | - | 143 | 142 | - |
| Critical Hdwy | 4.23 | - | - | 4.12 | - | - | 7.12 | 6.52 | 6.22 | 7.16 | 6.52 | 6.2 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.16 | 5.52 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.12 | 5.52 | - | 6.16 | 5.52 | - |
| Follow-up Hdwy | 2.317 | - | - | 2.218 | - | - | 3.518 | 4.018 | 3.318 | 3.554 | 4.018 | 3.3 |
| Pot Cap-1 Maneuver | 1372 | - | - | 1465 | - | - | 646 | 603 | 934 | 638 | 608 | 920 |
| Stage 1 | - | - | - | - | - | - | 866 | 783 | - | 829 | 762 | - |
| Stage 2 | - | - | - | - | - | - | 833 | 754 | - | 850 | 779 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 1371 | - | - | 1465 | - | - | 629 | 591 | 933 | 622 | 596 | 919 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 629 | 591 | - | 622 | 596 | - |
| Stage 1 | - | - | - | - | - | - | 859 | 777 | - | 822 | 753 | - |
| Stage 2 | - | - | - | - | - | - | 814 | 745 | - | 835 | 773 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.6 | 0.7 | 9.8 | 10.5 |
| HCM LOS | | | A | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 773 | 1371 | - | - | 1465 | - | - | 688 |
| HCM Lane V/C Ratio | 0.02 | 0.007 | - | - | 0.01 | - | - | 0.047 |
| HCM Control Delay (s) | 9.8 | 7.6 | 0 | - | 7.5 | 0 | - | 10.5 |
| HCM Lane LOS | A | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.1 | 0 | - | - | 0 | - | - | 0.1 |

## Lanes, Volumes, Timings
## 4: Street A & Oxbow Drive

200272
2029 Total PM Peak Hour

| | → | ↘ | ↙ | ← | ↖ | ↗ |
|---|---|---|---|---|---|---|
| Lane Group | EBT | EBR | WBL | WBT | NBL | NBR |
| Lane Configurations | ↱ | | | ↰ | Y | |
| Traffic Volume (vph) | 90 | 6 | 7 | 152 | 3 | 4 |
| Future Volume (vph) | 90 | 6 | 7 | 152 | 3 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.991 | | | | 0.923 | |
| Flt Protected | | | | 0.998 | 0.979 | |
| Satd. Flow (prot) | 1825 | 0 | 0 | 1838 | 1665 | 0 |
| Flt Permitted | | | | 0.998 | 0.979 | |
| Satd. Flow (perm) | 1825 | 0 | 0 | 1838 | 1665 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 753.9 | | | 156.3 | 136.8 | |
| Travel Time (s) | 54.3 | | | 11.3 | 9.8 | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 98 | 7 | 8 | 165 | 3 | 4 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 105 | 0 | 0 | 173 | 7 | 0 |
| Sign Control | Free | | | Free | Stop | |

| Intersection Summary | |
|---|---|
| Area Type: Other | |
| Control Type: Unsignalized | |
| Intersection Capacity Utilization 23.7% | ICU Level of Service A |
| Analysis Period (min) 15 | |

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## HCM 2010 TWSC
## 4: Street A & Oxbow Drive

200272
2029 Total PM Peak Hour

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.4 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↱ | | | ↰ | Y | |
| Traffic Vol, veh/h | 90 | 6 | 7 | 152 | 3 | 4 |
| Future Vol, veh/h | 90 | 6 | 7 | 152 | 3 | 4 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 2 | 2 | 2 | 2 | 2 | 2 |
| Mvmt Flow | 98 | 7 | 8 | 165 | 3 | 4 |

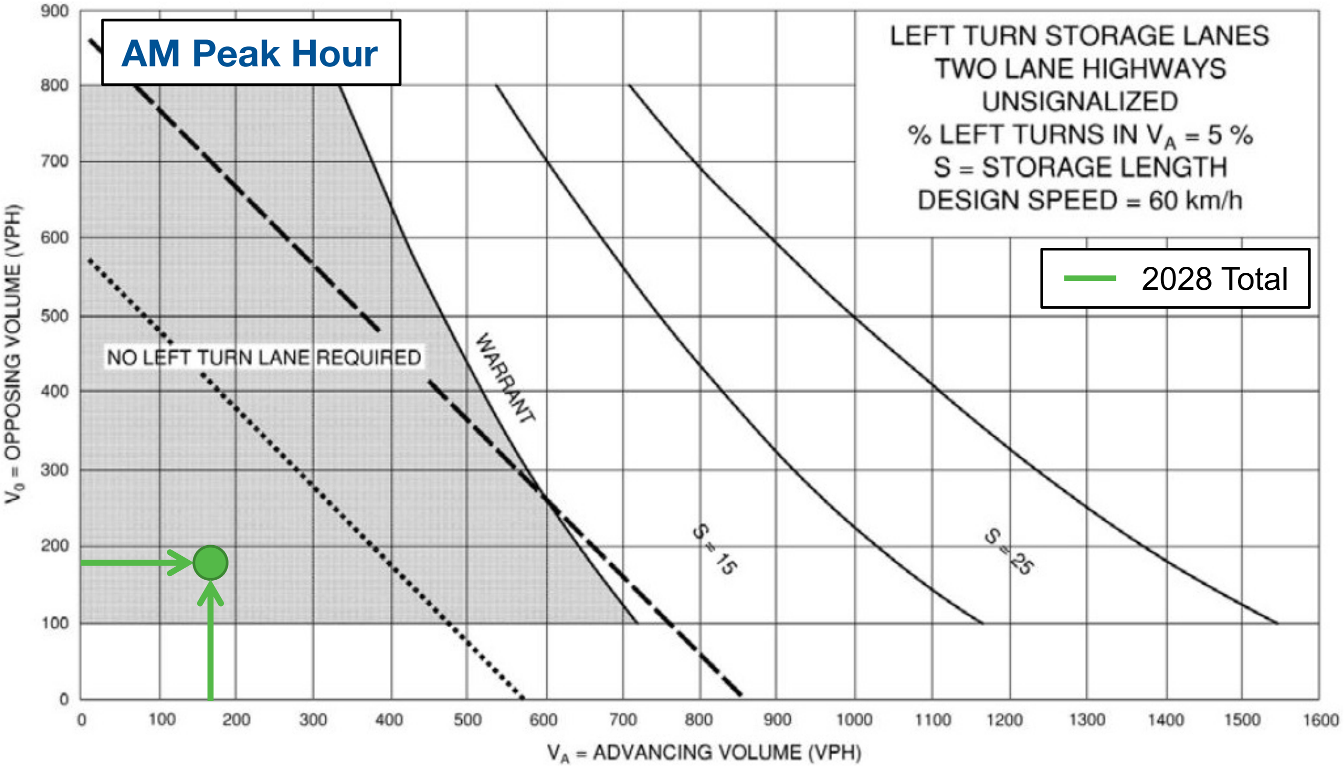
| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 105 | 0 | 283 | 102 |
| Stage 1 | - | - | - | - | 102 | - |
| Stage 2 | - | - | - | - | 181 | - |
| Critical Hdwy | - | - | 4.12 | - | 6.42 | 6.22 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.42 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.42 | - |
| Follow-up Hdwy | - | - | 2.218 | - | 3.518 | 3.318 |
| Pot Cap-1 Maneuver | - | - | 1486 | - | 707 | 953 |
| Stage 1 | - | - | - | - | 922 | - |
| Stage 2 | - | - | - | - | 850 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1486 | - | 703 | 953 |
| Mov Cap-2 Maneuver | - | - | - | - | 703 | - |
| Stage 1 | - | - | - | - | 922 | - |
| Stage 2 | - | - | - | - | 845 | - |

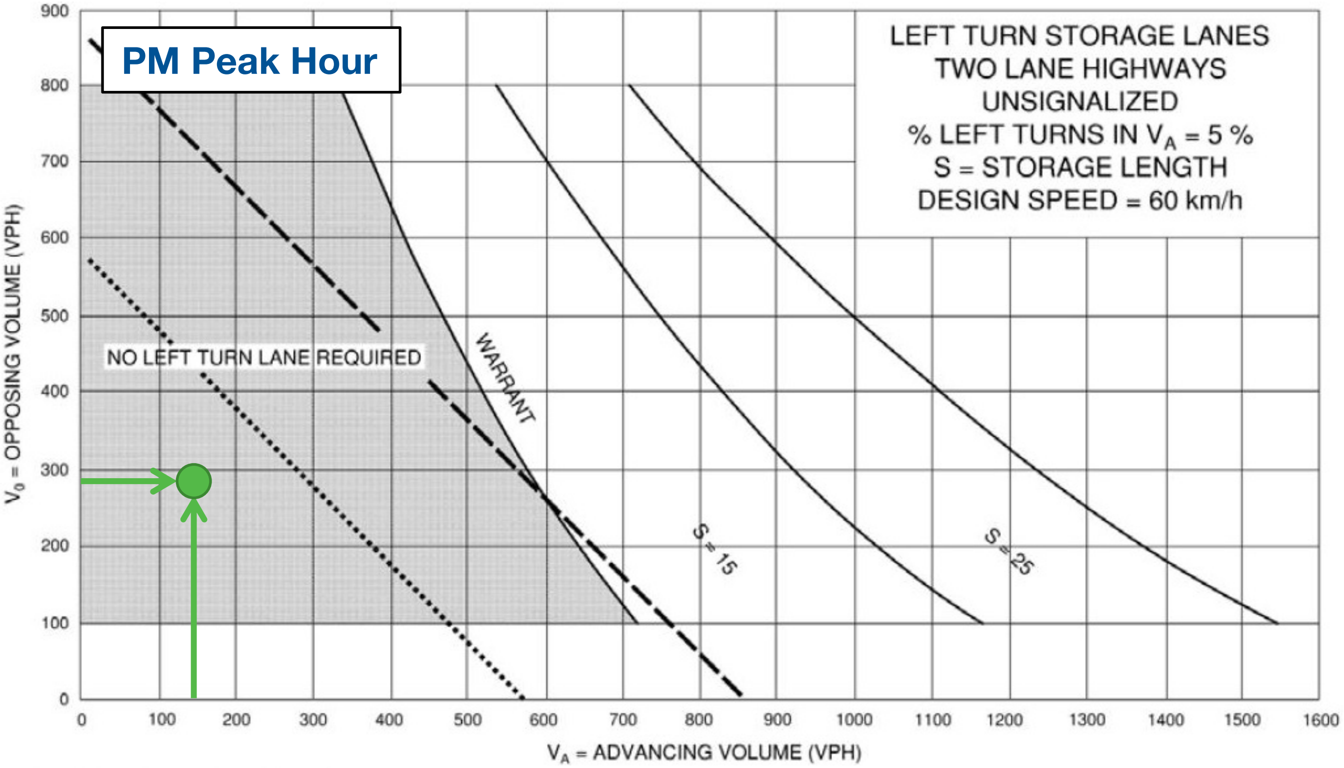
| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.3 | 9.4 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 827 | - | - | 1486 | - |
| HCM Lane V/C Ratio | 0.009 | - | - | 0.005 | - |
| HCM Control Delay (s) | 9.4 | - | - | 7.4 | 0 |
| HCM Lane LOS | A | - | - | A | A |
| HCM 95th %tile Q(veh) | 0 | - | - | 0 | - |

# Appendix F

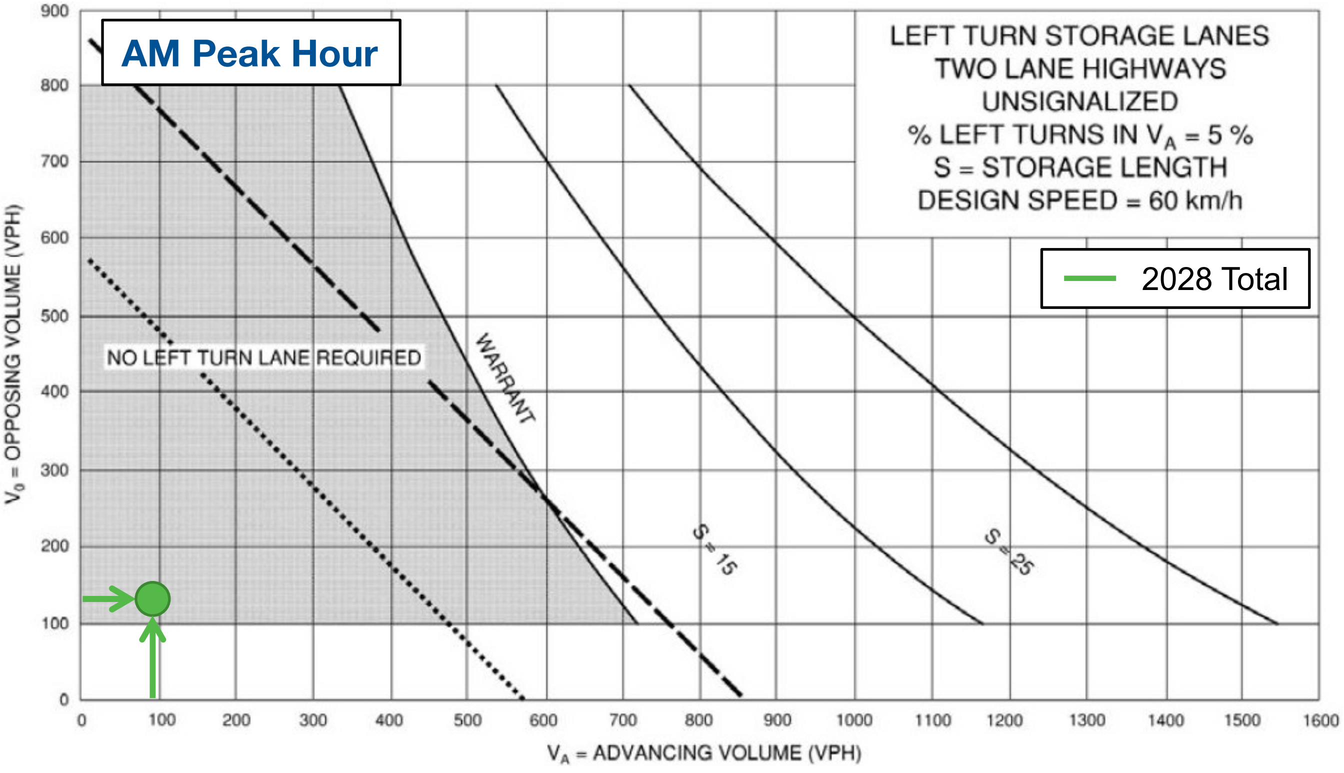
## Left-Turn Lane Warrants

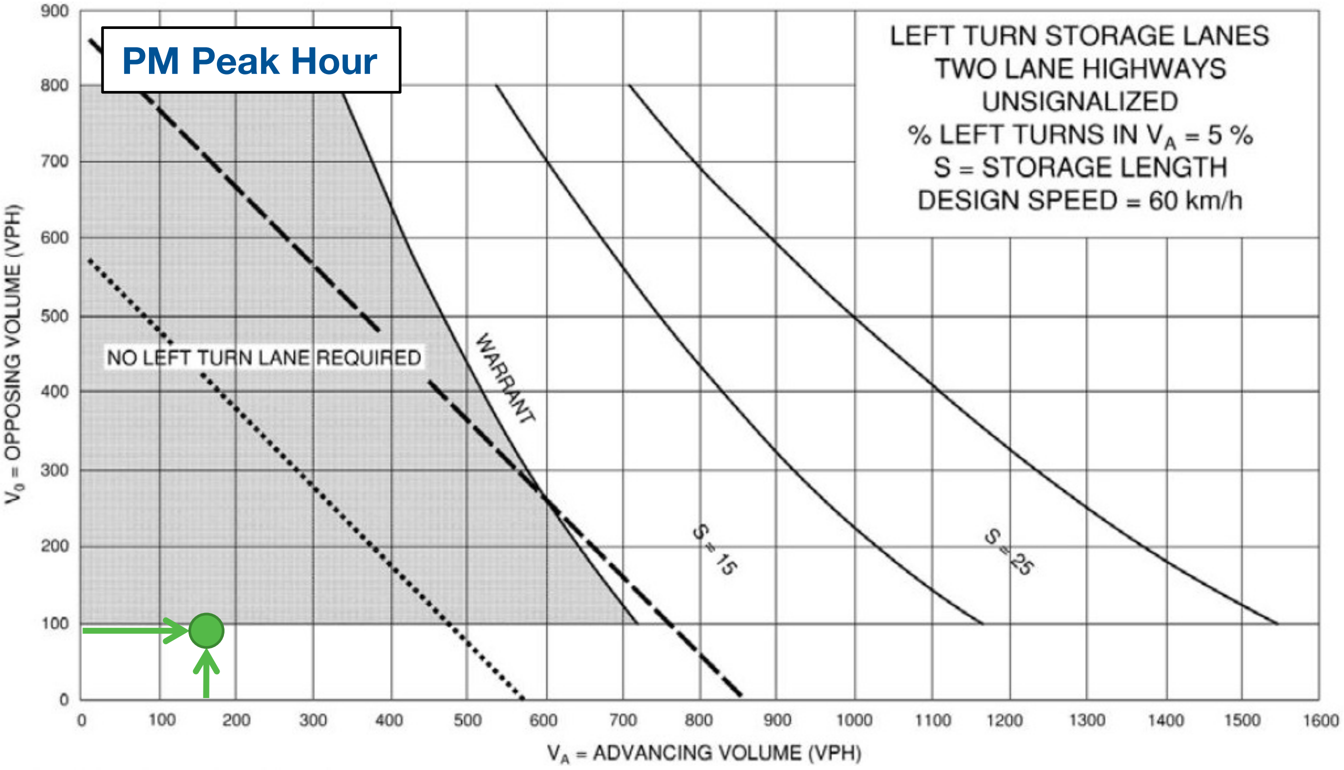




paradigm TRANSPORTATION SOLUTIONS LIMITED

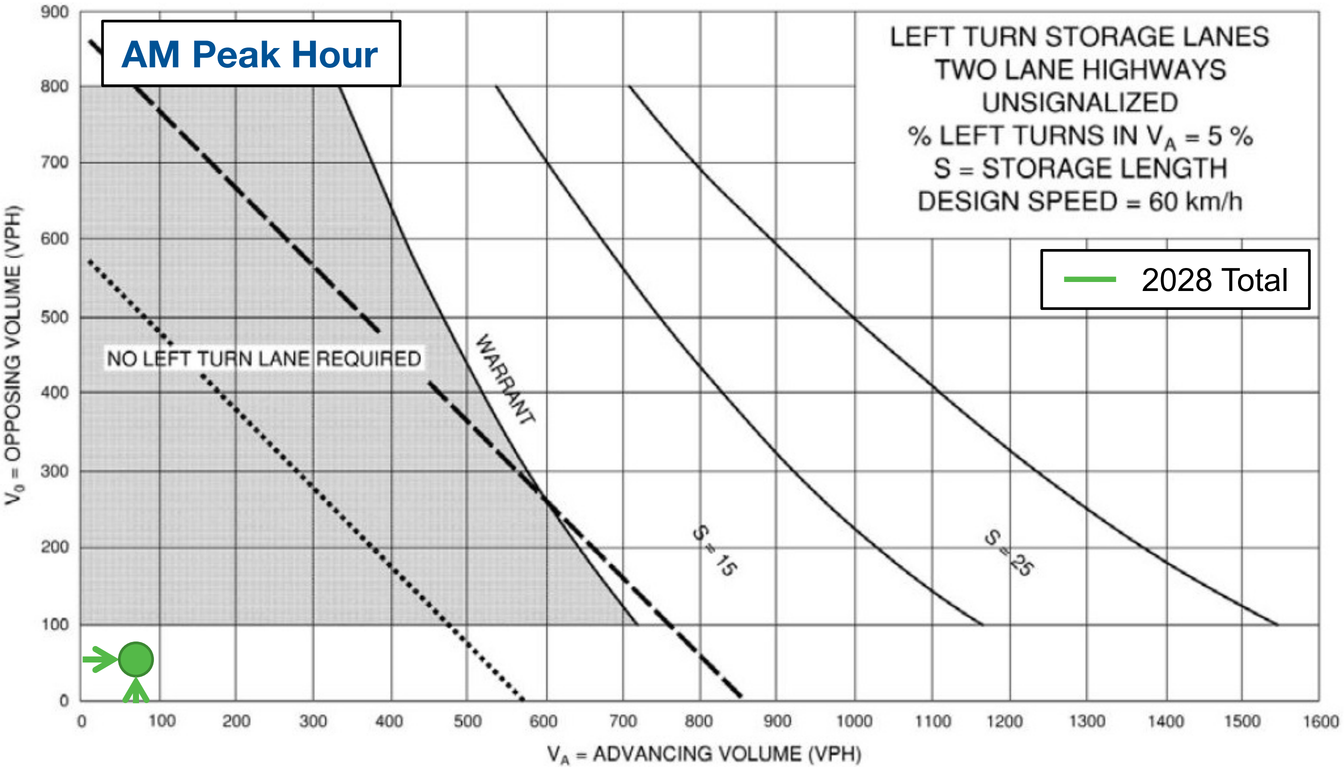
# Southbound Left-Turn Lane Warrant
# Komoka Road at Oxbow Drive

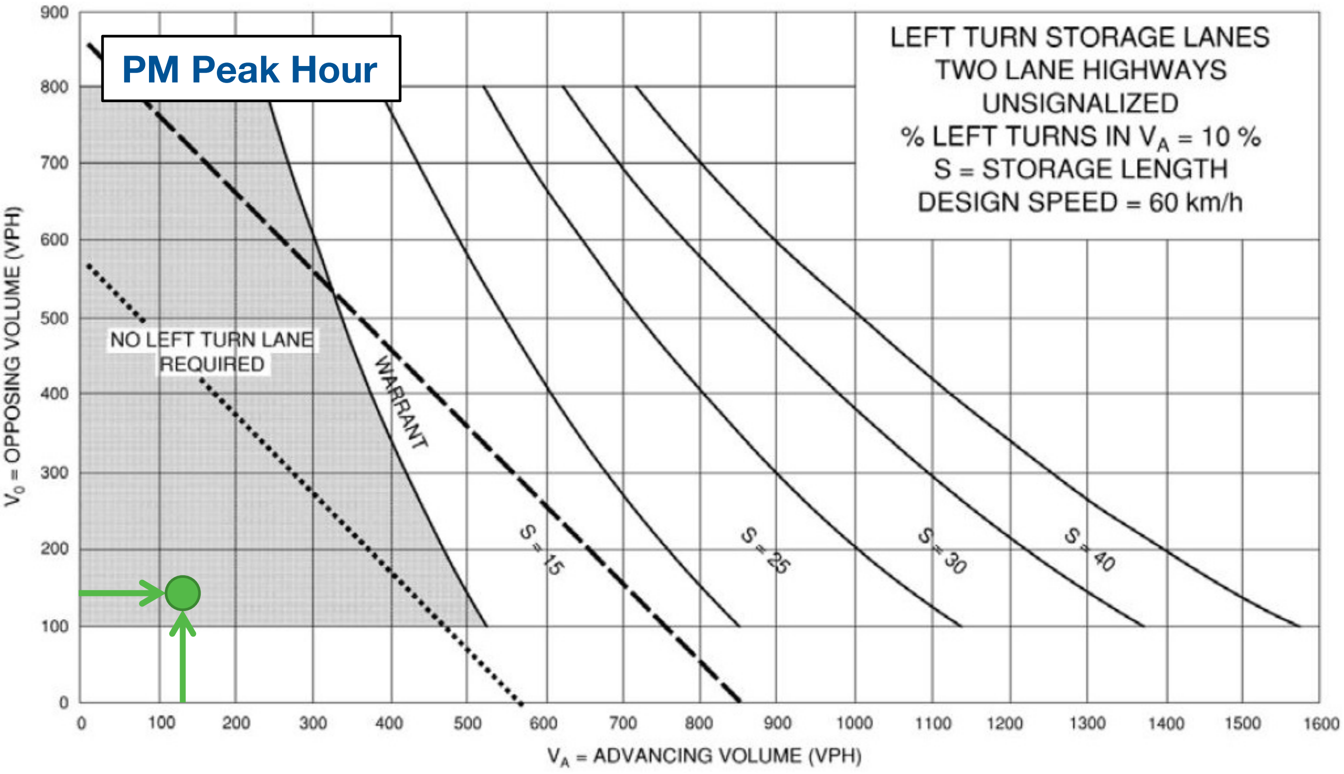




paradigm
TRANSPORTATION SOLUTIONS LIMITED

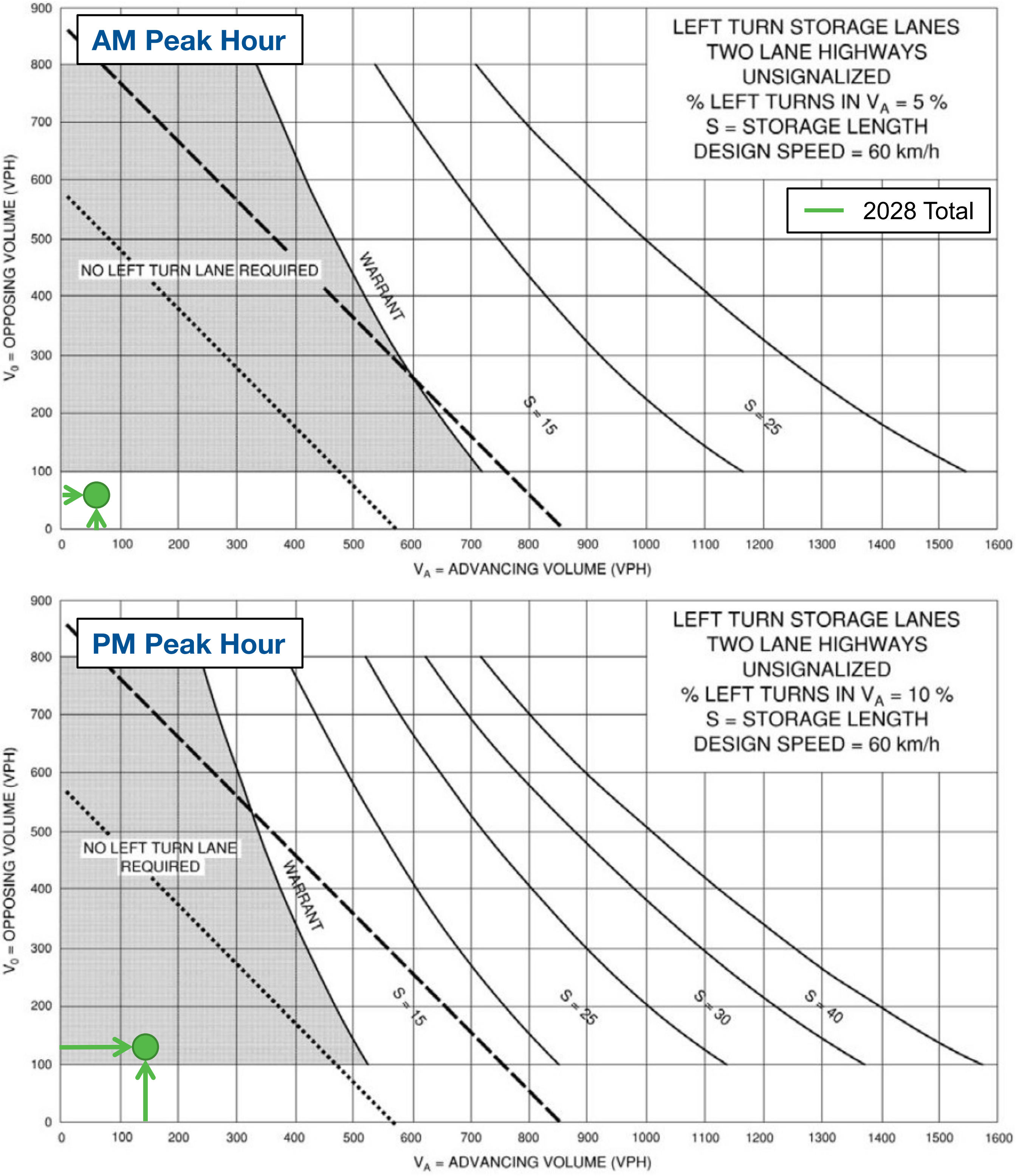
# Westbound Left-Turn Lane Warrant
# Oxbow Drive at Street 'A'





paradigm TRANSPORTATION SOLUTIONS LIMITED

# Eastbound Left-Turn Lane Warrant
# Oxbow Drive at Union Avenue



# Westbound Left-Turn Lane Warrant
# Oxbow Drive at Union Avenue

# Inglis Subdivision

## Preliminary
## Stormwater Management Report

**Project Location:**
10125 Oxbow Drive, Komoka, ON

**Prepared for:**
Heather Johnston-Inglis
P.O. Box 63, Formosa, ON

**Prepared by:**
MTE Consultants
123 St. George Street
London, ON  N6A 3A1

June 12, 2020

**MTE File No.:** 43705-104

*Engineers, Scientists, Surveyors.*

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Appendix ‘B’ Hydrologic Modelling Output
Appendix ‘C’ Geotechnical Report

## Drawings

MTE Dwg 43705-104-SW1.1 (PRELIMINARY)

# 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by the owner of municipal address 10125 Oxbow Drive, to complete a stormwater management design for proposed residential development on the property.

The property is approximately located at the intersection of Oxbow Drive and Union Avenue in the community of Komoka, Municipality of Middlesex Centre. The property is bounded to the north by Oxbow Drive, to the south and west by municipally owned properties (Park, water tower) and golf course, and to the east by existing single family residential properties.

This report addresses the stormwater management requirements set forth by the Municipality of Middlesex Centre and Upper Thames River Conservation Authority, and proposes a design which meets these requirements. The property is considered along with neighbouring residential properties (10147 & 10171 Oxbow Drive, and part of Lot 6, Lobo Conc. 2) for a total area of approximately 10.4ha, hereafter collectively referred to as ‘the site’. Site location is depicted on Figure 1.

# 2.0 Criteria

## 2.1 Stormwater Management Criteria

The stormwater management design criteria for the site, as discussed with the Municipality of Middlesex Center and the Upper Thames Conservation Authority are as follows:

- Capture and infiltrate runoff from the site for events up to the 5 year storm event;
- Attenuate runoff from major events up to the 250 year event and release at acceptable levels to the existing borrow pit located within the site; and
- Implementation of water quality controls to provide Level 1 (enhanced) treatment levels as per the MOECC SWM Practices Planning and Design Manual (2003).

## 2.2 Methodology

In order to successfully complete the stormwater management design for this site, the following specific tasks were undertaken:

- Determined the percent impervious of the site and catchment area parameters for inclusion in hydrologic modelling;
- Calculated post-development storage requirements; and
- Prepare preliminary design of the SWM Facility to attain the required storage for runoff control.

**MTE**

Engineers, Scientists, Surveyors

Division

Project Number:
43705-104

Project Name:
OXBOW DRIVE
SUBDIVISION

Drawing Title:
SITE LOCATION

Scale:
1:2000

Part of Dwg:

Date:
05/22/2020

Revision #:

Issued For:

Drawing Number:

FIG.1

DWG PATH:P: \P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg
date — time — CADTAG

# 3.0 Background Information

## 3.1 Geotechnical Information

A geotechnical investigation of 10125 Oxbow Drive was completed by LVM in 2015. The LVM investigation consisted of advancing 9 boreholes on the site ranging in depth from 5-10m. MTE Consultants Inc. in April of 2020. The investigation was completed by advancing 8 boreholes across the site to depths ranging from 5-11m in depth. The investigation revealed the native soils to comprise mainly of silty sand to sandy gravel materials overlain by sandy to silty-sand fill material. The LVM report indicated some stiff clayey material within the fill as well. Generally the fill materials were determined to be unsuitable for engineered fill and will need to be removed.

The hydraulic conductivity of the native soils was estimated using particle size distribution analyses of 6 samples of the granular deposits. The factored infiltration rates of the soils ranged from 39-200 mm/hr. A conservative infiltration rate of 40mm/hr was utilized for design purposes.

## 3.2 Hydro-Geological Information

As part of the MTE geotechnical investigation, 5 BH's were equipped with monitoring wells to determine the groundwater elevations across the site. Ground water elevations were measured in January and February of 2020. The February measurements ranged from 0.3-0.6m higher than the January measurements and indicate that the ground flows from the North-east (244.76) to the southwest (243.57). This flow direction was also reflected in the January measurements. The high groundwater elevation approximated for the vicinity of the proposed SWM facility is roughly 244.0. For Further geotechnical / hydro-geological information, refer to the Geotechnical investigation for the property prepared by MTE (Appendix 'C').

## 3.3 Receivers

As noted in Section 2, the 5-year runoff from the site is intended to be captured and infiltrated in the SWM facility. Runoff from major events (10-250 year) is intended to be released to the existing borrow pit located on the site. The borrow pit has no outlet and is sustained by the local shallow groundwater table.

# 4.0 Stormwater Management

## 4.1 Allowable Flow Rate

Under pre-development conditions, the majority of the site drains uncontrolled to the existing borrow pit (Figure 2). As noted above, the borrow pit has no outlet, thus there are no downstream erosion hazards associated with release to this receiver. Flow from the proposed facility to the borrow pit should be controlled to prevent scour and erosion of the banks and appropriate erosion control measure put in place to ensure long-term stability of the banks is maintained.

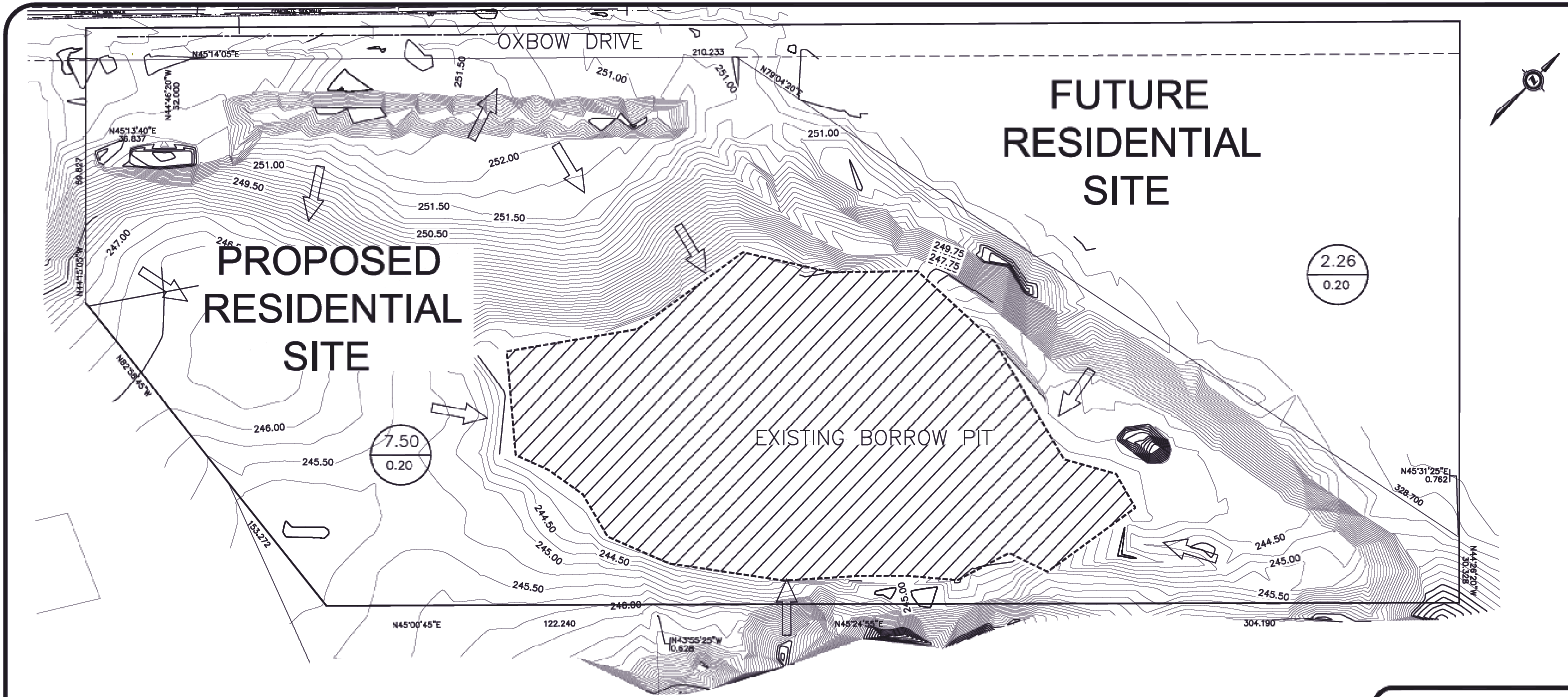
## 4.2 Catchment Parameters

Under post-development conditions approximately 2.9ha of the site, consisting of the borrow pit and some rear-yard areas, will flow from the site uncontrolled. The controlled portions of the site were separated into three catchment areas: The controlled portion of the Client's property (10125 Oxbow Drive); the adjacent properties to be serviced by the proposed facility (i.e. 10147 & 10171 Oxbow Drive); and half of the Oxbow ROW across the frontage of the serviced properties. Figure 3 illustrates the limits of the post development catchment areas. Table 4.1 summarises the parameters used to model the post development condition of the site.

While the native sandy/gravelly soils can be considered hydrologic soil group 'A', it is anticipated that a large amount of fill will be required to accommodate the proposed development. Thus, the post-development pervious CN value was conservatively estimated to be 67 assuming the fill will be a group B-C material.

*Table 4.1- Post-Development Catchment Parameters*

| No. | Catchment | Area (ha) | % Impervious | Pervious CN | Impervious CN | Slope (%) | Flow Length (Perv/Imp) |
|---|---|---|---|---|---|---|---|
| 201 | Prop Residential (10125 Oxbow) | 4.57 | 59.8 | 67 | 98 | 2.0 | 30/50 |
| 202 | Future Residential (10147 & 10171) | 2.26 | 60 | 67 | 98 | 2.0 | 30/50 |
| 203 | Oxbow Drive | 0.64 | 60 | 67 | 98 | 2.0 | 5/50 |



KEY

| | |
|---|---|
| 4.0 / 0.20 — AREA (IN Ha) / RUNOFF COEFFICIENT | DRAINAGE AREA CATCHMENT |
| ⇨ | OVERLAND FLOW DIRECTION |
| ▬ | DRAINAGE AREA BOUNDARY |

Scale: 1:1500 Date: MAY.22/20

**2270942**
**ONTARIO INC.**

**OXBOW DRIVE**
**SUBDIVISION**

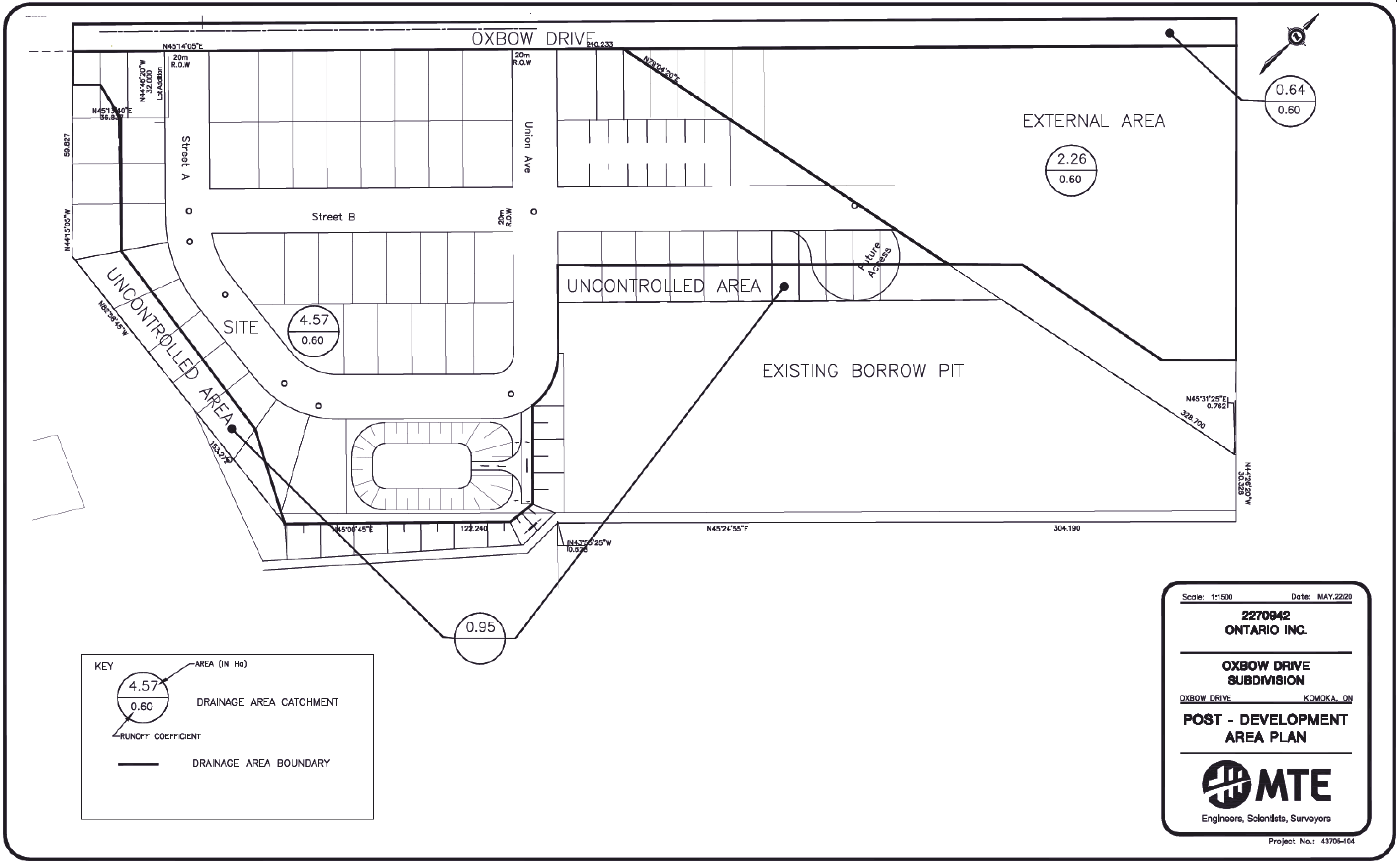
OXBOW DRIVE KOMOKA, ON

## PRE - DEVELOPMENT AREA PLAN

**MTE**
Engineers, Scientists, Surveyors

Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg



Scale: 1:1500 Date: MAY.22/20

**2270942 ONTARIO INC.**

**OXBOW DRIVE SUBDIVISION**

OXBOW DRIVE KOMOKA, ON

**POST - DEVELOPMENT AREA PLAN**

MTE

Engineers, Scientists, Surveyors

Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg

## 4.3 Quality Control

As the majority of runoff from the site is intended to be directed to groundwater, an Enhanced level of quality treatment (Level 1) is proposed for the site. Runoff from roof areas will be directed to lot-level galleries as this water is considered 'clean'. Runoff from the remainder of the site will be directed to an OGS unit sized to provide the required level of treatment. As per MOE guidelines, the bottom of the basin will be kept a minimum of 1.0m above the high groundwater elevation.

## 4.4 Quantity Control

In order to achieve the stormwater management requirements for the site, runoff generated from the controlled areas will be conveyed to the proposed SWM facility, wherein the flow will collect and infiltrate. An outlet structure will be provided in the pond with a top elevation set equal to the max 5-year ponding elevation (~247.80). The outlet structure will direct flows to an orifice outlet which will control flows from storms up to the 25 year event. During events greater than the 25 year storm, flows will spill over a proposed weir structure to the borrow pit. Peak flows from the facility are summarized in the table below along with ponding elevations and maximum ponding depths.

*Table 4.2 - Pond Outflow and Ponding Summary*

| Event | Peak Inflow (m$^3$/s) | Peak Outflow (m$^3$/s) | Maximum Ponding | |
|---|---|---|---|---|
| | | | Elevation (masl) | Depth (m) |
| 25mm | 0.644 | - | 247.32 | 0.62 |
| 2YR | 1.697 | - | 247.82 | 1.12 |
| 5YR | 1.765 | - | 247.83 | 1.13 |
| 10YR | 2.040 | 0.214 | 247.89 | 1.19 |
| 25YR | 2.416 | 0.270 | 248.03 | 1.33 |
| 50YR | 3.081 | 0.405 | 248.13 | 1.43 |
| 100YR | 3.416 | 0.643 | 248.19 | 1.49 |
| 250YR | 4.273 | 1.574 | 248.30 | 1.60 |

The pond has been designed with a minimum freeboard of 0.3m. Preliminary pond details are included in Appendix 'A' and on the attached preliminary pond design drawing. Hydrologic modelling output files are provided in Appendix 'B'.

The maximum ponding elevation within the facility exceeds the MOE recommended maximum ponding depth of 0.6m for infiltration basins. However, as greater than 90% of all rainfall events are less than a 25mm event, the recommended ponding elevation will only be exceeded on an infrequent basis. The designed bottom of pond elevation (246.70) is approximately 2.0m higher that the estimated high groundwater elevation (244.76) as determined from the Feb. 2020 groundwater measurements. Groundwater monitoring is ongoing and the separation distances will be confirmed as part of the detailed design of the facility.

Based on the design infiltration rate and the footprint area of the proposed facility, it is estimated that runoff from the 25mm and 5 year events can be completely infiltrated within approximately 18 and 28 hours respectively.

Under proposed conditions the borrow pit will be partially filled in to accommodate the proposed development. The post-development surface area of the borrow pit at it's low elevation (~243.90) is estimated to be approximately 1.17ha. As per the hydrologic modelling completed for the project, approximately 3,700m$^3$ of runoff will be directed to the borrow pit during a 250 year storm event. Based on the proposed surface area of the pond the depth would increase by approximately 0.32m in addition to the 0.12m of precipitation giving a total depth increase of approximately 0.45m. Assuming the pond were at the high groundwater elevation recorded by MTE (244.76) at the beginning of the rainfall event, the peak elevation at the end would be approximately 245.21. The lowest existing grade along the property line is approximately 246.2 which is well above the anticipated peak ponding elevation.

# 5.0 Conclusions

Based on the foregoing analysis, it is concluded that:

i. the proposed stormwater management Facility provides adequate volume to capture and infiltrate the 5 year storm event, roof runoff will be directed to lot-level infiltration galleries;

ii. An Enhanced Level of quality control (Level 1) will be provided upstream of the pond with and OGS unit; and

iii. Runoff from major events (i.e. >5YR) will be directed to the borrow pit;

iv. Upon completion of construction, the site will conform to the design criteria specified by the Municipality of Middlesex Centre and Upper Thames Conservation Authority.

All of which is respectfully submitted,

**MTE Consultants Inc.**

**Joshua Monster**
Design Engineer
519-743-6500 ext. 2202
jmonster@mte85.com

JJM:jjm

M:\43705\100\Reports\SWM\43705-100 SWM Report.docx

# Appendix A

# Pond Design Details

# INGLIS SUBDIVISION
## STORMWATER MANAGEMENT
**Komoka, Ontario**

Project Number: 43705-104
Date: May 22, 2020
Design By: JJM
File: Q:\43705\104\SWM\Preliminary\43705-104 Preliminary SWM Facility Design Sheet Option 2.xlsx

## HYDROLOGIC PARAMETERS

**Post-Development Conditions**

| Sub-Catchment Number | Area *(ha)* | Overland Slope *(%)* | Overland Length *(m)* | SCS Curve Number | | | Percent Impervious *(%)* | Land Use | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pervious (AMC II) | Pervious (AMC III) | Impervious | | | |
| 201 | 4.57 | 2 | 30 | 67 | 82 | 98 | 59.8 | 10125 Oxbow | |
| 202 | 2.26 | 2 | 30 | 67 | 82 | 98 | 60 | External Future Residential | |
| 203 | 0.64 | 2 | 30 | 67 | 82 | 98 | 60 | Oxbow Drive | |
| Total | 7.47 | | | | | | 59.88 | | |

## IDF PARAMETERS
**City of London**

| Frequency (Years) | a | b | c | Comment |
|---|---|---|---|---|
| 25mm (4hr) | 538.850 | 6.331 | 0.809 | |
| 2 | 1290.000 | 8.500 | 0.860 | |
| 5 | 1183.740 | 7.641 | 0.838 | |
| 10 | 1574.382 | 9.025 | 0.860 | |
| 25 | 2019.372 | 9.824 | 0.875 | |
| 50 | 2270.665 | 9.984 | 0.876 | |
| 100 | 2619.363 | 10.500 | 0.884 | |
| 250 | 3048.220 | 10.030 | 0.888 | |

# INGLIS SUBDIVISION
## STORMWATER MANAGEMENT
**Komoka, Ontario**

| | |
|---|---|
| Project Number: | 43705-104 |
| Date: | May 22, 2020 |
| Design By: | JJM |
| File: | Q:\43705\104\SWM\Preliminary\43705-104 Preliminary SWM Facility Design Sheet Option 2.xlsx |

## STAGE-STORAGE RELATIONSHIP

| Stage | Active Depth | Pond | | | | Active Storage Volume | Volume Summary | Ponding Elevation | Comments | Stage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Area | Volume | Cumulative Volume | | | | | | |
| *m* | *m* | *m*$^2$ | *m*$^3$ | *m*$^3$ | | *m*$^3$ | *m*$^3$ | *m* | | *m* |
| 246.70 | 0.00 | 864 | 0 | 0 | | 0 | | | | 246.70 |
| 246.80 | 0.10 | 947 | 91 | 91 | | 91 | | | | 246.80 |
| 246.90 | 0.20 | 1030 | 99 | 189 | | 189 | | | | 246.90 |
| 247.00 | 0.30 | 1112 | 107 | 296 | | 296 | | | | 247.00 |
| 247.10 | 0.40 | 1195 | 115 | 412 | | 412 | | | | 247.10 |
| 247.20 | 0.50 | 1278 | 124 | 535 | | 535 | | | | 247.20 |
| 247.30 | 0.60 | 1361 | 132 | 667 | | 667 | | | | 247.30 |
| 247.40 | 0.70 | 1443 | 140 | 808 | | 808 | 692 | 247.32 | 25mm Event | 247.40 |
| 247.50 | 0.80 | 1526 | 148 | 956 | | 956 | | | | 247.50 |
| 247.60 | 0.90 | 1609 | 157 | 1113 | | 1113 | | | | 247.60 |
| 247.70 | 1.00 | 1717 | 166 | 1279 | | 1279 | 1489 | 247.83 | 1:2 Year Event | 247.70 |
| 247.80 | 1.10 | 1824 | 177 | 1456 | | 1456 | 1505 | 247.83 | 1:5 Year Event | 247.80 |
| 247.90 | 1.20 | 1932 | 188 | 1644 | | 1644 | 1615 | 247.89 | 1:10 Year Event | 247.90 |
| 248.00 | 1.30 | 2039 | 199 | 1843 | | 1843 | 1889 | 248.03 | 1:25 Year Event | 248.00 |
| 248.10 | 1.40 | 2147 | 209 | 2052 | | 2052 | 2116 | 248.14 | 1:50 Year Event | 248.10 |
| 248.20 | 1.50 | 2255 | 220 | 2272 | | 2272 | 2239 | 248.19 | 1:100 Year Event | 248.20 |
| 248.30 | 1.60 | 2362 | 231 | 2503 | | 2503 | 2503 | 248.30 | 1:250 Year Event | 248.30 |
| 248.40 | 1.70 | 2470 | 242 | 2744 | | 2744 | | | | 248.40 |
| 248.50 | 1.80 | 2577 | 252 | 2997 | | 2997 | | | | 248.50 |
| 248.60 | 1.90 | 2685 | 263 | 3260 | | 3260 | | | Top of Pond | 248.60 |

# INGLIS SUBDIVISION
## STORMWATER MANAGEMENT
**Komoka, Ontario**

Project Number: 43705-104
Date: May 22, 2020
Design By: JJM
File: Q:\43705\104\SWM\Preliminary\43705-104 Preliminary SWM Facility Design Sheet Option 2.xlsx

**Orifice Calculations**

$Q_o=C_d*A_o*(2*g*H_o)\text{^}0.5$

| | Orifice 1 | Orifice 2 | Orifice 3 |
|---|---|---|---|
| $C_d$ | 0.63 | 0.63 | 0.63 |
| Invert (m) | 247.00 | 500.00 | 500.00 |
| Width (m) | | | |
| Diameter/Height (m) | 0.350 | | |
| Type (H/V) | V | V | V |

| $C_d$ | Description |
|---|---|
| 0.63 | Orifice Plate |
| 0.80 | Orifice Tube |

**Weir Calculations**

$Q_w= 2/3*C_d*(2g)^{1/2}*L*H_w^{3/2} + 8/15*C_d*(2g)^{1/2}*\tan\theta*H_w^{5/2}$

| | |
|---|---|
| $C_d$ | 0.50 |
| Invert (m) | 248.10 |
| Length (m) | 8.000 |
| Side Slope (H:V) | 10 |
| Side Slope (rad) | 1.471 |

## STAGE-DISCHARGE RELATIONSHIP

| | | Orifice 1 | | | Orifice 2 | | | Infiltration | | | | | | | | | 25mm | 5-year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stage | Active Volume | Area | $H_o$ | Flow | Area | $H_o$ | Flow | Contact Area | I | Flow | Weir Flow | Total Flow | | Average Discharge | Increment Volume | Increment Dewatering Time | Cumulative Dewatering Time | Cumulative Dewatering Time |
| *m* | $m^3$ | $m^2$ | *m* | $m^3/s$ | $m^2$ | *m* | $m^3/s$ | $m^2$ | *mm/hr* | $m^3/s$ | $m^3/s$ | $m^3/s$ | | $m^3/s$ | $m^3$ | *hours* | *hours* | *hours* |
| 246.70 | 0 | | | | | | | 864 | 40 | 0.0096 | 0.0000 | 0.0096 | | 0.0101 | 91 | 2.50 | 17.50 | 27.89 |
| 246.80 | 91 | | | | | | | 947 | 40 | 0.0105 | 0.0000 | 0.0105 | | 0.0110 | 99 | 2.50 | 15.00 | 25.39 |
| 246.90 | 189 | | | | | | | 1030 | 40 | 0.0114 | 0.0000 | 0.0114 | | 0.0119 | 107 | 2.50 | 12.50 | 22.89 |
| 247.00 | 296 | | | | | | | 1112 | 40 | 0.0124 | 0.0000 | 0.0124 | | 0.0128 | 115 | 2.50 | 10.00 | 20.39 |
| 247.10 | 412 | | | | | | | 1195 | 40 | 0.0133 | 0.0000 | 0.0133 | | 0.0137 | 124 | 2.50 | 7.50 | 17.89 |
| 247.20 | 535 | | | | | | | 1278 | 40 | 0.0142 | 0.0000 | 0.0142 | | 0.0147 | 132 | 2.50 | 5.00 | 15.39 |
| 247.30 | 667 | | | | | | | 1361 | 40 | 0.0151 | 0.0000 | 0.0151 | | 0.0156 | 140 | 2.50 | 2.50 | 12.89 |
| 247.40 | 808 | | | | | | | 1443 | 40 | 0.0160 | 0.0000 | 0.0160 | | 0.0165 | 148 | 2.50 | | 10.39 |
| 247.50 | 956 | | | | | | | 1526 | 40 | 0.0170 | 0.0000 | 0.0170 | | 0.0174 | 157 | 2.50 | | 7.89 |
| 247.60 | 1113 | | | | | | | 1609 | 40 | 0.0179 | 0.0000 | 0.0179 | | 0.0185 | 166 | 2.50 | | 5.39 |
| 247.70 | 1279 | | | | | | | 1717 | 40 | 0.0191 | 0.0000 | 0.0191 | | 0.0197 | 177 | 2.50 | | 2.89 |
| 247.80 | 1456 | | | | | | | 1824 | 40 | 0.0203 | 0.0000 | 0.0203 | | 0.1352 | 188 | 0.39 | | 0.39 |
| 247.90 | 1644 | 0.10 | 0.72 | 0.2286 | | | | 1932 | 40 | 0.0215 | 0.0000 | 0.2501 | | 0.2583 | 199 | 0.21 | | |
| 248.00 | 1843 | 0.10 | 0.82 | 0.2439 | | | | 2039 | 40 | 0.0227 | 0.0000 | 0.2665 | | 0.2743 | 209 | 0.21 | | |
| 248.10 | 2052 | 0.10 | 0.92 | 0.2582 | | | | 2147 | 40 | 0.0239 | 0.0000 | 0.2821 | | 0.4949 | 220 | 0.12 | | |
| 248.20 | 2272 | 0.10 | 1.02 | 0.2718 | | | | 2255 | 40 | 0.0251 | 0.4109 | 0.7077 | | 1.1433 | 231 | 0.06 | | |
| 248.30 | 2503 | 0.10 | 1.12 | 0.2848 | | | | 2362 | 40 | 0.0262 | 1.2678 | 1.5788 | | 2.2133 | 242 | 0.03 | | |
| 248.40 | 2744 | 0.10 | 1.22 | 0.2972 | | | | 2470 | 40 | 0.0274 | 2.5232 | 2.8478 | | 3.6845 | 252 | 0.02 | | |
| 248.50 | 2997 | 0.10 | 1.32 | 0.3090 | | | | 2577 | 40 | 0.0286 | 4.1835 | 4.5212 | | 5.5678 | 263 | 0.01 | | |
| 248.60 | 3260 | 0.10 | 1.42 | 0.3205 | | | | 2685 | 40 | 0.0298 | 6.2642 | 6.6145 | | 3.3073 | | | | |

# Appendix B

# Hydrologic Modelling Output

```
2     Metric units
*#*************************************************************************
*#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
*#  Date         : AUGUST 2019
*#  Modeller     : [JJM]
*#  Company      : MTE CONSULTANTS INC.
*#  License #    :
*#*************************************************************************
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
*%                    ["25mm.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------|
READ STORM           STORM_FILENAME=["STORM.001"]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*POST-DEV SITE PRELIMINARY MODEL TO SIZE SWM FACILITY
*=========================================================================
*AREA 201 - PROPOSED SITE  ->  4.60 @ 60% IMP
*                          ->  1.15 @ 100% IMP (ROOF AREA)
*                          ->  3.45 @ 47% IMP (REMAINDER)
*=========================================================================
*=========================================================================
*AREA 201A - ROOF AREA
*=========================================================================
CALIB STANDHYD       ID=[1], NHYD=["2010"], DT=[1](min), AREA=[1.15](ha),
                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[67],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2.0](%),
                                          LGP=[15](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2.0](%),
                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------|
*=========================================================================
*ROUTE ROOF RUNOFF THROUGH GALLERIES
*ASSUME 50 LOTS * 2.0W x 1.0D x 5.0L * 0.35 VOID RATIO = 175 CU METERS
*CONTACT AREA = 50 * 5 * 2.0 = 500 SQ METERS => 5.5 L/S
*=========================================================================
ROUTE RESERVOIR      IDout=[2],   NHYD=[2011],  IDin=[1],
                     RDT=[1](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                  [   0.0000 ,  0.0000 ]
                                  [   0.0055 ,  0.0005 ]
                                  [   0.0056 ,  0.0175 ]
                                  [      -1  ,  -1     ]  (max twenty pts)
                                IDovf=[3], NHYDovf=[2012]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*AREA 201B - REMAINDER
*=========================================================================
CALIB STANDHYD       ID=[4], NHYD=["2013"], DT=[1](min), AREA=[3.45](ha),
                     XIMP=[0.42], TIMP=[0.47], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[67],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2.0](%),
                                          LGP=[30](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2.0](%),
                                          LGI=[50](m), MNI=[0.015], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------|
ADD HYD              IDsum=[1], NHYD=[3000], IDs to add=[2+3+4]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*AREA 202 - EXTERNAL SITE (FUTURE) -> 2.52 HA
*ASSUME 10% UNCONTROLLED TO SOUTH  -> 2.26 HA TO SWM POND
*
*TO SWM POND  ->  2.26 @ 60% IMP
*              ->  0.56 @ 100% (ROOF)
*              ->  1.70 @ 47% (REMAINDER)
*=========================================================================
*=========================================================================
*AREA 202A - ROOF RUNOFF
*=========================================================================
CALIB STANDHYD       ID=[2], NHYD=["2020"], DT=[1](min), AREA=[0.56](ha),
                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[67],
```

```
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2.0](%),
                                          LGP=[15](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2.0](%),
                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------|
*=========================================================================
*ROUTE ROOF RUNOFF THROUGH GALLERIES
*ASSUME 40 LOTS * 2.0W x 1.0D x 5.0L * 0.35 VOID RATIO = 140 CU METERS
*CONTACT AREA = 40 * 5 * 2.0 = 400 SQ METERS => 4.4 L/S
*=========================================================================
ROUTE RESERVOIR      IDout=[3],   NHYD=[2021],  IDin=[2],
                     RDT=[1](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                  [   0.0000 ,  0.0000 ]
                                  [   0.0044 ,  0.0004 ]
                                  [   0.0045 ,  0.0140 ]
                                  [      -1  ,  -1     ]  (max twenty pts)
                                IDovf=[4], NHYDovf=[2022]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*AREA 201B - REMAINDER
*=========================================================================
CALIB STANDHYD       ID=[5], NHYD=["2023"], DT=[1](min), AREA=[1.70](ha),
                     XIMP=[0.42], TIMP=[0.47], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[67],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2.0](%),
                                          LGP=[30](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2.0](%),
                                          LGI=[50](m), MNI=[0.015], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------|
ADD HYD              IDsum=[2], NHYD=[3000], IDs to add=[3+4+5]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*AREAS 3 - OXBOW DRIVE ROW
*=========================================================================
CALIB STANDHYD       ID=[3], NHYD=["203"], DT=[1](min), AREA=[0.64](ha),
                     XIMP=[0.60], TIMP=[0.60], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[67],
                     Pervious   surfaces: IAper=[5](mm), SLPP=[2.0](%),
                                          LGP=[5](m), MNP=[0.25], SCP=[0](min),
                     Impervious surfaces: IAimp=[2](mm), SLPI=[2.0](%),
                                          LGI=[50](m), MNI=[0.015], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------|
ADD HYD              IDsum=[4], NHYD=[3000], IDs to add=[1+2+3]
*%-----------------|-----------------------------------------------------|
*=========================================================================
*ROUTE TOTAL FLOWS THROUGH POND
*=========================================================================
*%-----------------|-----------------------------------------------------|
ROUTE RESERVOIR      IDout=[5],   NHYD=[3000],  IDin=[4],
                     RDT=[1](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                  [   0.0000 ,  0.0000 ]
                                  [   0.0096 ,  0.0043 ]
                                  [   0.0203 ,  0.1456 ]
                                  [   0.2501 ,  0.1644 ]
                                  [   0.2665 ,  0.1843 ]
                                  [   0.2821 ,  0.2052 ]
                                  [   0.7077 ,  0.2272 ]
                                  [   1.5788 ,  0.2503 ]
                                  [   2.8478 ,  0.2744 ]
                                  [   4.5212 ,  0.2997 ]
                                  [   6.6145 ,  0.3260 ]
                                  [      -1  ,  -1     ]  (max twenty pts)
                            IDovf=[6], NHYDovf=[3001]
*%-----------------|-----------------------------------------------------|
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
*%                    ["2YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------|
START                TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
```

```
*%                    ["5YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
*%                    ["10YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
*%                    ["25YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
*%                    ["50YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
*%                    ["100YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
*%                    ["250YR.HYT"] <--storm filename, one per line for NSTORM time
*%-----------------|-----------------------------------------------------------|
FINISH
```

```
==================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    ========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   ========
                                                        9   9  9   9   # 3057174
        StormWater Management HYdrologic Model           999    999    ========

 *********************************************************************************
 ***************************** SWMHYMO Ver/4.05 ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 *********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.           *********
 *********                  Ottawa,  Ontario: (613) 836-3884            *********
 *********                  Gatineau, Quebec: (819) 243-6858            *********
 *********                  E-Mail: swmhymo@jfsa.Com                    *********
 *********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: MIE Consultants Inc.                          +++++++++
 +++++++++                in any City          SERIAL#:3057174          +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 *********************************************************************************
 *********              ++++++ PROGRAM ARRAY DIMENSIONS ++++++          *********
 *********              Maximum value for ID numbers  :     10          *********
 *********              Max. number of rainfall points: 105408          *********
 *********              Max. number of flow points    : 105408          *********
 *********************************************************************************

 ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
 *****-------------------------------------------------------------------------*****
 *****     ID:  Hydrograph IDentification numbers, (1-10).                 *****
 *****   NHYD:  Hydrograph reference numbers, (6 digits or characters).    *****
 *****   AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  *****
 ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    *****
 ***** TpeakDate_hh:mm is the date and time of the peak flow.              *****
 *****   R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       *****
 *****   R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       *****
 *****      *:  see WARNING or NOTE message printed at end of run.         *****
 *****     **:  see  ERROR  message printed at end of run.                 *****
 *********************************************************************************
 *********************************************************************************

:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 *********************************************************************************

 ***********************     S U M M A R Y   O U T P U T     *********************
 *********************************************************************************
 *         DATE: 2020-05-22     TIME: 12:21:43     RUN COUNTER: 001483          *
 *********************************************************************************
 * Input   filename: Q:\43705\104\SWM\PRELIM-1\POST_M-1.DAT                     *
 * Output  filename: Q:\43705\104\SWM\PRELIM-1\POST_M-1.out                     *
 * Summary filename: Q:\43705\104\SWM\PRELIM-1\POST_M-1.sum                     *
 * User comments:                                                               *
 * 1:___________________________________________________________________________*
 * 2:___________________________________________________________________________*
 * 3:___________________________________________________________________________*
 *********************************************************************************


#********************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date        : AUGUST 2019
#  Modeller    : [JJM]
#  Company     : MIE CONSULTANTS INC.
#  License #   :
#********************************************************************************
 RUN:COMMAND#
 001:0001------------------------------------------------------------------------
```

```
     START
      [TZERO =     .00 hrs on         0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=   4.02:PTOT=  25.25]
 001:0003---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     01:2010            1.15     .358 No_date    1:37   23.04 .913
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 001:0004---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010            1.15     .358 No_date    1:37   23.04  n/a
      [RDT= 1.00] out<- 02:       2011     1.01     .006 No_date    1:54   23.04  n/a
            overflow <= 03:       2012      .14     .029 No_date    1:54   23.04  n/a
     (MxStoUsed=.1750E-01, TotOvfVol=.3287E-02, N-Ovf=    3, TotDurOvf=    1.hrs)
 001:0005---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     04:2013            3.45     .361 No_date    1:37   11.60 .459
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 001:0006---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:       2011     1.01     .006 No_date    1:54   23.04  n/a
                      + 03:       2012      .14     .029 No_date    1:54   23.04  n/a
                      + 04:2013            3.45     .361 No_date    1:37   11.60  n/a
      [DT= 1.00]  SUM=  01:       3000     4.60     .366 No_date    1:37   14.46  n/a
 001:0007---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     02:2020             .56     .174 No_date    1:37   23.04 .913
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 001:0008---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020             .56     .174 No_date    1:37   23.04  n/a
      [RDT= 1.00] out<- 03:       2021      .56     .004 No_date    2:39   23.04  n/a
            overflow <= 04:       2022      .00     .000 No_date    0:00     .00  n/a
     (MxStoUsed=.9055E-02, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
 001:0009---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     05:2023            1.70     .178 No_date    1:37   11.60 .459
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 001:0010---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:       2021      .56     .004 No_date    2:39   23.04  n/a
                      + 04:       2022      .00     .000 No_date    0:00     .00  n/a
                      + 05:2023            1.70     .178 No_date    1:37   11.60  n/a
      [DT= 1.00]  SUM=  02:       3000     2.26     .182 No_date    1:37   14.44  n/a
 001:0011---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     03:203              .64     .096 No_date    1:37   15.08 .597
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 001:0012---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:       3000     4.60     .366 No_date    1:37   14.46  n/a
                      + 02:       3000     2.26     .182 No_date    1:37   14.44  n/a
                      + 03:203              .64     .096 No_date    1:37   15.08  n/a
      [DT= 1.00]  SUM=  04:       3000     7.50     .644 No_date    1:37   14.51  n/a
 001:0013---------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:       3000     7.50     .644 No_date    1:37   14.51  n/a
      [RDT= 1.00] out<- 05:       3000     7.50     .015 No_date    4:05   14.51  n/a
            overflow <= 06:       3001      .00     .000 No_date    0:00     .00  n/a
     (MxStoUsed=.6915E-01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
  ** END OF RUN :    1

*********************************************************************************
```

```
 RUN:COMMAND#
 002:0001------------------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   2 ]
#**************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date         : AUGUST 2019
#  Modeller     : [JJM]
#  Company      : MTE CONSULTANTS INC.
#  License #    :
#**************************************************************************
 002:0002------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=   3.02:PTOT=  43.03]
 002:0003-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     01:2010            1.15      .624 No_date    1:13   40.71 .946
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 002:0004-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010            1.15      .624 No_date    1:13   40.71  n/a
      [RDT= 1.00] out<- 02:       2011      .55      .006 No_date    1:14   40.71  n/a
            overflow <= 03:       2012      .60      .552 No_date    1:14   40.71  n/a
     (MxStoUsed=.1750E-01, TotOvfVol=.2449E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 002:0005-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     04:2013            3.45      .677 No_date    1:13   22.85 .531
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 002:0006-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:       2011      .55      .006 No_date    1:14   40.71  n/a
                     +  03:       2012      .60      .552 No_date    1:14   40.71  n/a
                     +  04:2013            3.45      .677 No_date    1:13   22.85  n/a
      [DT= 1.00]  SUM=  01:       3000     4.60     1.201 No_date    1:14   27.31  n/a
 002:0007-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     02:2020             .56      .304 No_date    1:13   40.71 .946
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 002:0008-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020             .56      .304 No_date    1:13   40.71  n/a
      [RDT= 1.00] out<- 03:       2021      .44      .004 No_date    1:21   40.71  n/a
            overflow <= 04:       2022      .12      .068 No_date    1:21   40.71  n/a
     (MxStoUsed=.1400E-01, TotOvfVol=.5009E-02, N-Ovf=    3, TotDurOvf=    1.hrs)
 002:0009-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     05:2023            1.70      .334 No_date    1:13   22.85 .531
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 002:0010-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:       2021      .44      .004 No_date    1:21   40.71  n/a
                     +  04:       2022      .12      .068 No_date    1:21   40.71  n/a
                     +  05:2023            1.70      .334 No_date    1:13   22.85  n/a
      [DT= 1.00]  SUM=  02:       3000     2.26      .338 No_date    1:13   27.27  n/a
 002:0011-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     03:203              .64      .182 No_date    1:13   28.16 .655
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 002:0012-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:       3000     4.60     1.201 No_date    1:14   27.31  n/a
                     +  02:       3000     2.26      .338 No_date    1:13   27.27  n/a
```

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                     +  03:203              .64      .182 No_date    1:13   28.16  n/a
      [DT= 1.00]  SUM=  04:       3000     7.50     1.697 No_date    1:14   27.37  n/a
 002:0013-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:       3000     7.50     1.697 No_date    1:14   27.37  n/a
      [RDT= 1.00] out<- 05:       3000     7.50      .061 No_date    2:32   27.37  n/a
            overflow <= 06:       3001      .00      .000 No_date    0:00     .00  n/a
     (MxStoUsed=.1489E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
  ** END OF RUN :   2

**************************************************************************





 RUN:COMMAND#
 003:0001------------------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#**************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date         : AUGUST 2019
#  Modeller     : [JJM]
#  Company      : MTE CONSULTANTS INC.
#  License #    :
#**************************************************************************
 003:0002------------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=   3.02:PTOT=  44.51]
 003:0003-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     01:2010            1.15      .657 No_date    1:13   42.18 .948
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 003:0004-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010            1.15      .657 No_date    1:13   42.18  n/a
      [RDT= 1.00] out<- 02:       2011      .53      .006 No_date    1:14   42.18  n/a
            overflow <= 03:       2012      .62      .576 No_date    1:14   42.18  n/a
     (MxStoUsed=.1751E-01, TotOvfVol=.2609E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 003:0005-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     04:2013            3.45      .711 No_date    1:13   23.85 .536
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 003:0006-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:       2011      .53      .006 No_date    1:14   42.18  n/a
                     +  03:       2012      .62      .576 No_date    1:14   42.18  n/a
                     +  04:2013            3.45      .711 No_date    1:13   23.85  n/a
      [DT= 1.00]  SUM=  01:       3000     4.60     1.250 No_date    1:14   28.43  n/a
 003:0007-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     02:2020             .56      .320 No_date    1:13   42.18 .948
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 003:0008-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020             .56      .320 No_date    1:13   42.18  n/a
      [RDT= 1.00] out<- 03:       2021      .42      .004 No_date    1:20   42.18  n/a
            overflow <= 04:       2022      .14      .078 No_date    1:20   42.18  n/a
     (MxStoUsed=.1400E-01, TotOvfVol=.5739E-02, N-Ovf=    4, TotDurOvf=    2.hrs)
 003:0009-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     05:2023            1.70      .350 No_date    1:13   23.85 .536
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 003:0010-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:       2021      .42      .004 No_date    1:20   42.18  n/a
```

```
                     + 04:       2022       .14      .078 No_date    1:20   42.18  n/a
                     + 05:2023             1.70      .350 No_date    1:13   23.85  n/a
      [DT= 1.00]  SUM= 02:       3000      2.26      .355 No_date    1:13   28.39  n/a
 003:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      03:203              .64      .191 No_date    1:13   29.30 .658
     [XIMP=.60:TIMP=.60]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 003:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:       3000     4.60     1.250 No_date    1:14   28.43  n/a
                     + 02:       3000     2.26      .355 No_date    1:13   28.39  n/a
                     + 03:203              .64      .191 No_date    1:13   29.30  n/a
      [DT= 1.00]  SUM= 04:       3000     7.50     1.765 No_date    1:14   28.49  n/a
 003:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:       3000     7.50     1.765 No_date    1:14   28.49  n/a
     [RDT= 1.00] out<- 05:       3000     7.50      .080 No_date    2:20   28.49  n/a
           overflow <= 06:       3001      .00      .000 No_date    0:00     .00  n/a
    (MxStoUsed=.1505E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
 ** END OF RUN :    3

*********************************************************************************




 RUN:COMMAND#
 004:0001--------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   4 ]
#********************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date         : AUGUST 2019
#  Modeller     : [JJM]
#  Company      : MTE CONSULTANTS INC.
#  License #    :
#********************************************************************************
 004:0002--------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT= 1.00:SDUR=   3.02:PTOT=  52.36]
 004:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      01:2010            1.15      .729 No_date    1:13   49.99 .955
     [XIMP=.99:TIMP=.99]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 004:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 01:2010            1.15      .729 No_date    1:13   49.99  n/a
     [RDT= 1.00] out<- 02:       2011      .45      .006 No_date    1:13   49.99  n/a
           overflow <= 03:       2012      .70      .647 No_date    1:14   49.99  n/a
    (MxStoUsed=.1751E-01, TotOvfVol=.3499E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 004:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      04:2013            3.45      .811 No_date    1:13   29.32 .560
     [XIMP=.42:TIMP=.47]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 004:0006---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             02:       2011      .45      .006 No_date    1:13   49.99  n/a
                     + 03:       2012      .70      .647 No_date    1:14   49.99  n/a
                     + 04:2013            3.45      .811 No_date    1:13   29.32  n/a
      [DT= 1.00]  SUM= 01:       3000     4.60     1.422 No_date    1:14   34.49  n/a
 004:0007---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      02:2020             .56      .355 No_date    1:13   49.99 .955
     [XIMP=.99:TIMP=.99]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 004:0008---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ROUTE RESERVOIR -> 02:2020             .56      .355 No_date    1:13   49.99  n/a
     [RDT= 1.00] out<- 03:       2021      .36      .004 No_date    1:17   49.99  n/a
           overflow <= 04:       2022      .20      .158 No_date    1:17   49.99  n/a
    (MxStoUsed=.1400E-01, TotOvfVol=.1004E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 004:0009---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      05:2023            1.70      .400 No_date    1:13   29.32 .560
     [XIMP=.42:TIMP=.47]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 004:0010---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             03:       2021      .36      .004 No_date    1:17   49.99  n/a
                     + 04:       2022      .20      .158 No_date    1:17   49.99  n/a
                     + 05:2023            1.70      .400 No_date    1:13   29.32  n/a
      [DT= 1.00]  SUM= 02:       3000     2.26      .404 No_date    1:13   34.44  n/a
 004:0011---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      03:203              .64      .218 No_date    1:13   35.42 .676
     [XIMP=.60:TIMP=.60]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 004:0012---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:       3000     4.60     1.422 No_date    1:14   34.49  n/a
                     + 02:       3000     2.26      .404 No_date    1:13   34.44  n/a
                     + 03:203              .64      .218 No_date    1:13   35.42  n/a
      [DT= 1.00]  SUM= 04:       3000     7.50     2.040 No_date    1:13   34.56  n/a
 004:0013---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:       3000     7.50     2.040 No_date    1:13   34.56  n/a
     [RDT= 1.00] out<- 05:       3000     7.50      .214 No_date    1:48   34.56  n/a
           overflow <= 06:       3001      .00      .000 No_date    0:00     .00  n/a
    (MxStoUsed=.1615E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
 ** END OF RUN :    4

*********************************************************************************




 RUN:COMMAND#
 005:0001--------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   5 ]
#********************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date         : AUGUST 2019
#  Modeller     : [JJM]
#  Company      : MTE CONSULTANTS INC.
#  License #    :
#********************************************************************************
 005:0002--------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  =
     [SDT= 1.00:SDUR=   3.02:PTOT=  61.82]
 005:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      01:2010            1.15      .844 No_date    1:13   59.40 .961
     [XIMP=.99:TIMP=.99]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 005:0004---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 01:2010            1.15      .844 No_date    1:13   59.40  n/a
     [RDT= 1.00] out<- 02:       2011      .38      .006 No_date    1:12   59.40  n/a
           overflow <= 03:       2012      .77      .753 No_date    1:14   59.40  n/a
    (MxStoUsed=.1751E-01, TotOvfVol=.4572E-01, N-Ovf=    2, TotDurOvf=    2.hrs)
 005:0005---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      04:2013            3.45      .966 No_date    1:13   36.21 .586
     [XIMP=.42:TIMP=.47]
     [LOSS= 2 :CN= 67.0]
     [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
```

```
 005:0006-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:        2011       .38      .006 No_date     1:12    59.40  n/a
                       + 03:        2012       .77      .753 No_date     1:14    59.40  n/a
                       + 04:2013              3.45      .966 No_date     1:13    36.21  n/a
      [DT= 1.00]  SUM=   01:        3000      4.60     1.675 No_date     1:14    42.01  n/a
 005:0007-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      02:2020               .56      .411 No_date     1:13    59.40 .961
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 005:0008-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020               .56      .411 No_date     1:13    59.40  n/a
      [RDT= 1.00] out<- 03:        2021       .30      .004 No_date     1:15    59.40  n/a
           overflow <= 04:        2022       .26      .289 No_date     1:15    59.40  n/a
     (MxStoUsed=.1400E-01, TotOvfVol=.1524E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 005:0009-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      05:2023              1.70      .476 No_date     1:13    36.21 .586
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 005:0010-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:        2021       .30      .004 No_date     1:15    59.40  n/a
                       + 04:        2022       .26      .289 No_date     1:15    59.40  n/a
                       + 05:2023              1.70      .476 No_date     1:13    36.21  n/a
      [DT= 1.00]  SUM=   02:        3000      2.26      .687 No_date     1:15    41.96  n/a
 005:0011-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      03:203                .64      .262 No_date     1:13    42.99 .695
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 005:0012-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:        3000      4.60     1.675 No_date     1:14    42.01  n/a
                       + 02:        3000      2.26      .687 No_date     1:15    41.96  n/a
                       + 03:203                .64      .262 No_date     1:13    42.99  n/a
      [DT= 1.00]  SUM=   04:        3000      7.50     2.416 No_date     1:13    42.08  n/a
 005:0013-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:        3000      7.50     2.416 No_date     1:13    42.08  n/a
      [RDT= 1.00] out<- 05:        3000      7.50      .270 No_date     1:47    42.08  n/a
           overflow <= 06:        3001       .00      .000 No_date     0:00      .00  n/a
     (MxStoUsed=.1889E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
  ** END OF RUN :    5

*******************************************************************************




 RUN:COMMAND#
 006:0001---------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#******************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date        : AUGUST 2019
#  Modeller    : [JJM]
#  Company     : MTE CONSULTANTS INC.
#  License #   :
#******************************************************************************
 006:0002---------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=   3.02:PTOT=  69.09]
 006:0003-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      01:2010              1.15      .937 No_date     1:13    66.64 .964
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
```

```
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 006:0004-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010              1.15      .937 No_date     1:13    66.64  n/a
      [RDT= 1.00] out<- 02:        2011       .34      .006 No_date     1:11    66.64  n/a
           overflow <= 03:        2012       .81      .835 No_date     1:14    66.64  n/a
     (MxStoUsed=.1749E-01, TotOvfVol=.5398E-01, N-Ovf=    2, TotDurOvf=    2.hrs)
 006:0005-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      04:2013              3.45     1.092 No_date     1:13    41.68 .603
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 006:0006-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:        2011       .34      .006 No_date     1:11    66.64  n/a
                       + 03:        2012       .81      .835 No_date     1:14    66.64  n/a
                       + 04:2013              3.45     1.092 No_date     1:13    41.68  n/a
      [DT= 1.00]  SUM=   01:        3000      4.60     1.879 No_date     1:13    47.92  n/a
 006:0007-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      02:2020               .56      .456 No_date     1:13    66.64 .964
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 006:0008-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020               .56      .456 No_date     1:13    66.64  n/a
      [RDT= 1.00] out<- 03:        2021       .27      .004 No_date     1:14    66.64  n/a
           overflow <= 04:        2022       .29      .405 No_date     1:14    66.64  n/a
     (MxStoUsed=.1400E-01, TotOvfVol=.1923E-01, N-Ovf=    3, TotDurOvf=    2.hrs)
 006:0009-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      05:2023              1.70      .538 No_date     1:13    41.68 .603
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 006:0010-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:        2021       .27      .004 No_date     1:14    66.64  n/a
                       + 04:        2022       .29      .405 No_date     1:14    66.64  n/a
                       + 05:2023              1.70      .538 No_date     1:13    41.68  n/a
      [DT= 1.00]  SUM=   02:        3000      2.26      .920 No_date     1:14    47.87  n/a
 006:0011-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      03:203                .64      .296 No_date     1:13    48.94 .708
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 006:0012-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:        3000      4.60     1.879 No_date     1:13    47.92  n/a
                       + 02:        3000      2.26      .920 No_date     1:14    47.87  n/a
                       + 03:203                .64      .296 No_date     1:13    48.94  n/a
      [DT= 1.00]  SUM=   04:        3000      7.50     3.081 No_date     1:14    47.99  n/a
 006:0013-----------------ID:NHYD------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:        3000      7.50     3.081 No_date     1:14    47.99  n/a
      [RDT= 1.00] out<- 05:        3000      7.50      .405 No_date     1:40    47.99  n/a
           overflow <= 06:        3001       .00      .000 No_date     0:00      .00  n/a
     (MxStoUsed=.2116E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
  ** END OF RUN :    6

*******************************************************************************




 RUN:COMMAND#
 007:0001---------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   7 ]
#******************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date        : AUGUST 2019
#  Modeller    : [JJM]
#  Company     : MTE CONSULTANTS INC.
```

```
#  License #    :
#*************************************************************************
 007:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=   3.02:PTOT=  76.22]
 007:0003-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      01:2010             1.15    1.017 No_date    1:13   73.74 .967
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 007:0004-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010             1.15    1.017 No_date    1:13   73.74  n/a
      [RDT= 1.00] out<- 02:      2011        .31     .006 No_date    1:10   73.74  n/a
            overflow <= 03:      2012        .84     .910 No_date    1:14   73.74  n/a
     (MxStoUsed=.1751E-01, TotOvfVol=.6208E-01, N-Ovf=    2, TotDurOvf=    2.hrs)
 007:0005-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      04:2013             3.45    1.214 No_date    1:13   47.19 .619
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 007:0006-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:      2011        .31     .006 No_date    1:10   73.74  n/a
                       + 03:      2012        .84     .910 No_date    1:14   73.74  n/a
                       + 04:2013             3.45    1.214 No_date    1:13   47.19  n/a
      [DT= 1.00]  SUM=   01:      3000       4.60    2.073 No_date    1:13   53.83  n/a
 007:0007-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      02:2020              .56     .495 No_date    1:13   73.74 .967
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 007:0008-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020              .56     .495 No_date    1:13   73.74  n/a
      [RDT= 1.00] out<- 03:      2021        .25     .004 No_date    1:13   73.74  n/a
            overflow <= 04:      2022        .31     .441 No_date    1:14   73.74  n/a
     (MxStoUsed=.1401E-01, TotOvfVol=.2315E-01, N-Ovf=    4, TotDurOvf=    2.hrs)
 007:0009-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      05:2023             1.70     .598 No_date    1:13   47.19 .619
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 007:0010-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:      2021        .25     .004 No_date    1:13   73.74  n/a
                       + 04:      2022        .31     .441 No_date    1:14   73.74  n/a
                       + 05:2023             1.70     .598 No_date    1:13   47.19  n/a
      [DT= 1.00]  SUM=   02:      3000       2.26    1.017 No_date    1:13   53.77  n/a
 007:0011-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      03:203               .64     .327 No_date    1:13   54.87 .720
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 007:0012-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:      3000       4.60    2.073 No_date    1:13   53.83  n/a
                       + 02:      3000       2.26    1.017 No_date    1:13   53.77  n/a
                       + 03:203               .64     .327 No_date    1:13   54.87  n/a
      [DT= 1.00]  SUM=   04:      3000       7.50    3.416 No_date    1:13   53.90  n/a
 007:0013-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:      3000       7.50    3.416 No_date    1:13   53.90  n/a
      [RDT= 1.00] out<- 05:      3000       7.50     .643 No_date    1:33   53.90  n/a
            overflow <= 06:      3001        .00     .000 No_date    0:00     .00  n/a
     (MxStoUsed=.2239E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs)
  ** END OF RUN :    7

*************************************************************************
```

```
 RUN:COMMAND#
 008:0001-----------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   8 ]
#*************************************************************************
#  Project Name: [LIGHTHOUSE]    Project Number: [39042-101]
#  Date         : AUGUST 2019
#  Modeller     : [JJM]
#  Company      : MTE CONSULTANTS INC.
#  License #    :
#*************************************************************************
 008:0002-----------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  =
      [SDT= 1.00:SDUR=  24.02:PTOT= 114.42]
 008:0003-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      01:2010             1.15    1.226 No_date    9:37  111.81 .977
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 008:0004-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 01:2010             1.15    1.226 No_date    9:37  111.81  n/a
      [RDT= 1.00] out<- 02:      2011        .42     .006 No_date    9:30  111.81  n/a
            overflow <= 03:      2012        .73    1.089 No_date    9:38  111.81  n/a
     (MxStoUsed=.1750E-01, TotOvfVol=.8135E-01, N-Ovf=    3, TotDurOvf=    5.hrs)
 008:0005-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      04:2013             3.45    1.561 No_date    9:37   78.44 .686
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 008:0006-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:      2011        .42     .006 No_date    9:30  111.81  n/a
                       + 03:      2012        .73    1.089 No_date    9:38  111.81  n/a
                       + 04:2013             3.45    1.561 No_date    9:37   78.44  n/a
      [DT= 1.00]  SUM=   01:      3000       4.60    2.589 No_date    9:37   86.78  n/a
 008:0007-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      02:2020              .56     .597 No_date    9:37  111.81 .977
      [XIMP=.99:TIMP=.99]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  15.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  10.:MNI=.015:SCI=   .0]
 008:0008-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 02:2020              .56     .597 No_date    9:37  111.81  n/a
      [RDT= 1.00] out<- 03:      2021        .29     .004 No_date    9:36  111.81  n/a
            overflow <= 04:      2022        .27     .529 No_date    9:38  111.81  n/a
     (MxStoUsed=.1400E-01, TotOvfVol=.3064E-01, N-Ovf=    4, TotDurOvf=    3.hrs)
 008:0009-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      05:2023             1.70     .769 No_date    9:37   78.44 .686
      [XIMP=.42:TIMP=.47]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=  30.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 008:0010-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:      2021        .29     .004 No_date    9:36  111.81  n/a
                       + 04:      2022        .27     .529 No_date    9:38  111.81  n/a
                       + 05:2023             1.70     .769 No_date    9:37   78.44  n/a
      [DT= 1.00]  SUM=   02:      3000       2.26    1.270 No_date    9:37   86.71  n/a
 008:0011-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      03:203               .64     .414 No_date    9:37   87.87 .768
      [XIMP=.60:TIMP=.60]
      [LOSS= 2 :CN= 67.0]
      [Pervious     area: IAper= 5.00:SLPP=2.00:LGP=   5.:MNP=.250:SCP=   .0]
      [Impervious   area: IAimp= 2.00:SLPI=2.00:LGI=  50.:MNI=.015:SCI=   .0]
 008:0012-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:      3000       4.60    2.589 No_date    9:37   86.78  n/a
                       + 02:      3000       2.26    1.270 No_date    9:37   86.71  n/a
                       + 03:203               .64     .414 No_date    9:37   87.87  n/a
      [DT= 1.00]  SUM=   04:      3000       7.50    4.273 No_date    9:37   86.85  n/a
 008:0013-----------------ID:NHYD-------------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
     ROUTE RESERVOIR -> 04:       3000     7.50    4.273 No_date    9:37    86.85  n/a
      [RDT= 1.00] out<- 05:       3000     7.50    1.574 No_date    9:47    86.85  n/a
            overflow <= 06:       3001      .00     .000 No_date    0:00      .00  n/a
     (MxStoUsed=.2503E+00, TotOvfVol=.0000E+00, N-Ovf=     0, TotDurOvf=     0.hrs)
 008:0002------------------------------------------------------------------------------
      FINISH
---------------------------------------------------------------------------------------
***************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-05-22      at 12:21:50
=======================================================================================
```

# Appendix C

# Geotechnical Report

# 10125 Oxbow Drive Development

## Geotechnical Investigation

**Project Location:**
10125 Oxbow Drive
Komoka, ON

**Prepared for:**
2270942 Ontario Ltd.
P.O. Box 63
Formosa, ON N0G 1W0

**Prepared by:**
MTE Consultants
123 St. George Street
London, ON N6A 3A1

April 2, 2020

**MTE File No.:** 43705-301

*Engineers, Scientists, Surveyors.*

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## Appendices

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# 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Ms. Heather Johnson-Inglis to conduct a geotechnical investigation for a proposed development at 10125 Oxbow Drive, Komoka Ontario, as shown on **Figure 1 in Appendix A**. The 7.7 hectare site is currently vacant and was a previous aggregate extraction pit.

The site is bordered to the north by Oxbow Drive and a retirement facility; to the east by residential buildings; to the west by a park and Municipality lands and to the south by a golf course. The ground surface generally slopes from north to south from approximate Elevation 251.5 to 245.5 metres (m).

A previous report was completed by LVM entitled "Planned Residential Subdivision, 10125 Oxbow Drive, Komoka, Ontario" dated May 20, 2015. The previous boreholes from LVM have been incorporated into this report. Geodetic elevations have been added to the LVM borehole logs based on the site benchmark used in the previous investigation. The borehole logs from the previous report are provided in Appendix B.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

# 2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out between December 10 and 19, 2019 and involved the drilling of eight boreholes (Boreholes MW101-19 to BH108-19) to depths ranging from 5.0 to 11.3 m. The locations of the boreholes are shown on the Site Plan, **Figure 2 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a D50 track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by London Soil Test Ltd.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B**.

Upon completion of drilling, monitoring wells were installed in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19. The remaining boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

Five 50 mm diameter monitoring wells were installed in Boreholes MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 to allow measurement of stabilized groundwater levels and groundwater sampling and testing, if required. The installations comprised 1.5 m filtered screen and bentonite seals above the screen. Stabilized water level measurements were taken by MTE on January 7 and February 4, 2020. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT tests; documented the soil stratigraphies; monitored the groundwater conditions; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations were surveyed by MTE OLS Ltd. and referenced to geodetic datum.

All of the soil samples collected were submitted for moisture content testing and six soil samples were submitted for particle size distribution analyses. The results of the laboratory tests are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

## 3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include topsoil/fill materials overlying granular deposits and silt.

### 3.1 Topsoil

Topsoil/Surficial organic fill was encountered surficially in all of the boreholes and was 80 to 915 mm thick (average thickness = 430 mm). The topsoil typically comprises dark brown silty to sandy topsoil. A layer of buried topsoil was encountered MW108-19 at a depth of 1.1 m and was 30 mm thick. Topsoil was determined through visual observation and no nutrient testing for applicable plant growth was performed as part of the scope of work for this project.

### 3.2 Fill Material

Variable fill material was encountered beneath topsoil in Boreholes MW101-19, BH102-19, MW104-19, BH105-19, BH106-19 and MW108-19. The fill materials ranged in thickness from 40 mm to 9.3 m and extended to depths of 0.1 to 9.4 m. The fill was deepest at the northern part of the site near Oxbow Drive. The fill typically ranges in composition from sand to silty sand to sand and gravel with rootlets. SPT N-values measured in the fill ranged from 5 to 19 blows per 300 mm penetration of the split spoon sampler indicating loose to compact conditions. Insitu moisture contents in the fill were 5 to 19% indicating moist to wet conditions.

Fill materials encountered in the LVM Boreholes BH01-15 to BH06-15 ranged in thickness from 0.7 to 8.5 m and extended to the termination depth of Borehole 04-15.

### 3.3 Granular Deposits

Granular soils were encountered beneath topsoil, fill materials or silts in all of the boreholes. The granular deposits were about 1.0 to 7.9 m. All boreholes were terminated in the granular soils except for MW104-19, BH106-19 and MW108-19. The granular soils typically range in composition from sand to silty sand to gravelly sand to sand and gravel. The results of six particle size distribution analyses conducted on the granular deposits are provided in **Appendix C** and summarized in the following table;

**Table 1 - Results of Granular Deposits Particle Size Distribution Analyses**

| Borehole Number | Sample Depth (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) |
|---|---|---|---|---|---|
| MW101-19 | 10.7 - 11.3 | 0 | 85 | 14 | 1 |
| MW103-19 | 7.6 - 8.2 | 53 | 40 | 6 | 1 |
| MW104-19 | 7.6 - 8.1 | 24 | 66 | 9 | 1 |
| BH106-19 | 3.8 – 4.3 | 0 | 73 | 26 | 1 |
| MW107-19 | 3.8 - 4.4 | 0 | 73 | 26 | 1 |
| MW108-19 | 1.5 - 2.0 | 3 | 87 | 9 | 1 |

SPT N-values measured in the granular soils range from 4 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating very loose to very dense conditions. Insitu moisture contents in the granular range from 2 to 20% indicating damp to wet conditions. Cobbles were encountered in MW103-19 and MW104-19 at depths of 5.3m and 4.4m, respectively, during drilling.

### 3.4 Silt and Clayey Silt Deposits

Silt to clayey silt was encountered beneath or interlayered in the granular soils in all of the boreholes except BH102-19, MW103-19 and MW107-19 and extends to the termination depth of MW104-19, BH106-19 and MW108-19. SPT N-values range from 26 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating compact to very dense conditions. Insitu moisture contents in the silt soils range from 8 to 21% indicating moist to wet conditions.

## 4.0 Groundwater Conditions

Groundwater observations were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Groundwater was noted within the granular deposits or fill materials in all boreholes at depths of 0.9 to 9.1 m below the ground surface.

Groundwater levels were measured in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 on January 7 and February 4, 2020 at depth of 0.5 to 8.8 m beneath the ground surface or Elevations 243.1 to 244.8 m. The results of the measured groundwater levels are summarized in the table below:

**Table 2 – Groundwater Measurements**

| Borehole | Ground Surface Elevation (mASL | Measured Groundwater Level January 7, 2020 | | Measured Groundwater Level February 4, 2020 | |
|---|---|---|---|---|---|
| | | Depth (m) | Elevation (m) | Depth (m) | Elevation (m) |
| MW101-19 | 251.9 | 8.79 | 243.11 | 8.33 | 243.57 |
| MW103-19 | 250.9 | 7.45 | 243.45 | 7.17 | 243.73 |
| MW104-19 | 250.2 | 6.29 | 243.91 | 6.01 | 244.19 |
| MW107-19 | 245.8 | 1.72 | 244.08 | 1.10 | 244.70 |
| MW108-19 | 245.3 | 0.85 | 244.45 | 0.54 | 244.76 |

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

# 5.0 Discussion and Recommendations

## 5.1 General

The project involves the design for a proposed development located at 10125 Oxbow Drive in Komoka, Ontario. Based on the detailed design information known at the time of preparing this report, a total of about 97 residential lots were proposed with a stormwater management dry pond to the west part of the property and a medium density block to the southeast corner.

The subsurface stratigraphy at the site generally comprises topsoil and/or fill materials overlying granular soils and silt deposits. Groundwater was measured within the granular deposits about 0.5 to 8.8 m below the ground surface or Elevations 243.1 to 244.8 m in MW101-19, MW103-19, MW104-19, MW107-9 and MW108-19 on January 7 and February 4, 2020.

Based on the results of this geotechnical investigation, the proposed development will be problematic due to the thickness of fill soils on site and the elevation difference across the site. The following subsections of this report contain geotechnical recommendations pertaining to development of the property; including, site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration. It is recommended that geotechnical consultant provide additional recommendations once the final grading, servicing and cut/fill plans are completed.

## 5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Prior to carrying out any cutting and engineering fill operations, the surficial topsoil and fill materials must be removed and stockpiled. The average topsoil and fill thickness for the north part of the site (BH102-19 and LVM Boreholes BH01-15 to BH05-15) was approximately 7.7 m. The topsoil and fill materials thickness in the remaining areas of the property averaged about 0.7 m. The topsoil and fill soils could be used in landscaping areas.

The southern part of the site will require a grade raise to construct the proposed design of the development. The majority of the existing fill materials are not suitable for use as structural fill but could be used in parkland or landscape areas where no bearing capacity is required.

The majority of the inorganic native soils above the groundwater table are suitable for reuse as engineered fill if sufficient drying time is allotted. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

**Table 3 - Engineered Fill Requirements**

| Fill Use | Minimum Compaction Required |
|---|---|
| Structural fill to support buildings | 100% SPMDD |
| Subgrade fill beneath pavements or services | 95%SPMDD |
| Bulk fill in landscape area | 90%SPMDD |

The subgrade soils are susceptible to disturbance due to the silt content, and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the buildings should comprise granular material such as OPSS Granular 'B'. Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

## 5.3 Site Servicing

### 5.3.1 Excavations and Dewatering

The development will be serviced with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths in engineered fill soils.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)), exclusive of groundwater effects. Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Groundwater inflow should be expected where the excavations extend into the groundwater encountered within the granular deposits at about Elevations 243.1 to 244.8 m. It is our geotechnical opinion that proactive dewatering in the form of vacuum well points or the like would be required to handle the groundwater infiltration in this area if excavations extend below the groundwater level. It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW) will be required for the dewatering system for sewer installations at the site installed below the groundwater level. The design of the dewatering system should be completed by a specialized dewatering contractor to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base.

### 5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on properly dewatered native inorganic subsoil or imported structural fill. The existing fill and topsoil are not suitable to support pipes without significant settlement. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD).

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth.

### 5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native soils are not considered suitable for reuse as trench backfill. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

## 5.4 Pavements

It is understood pavements will be constructed for the proposed roadways at the site. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The pavement component thicknesses in the following table are recommended based on the proposed pavement usage, the frost-susceptibility and strength of the subgrade soils, Municipality standards and the Benkelman beam spring rebound coefficient for granular soils;

**Table 4 - Pavement Design**

| Pavement Component | Light Duty | Heavy Duty |
|---|---|---|
| Asphalt Hot Mix | 90 mm | 110 mm |
| OPSS 1010 Granular ‘A’ Base | 150 mm | 150 mm |
| OPSS 1010 Granular ‘B’ Subbase | 350 mm | 450 mm |

Heavy duty pavements should be used for main access ways to the development and where large vehicles will frequent, such as garbage and fire trucks.

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of HL3 surface over 50 mm of HL8 binder for the light duty pavement option and 50 mm of HL3 surface over 60 mm of HL8 binder for the heavy duty pavement option.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is strongly recommended to install subdrains beneath the low areas of pavement and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. Consideration should be given to providing continuous subdrains along the perimeter edges of the new roadways to promote drainage of the granular materials.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

## 5.5 Curbs, Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the Municipality of Middlesex Centre standards or specific requirements (OPSS 353.05.01):

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 7.0 ± 1.5%

During cold weather any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

## 5.6 Foundation Design

It is understood that the proposed building design may be constructed with slab-on-grade floors or with full basements.

In general, the undisturbed compact native soils or approved structural fill is considered suitable to support building foundations.

Building footings constructed on the undisturbed compact native granular soils or approved structural fill may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability

Limit States (SLS) of 150 kPa. The existing fill and topsoil are not suitable to support building foundations.

The founding materials are susceptible to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata.

The soil in trenches beneath footings for sewer and watermain services shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 25 MPa/m should be used in the design of the floor slab.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘D’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils, and temporary side slopes through this material must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation, exclusive of groundwater effects.

### 5.6.1 Basements

It is understood that basements may be installed for the proposed buildings at the site. Basement construction at the site may be problematic if a grade raise is not employed. The basement excavations will encounter groundwater conditions in the granular soils at Elevations 243.1 to 244.8 m. We recommend the basement floor levels be designed a minimum 0.5 m above the seasonal high groundwater elevations.

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service or other frost free outlet.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m$^3$ for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed compact native soil or well compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. If the subgrade soil is wet, we strongly recommend that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

### 5.7 Storm water Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may also be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). Six particle size distribution analyses were carried out on the granular deposits encountered at the site. They are plotted on **Table 101 in Appendix C**.

The estimated vertical hydraulic conductivity (k) is derived from an empirical formula by Hazen and Beyer. The estimated design infiltration rate is based on recommendations found in the Low Impact Development Stormwater Management Planning and Design Guide, Appendix C, Version 1.0, 2011, published by the Toronto and Region (TRCA) and the Credit Valley (CVC) Conservation Authority, and the approximate relationship between hydraulic conductivity and infiltration rate. A Factor of Safety of 2.5 has been applied to the calculated infiltration rates.

**Table 5 - Infiltration Rates for Native Soils**

| Borehole Number | Sample Depth (m) | Borehole Elevation (mASL) | Soil Type | Estimated K-Value (m/sec) | Infiltration Rate (mm/hr) |
|---|---|---|---|---|---|
| MW101-19 | 10.7 – 11.3 | 251.9 | Sand | 3.9E-5 | 49 |
| MW103-19 | 7.6 – 8.2 | 250.9 | Sand and Gravel | 7.4E-3 | 201 |
| MW104-19 | 7.6 – 8.1 | 250.2 | Gravelly Sand | 6.5E-5 | 56 |
| BH106-19 | 3.8 – 4.3 | 245.3 | Silty Sand | 1.7E-5 | 39 |
| MW107-19 | 3.8 – 4.3 | 245.8 | Silty Sand | 2.9E-5 | 46 |
| MW108-19 | 1.5 – 2.0 | 245.3 | Sand | 6.5E-5 | 57 |

It is our opinion that at-source infiltration of stormwater runoff is feasible for this development but will be dependent on the type of imported structural fill soils used to raise grades at the site.

## 5.8 Construction inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford and London offices.

## 6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

**MTE Consultants Inc.**

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BXT:MXW

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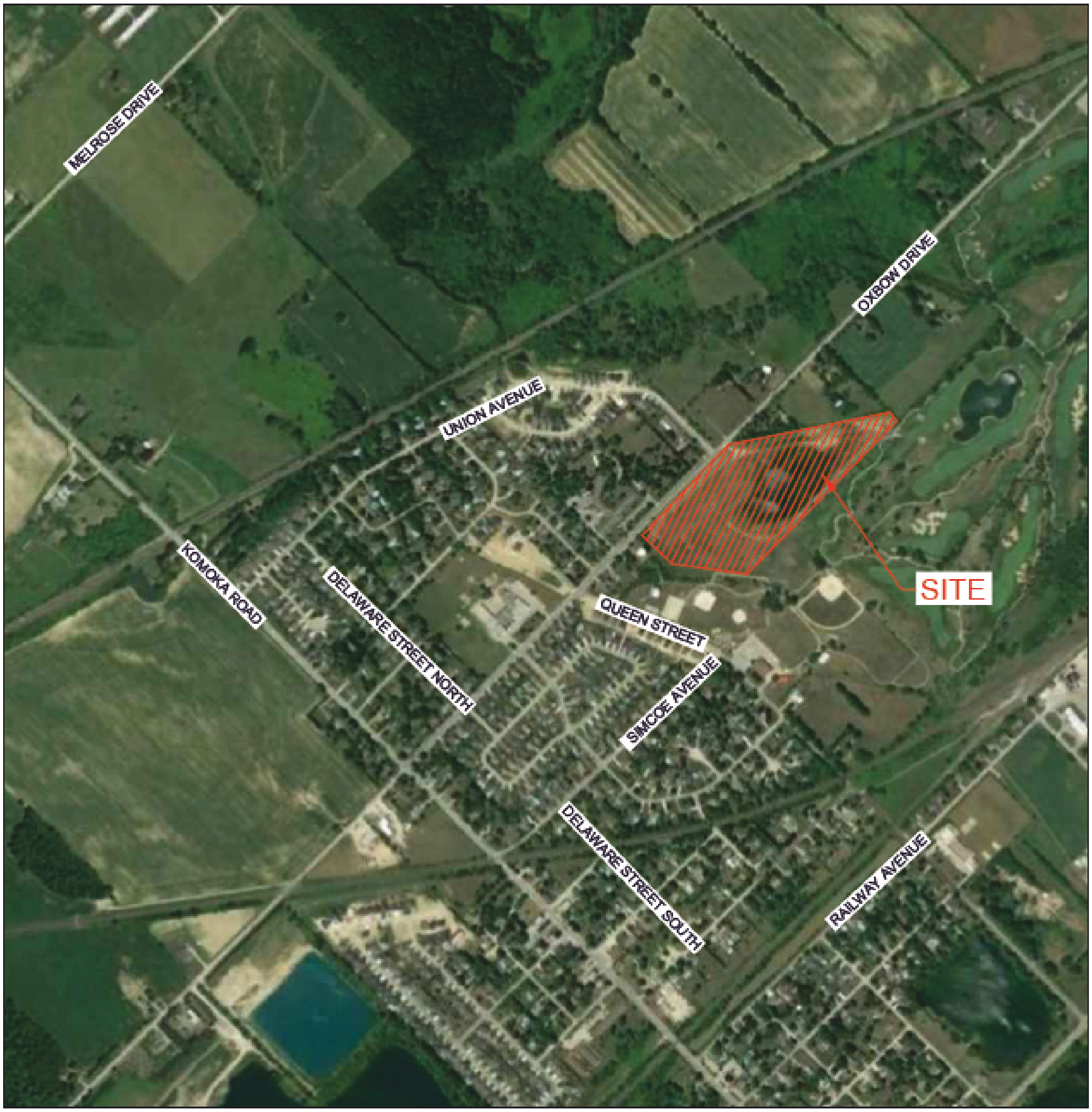
# Appendix A

## Figures

Figure 1- Location Plan

Figure 2- Site Plan

January 16, 2020 – 11:07 a.m. – Plotted By: dgross    1 LOCATION PLAN    Project: 43705–301    CAD: \\MTE85.LOCAL\MTE\DWG\P\43705\301\BH FIGURES\43705–301–BH



REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO

**MTE**
Engineers, Scientists, Surveyors
519-271-7952

SCALE: N.T.S

CLIENT
2270942 ONTARIO LTD.

PROJECT
OXBOW DRIVE GEOTECHNICAL
AND HYDROGEOLOGICAL
INVESTIGATION

SITE
10125 OXBOW DRIVE,
MIDDLESEX CENTRE, ONTARIO

TITLE
LOCATION PLAN

| | |
|---|---|
| Reviewed By | DMG |
| Prepared By | AKW |
| Drawn By | AKW |
| Date | JANUARY 2020 |
| Project No. | 43705–301 |
| Figure No. | 1 |

N
NORTH

Project: 43705-301 CAD: \\MTE85.LOCAL\MTE\DWG\P\43705\301\BH FIGURES\43705-

2 SITE PLAN

January 16, 2020 — 11:07 a.m. — Plotted By: dgross

N

NORTH

0 20 40 60 80 100m

Scale(11x17): 1:2000

## LEGEND

BH101-20

⊕ MTE BOREHOLE

MW103-20

⊕ MTE MONITORING WELL

BH01-15

⊕ LVM BOREHOLE (2015)

TBM

▲ TEMPORARY BENCHMARK

## REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO.
- EXISTING LVM BH FROM LVM DWG #P-0008182-01-100 SHEET 002 REV 00
- TBM: EXISTING TOP OF FIRE HYDRANT NORTH OF SITE (TOP OF SPINDLE, ELEVATION=251.12m)

MTE

Engineers, Scientists, Surveyors

519-271-7952

CLIENT

2270942 ONTARIO LTD.

PROJECT

OXBOW DRIVE GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

SITE

10125 OXBOW DRIVE,
MIDDLESEX CENTRE, ONTARIO

TITLE

SITE PLAN

| | | | |
|---|---|---|---|
| Reviewed By | BXT | | |
| Prepared By | AKW | Project No. | 43705-301 |
| Drawn By | AKW | Figure No. | 2 |
| Date | JANUARY 2020 | | |

# Appendix B

# Borehole Logs

### Abbreviations and Symbols

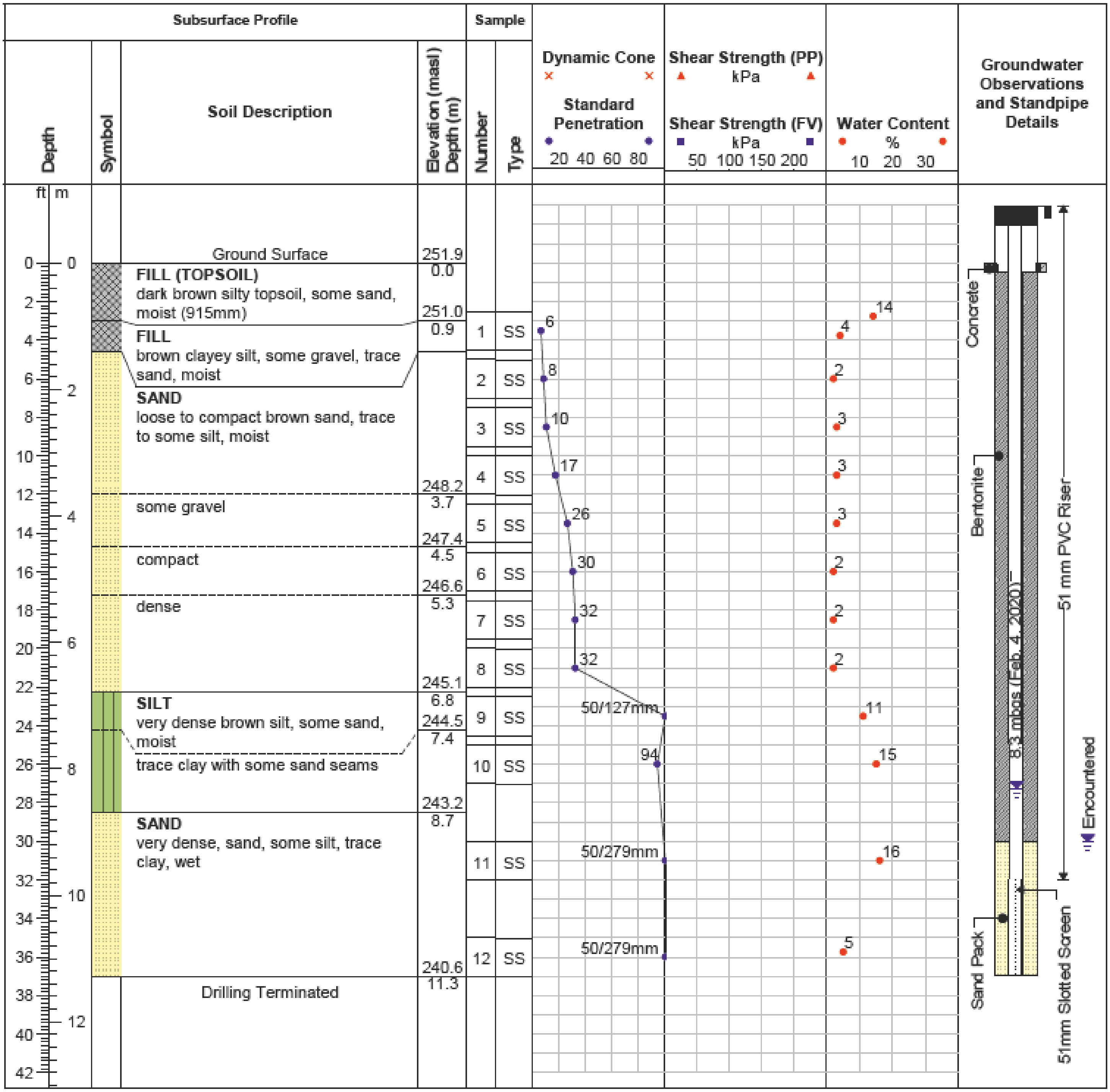
### Boreholes BH101-19 to BH108-19

### LVM Boreholes BH-01-15 to BH-09-15

## ID Number: MW101-19

**Project:** 10125 Oxbow Drive Development
**Project No:** 43705-301
**Client:** 2270942 Ontario Ltd.
**Site Location:** 10125 Oxbow Drive, Komoka, ON

**Drill Date:** 12/11/2019
**Drilling Contractor:** London Soil Test Ltd.
**Drill Rig:** D50T Track
**Drill Method:** Hollow Stem Augers
**Protective Cover:** Monument Casing



| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 251.9<br>0.0 |
| **FILL (TOPSOIL)** dark brown silty topsoil, some sand, moist (915mm) | 251.0<br>0.9 |
| **FILL** brown clayey silt, some gravel, trace sand, moist | |
| **SAND** loose to compact brown sand, trace to some silt, moist | 248.2<br>3.7 |
| some gravel | 247.4<br>4.5 |
| compact | 246.6<br>5.3 |
| dense | 245.1<br>6.8 |
| **SILT** very dense brown silt, some sand, moist | 244.5<br>7.4 |
| trace clay with some sand seams | 243.2<br>8.7 |
| **SAND** very dense, sand, some silt, trace clay, wet | 240.6<br>11.3 |
| Drilling Terminated | |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| | | | 14 |
| 1 | SS | 6 | 4 |
| 2 | SS | 8 | 2 |
| 3 | SS | 10 | 3 |
| 4 | SS | 17 | 3 |
| 5 | SS | 26 | 3 |
| 6 | SS | 30 | 2 |
| 7 | SS | 32 | 2 |
| 8 | SS | 32 | 2 |
| 9 | SS | 50/127mm | 11 |
| 10 | SS | 94 | 15 |
| 11 | SS | 50/279mm | 16 |
| 12 | SS | 50/279mm | 5 |

**Field Technician:** M. Costello
**Drafted by:** M. Costello
**Reviewed by:** B. Thorner

MTE

**Sheet:** 1 of 1

Top of pipe elevation: 252.57m asl
Water encountered at 9.1mbgs during drilling
Water level measured at 243.11m asl on January 7, 2020
Water level measured at 243.57m asl on February 4, 2020

## ID Number: BH102-19

**Project:** 10125 Oxbow Drive Development
**Project No:** 43705-301
**Client:** 2270942 Ontario Ltd.
**Site Location:** 10125 Oxbow Drive, Komoka, ON

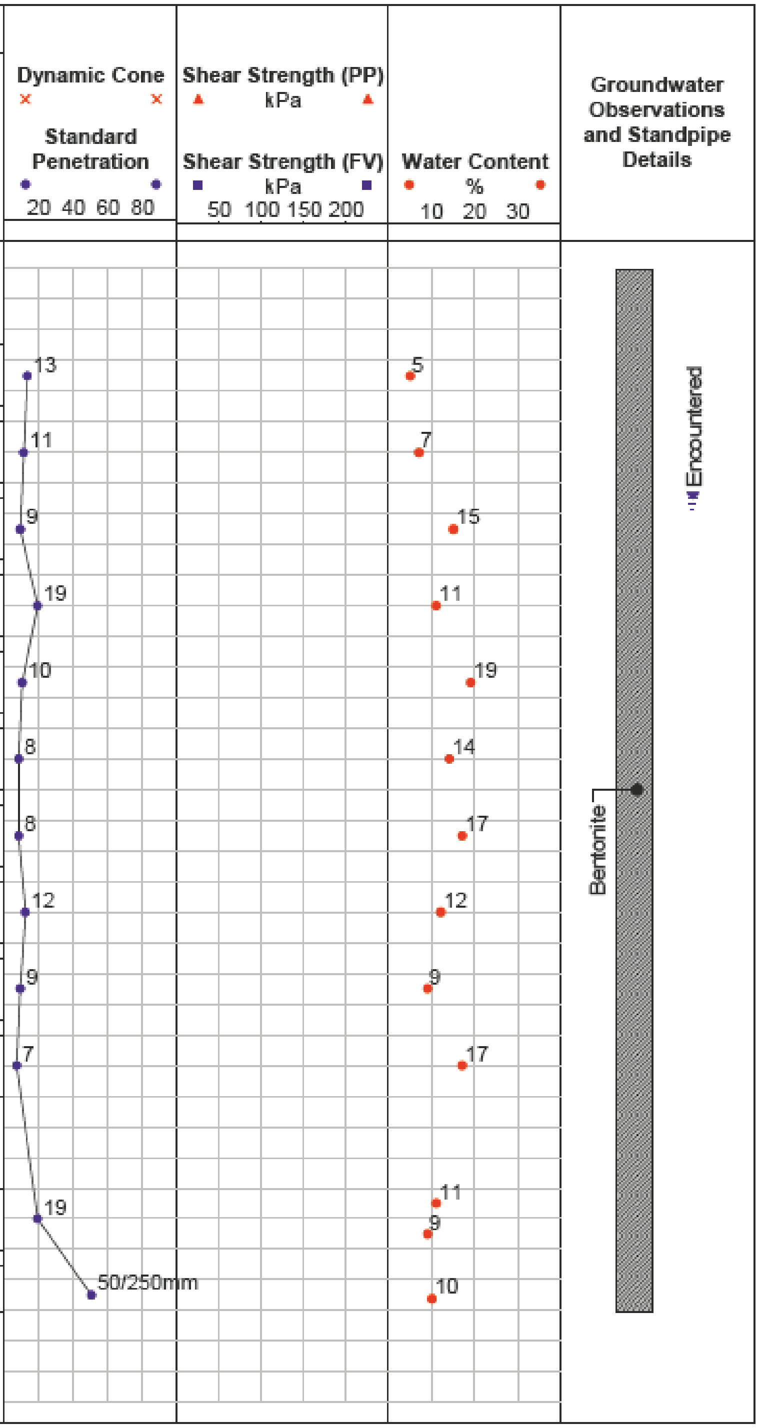
**Drill Date:** 12/10/2019
**Drilling Contractor:** London Soil Test Ltd.
**Drill Rig:** D50T Track
**Drill Method:** Hollow Stem Augers
**Protective Cover:** N/A

**Subsurface Profile**

| Soil Description | Elevation (masl)<br>Depth (m) |
|---|---|
| Ground Surface | 251.6<br>0.0 |
| **FILL (TOPSOIL)** dark brown, clayey topsoil, some silt, very moist (150mm) | |
| **FILL** compact brown silty sand, some clay, some gravel, moist | |
| grey at 1.5mbgs | 250.1<br>1.5 |
| stiff to very stiff grey clayey silt, some sand, some gravel, saturated with wood pieces | 249.4<br>2.2 |
| black sand and gravel layer (50mm) at 2.8mbgs | 248.8<br>2.8 |
| firm brown with grey silt veins from at 4.5mbgs | 247.1<br>4.5 |
| grey-brown with some organics at 5.3mbgs | 246.3<br>5.3 |
| compact grey sand, some gravel, wet | 245.0<br>6.6 |
| stiff grey clayey silt, some sand, some gravel, wet with grey mottling | |
| grey at 8.7mbgs | 242.9<br>8.7 |
| **SAND** compact to very dense brown sand, trace silt, gravel and clay, wet | 242.2<br>9.4 |
| Drilling Terminated | 241.2<br>10.4 |

**Sample**

| Number | Type |
|---|---|
| 1 | SS |
| 2 | SS |
| 3 | SS |
| 4 | SS |
| 5 | SS |
| 6 | SS |
| 7 | SS |
| 8 | SS |
| 9 | SS |
| 10 | SS |
| 11 | SS |
| 12 | SS |



**Field Technician:** M. Costello
**Drafted by:** M. Costello
**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Water encountered at 2.3mbgs during drilling

## ID Number: MW103-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

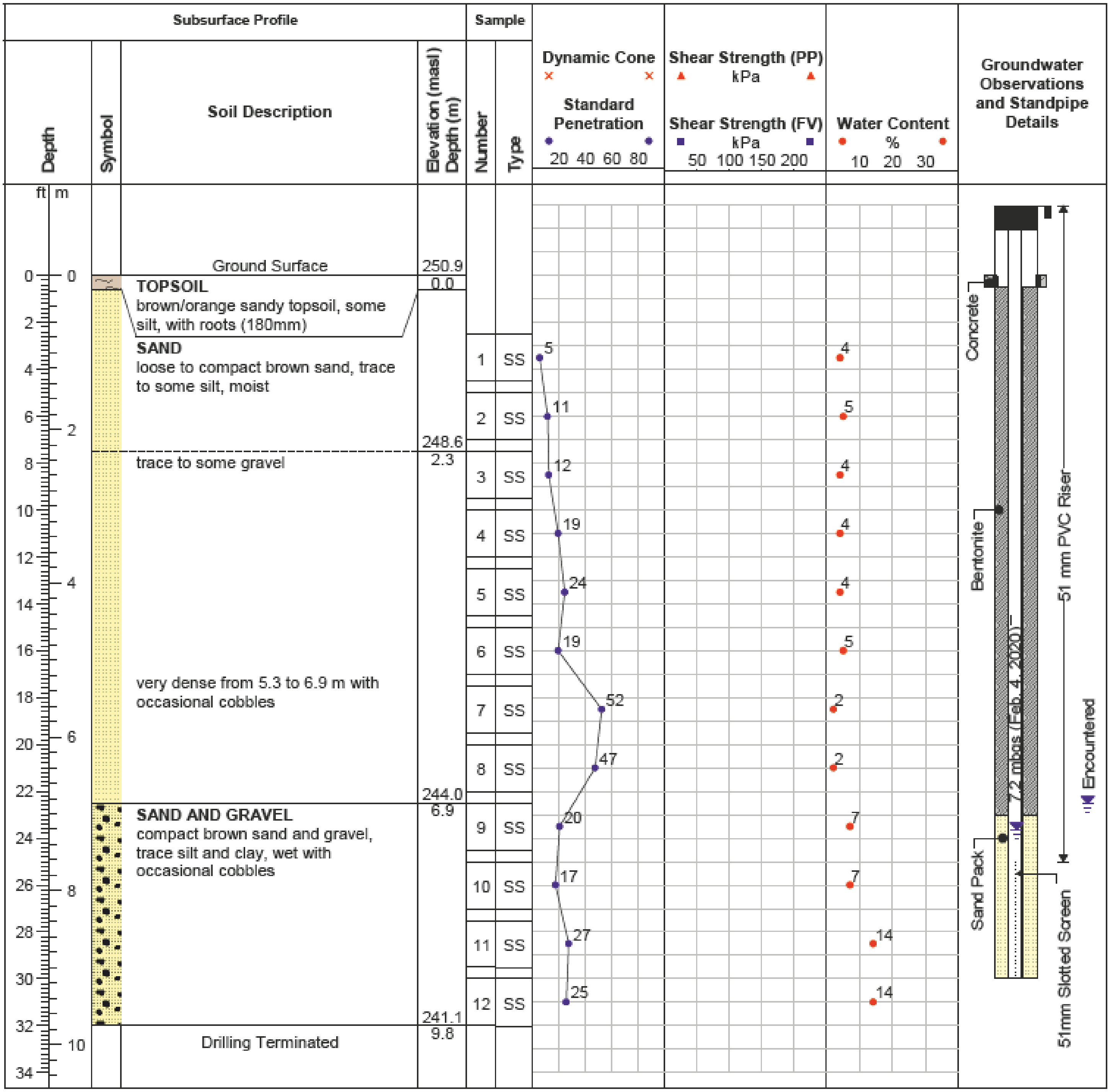
**Drill Date:** 12/10/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



**Subsurface Profile**

| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 250.9<br>0.0 |
| **TOPSOIL** brown/orange sandy topsoil, some silt, with roots (180mm) | |
| **SAND** loose to compact brown sand, trace to some silt, moist | |
| trace to some gravel | 248.6<br>2.3 |
| very dense from 5.3 to 6.9 m with occasional cobbles | |
| **SAND AND GRAVEL** compact brown sand and gravel, trace silt and clay, wet with occasional cobbles | 244.0<br>6.9 |
| Drilling Terminated | 241.1<br>9.8 |

**Sample**

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 5 | 4 |
| 2 | SS | 11 | 5 |
| 3 | SS | 12 | 4 |
| 4 | SS | 19 | 4 |
| 5 | SS | 24 | 4 |
| 6 | SS | 19 | 5 |
| 7 | SS | 52 | 2 |
| 8 | SS | 47 | 2 |
| 9 | SS | 20 | 7 |
| 10 | SS | 17 | 7 |
| 11 | SS | 27 | 14 |
| 12 | SS | 25 | 14 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

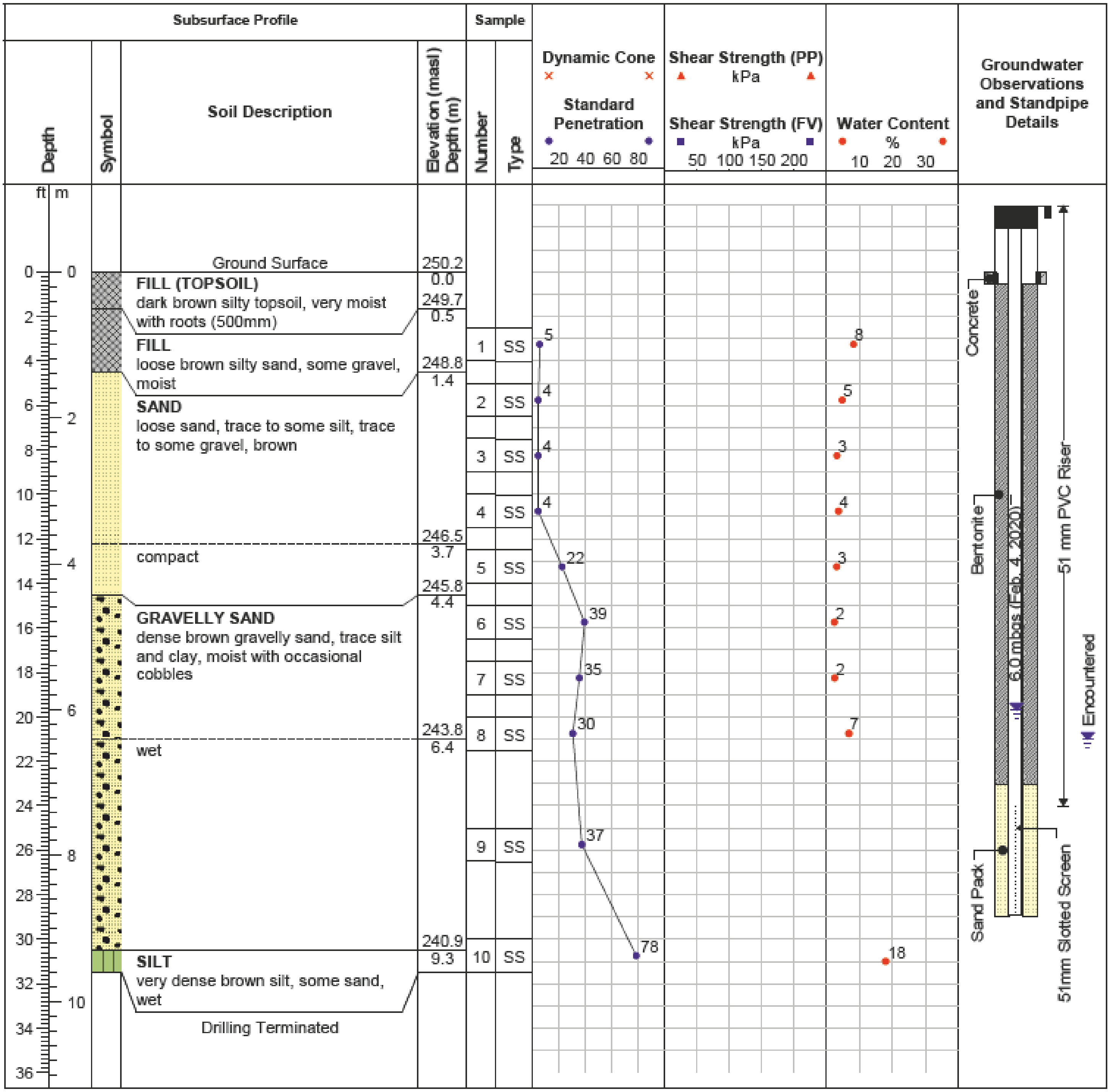
**Sheet:** 1 of 1

Top of pipe elevation: 251.74m asl
Water encountered at 6.9mbgs during drilling
Water level measured at 243.45m asl on January 7, 2020
Water level measured at 243.73m asl on February 4, 2020

## ID Number: MW104-19

**Project:** 10125 Oxbow Drive Development
**Project No:** 43705-301
**Client:** 2270942 Ontario Ltd.
**Site Location:** 10125 Oxbow Drive, Komoka, ON

**Drill Date:** 12/19/2019
**Drilling Contractor:** London Soil Test Ltd.
**Drill Rig:** D50T Track
**Drill Method:** Hollow Stem Augers
**Protective Cover:** Monument Casing



| | |
|---|---|
| 250.2<br>0.0 | Ground Surface |
| | **FILL (TOPSOIL)** dark brown silty topsoil, very moist with roots (500mm) |
| 249.7<br>0.5 | **FILL** loose brown silty sand, some gravel, moist |
| 248.8<br>1.4 | **SAND** loose sand, trace to some silt, trace to some gravel, brown |
| 246.5<br>3.7 | compact |
| 245.8<br>4.4 | **GRAVELLY SAND** dense brown gravelly sand, trace silt and clay, moist with occasional cobbles |
| 243.8<br>6.4 | wet |
| 240.9<br>9.3 | **SILT** very dense brown silt, some sand, wet |
| | Drilling Terminated |

| Number | Type | Standard Penetration | Water Content % |
|---|---|---|---|
| 1 | SS | 5 | 8 |
| 2 | SS | 4 | 5 |
| 3 | SS | 4 | 3 |
| 4 | SS | 4 | 4 |
| 5 | SS | 22 | 3 |
| 6 | SS | 39 | 2 |
| 7 | SS | 35 | 2 |
| 8 | SS | 30 | 7 |
| 9 | SS | 37 | |
| 10 | SS | 78 | 18 |

**Field Technician:** M. Costello
**Drafted by:** M. Costello
**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 251.13m asl
Water encountered at 6.4mbgs during drilling
Water level measured at 243.91m asl on January 7, 2020
Water level measured at 244.19m asl on February 4, 2020

**ID Number: BH105-19**

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

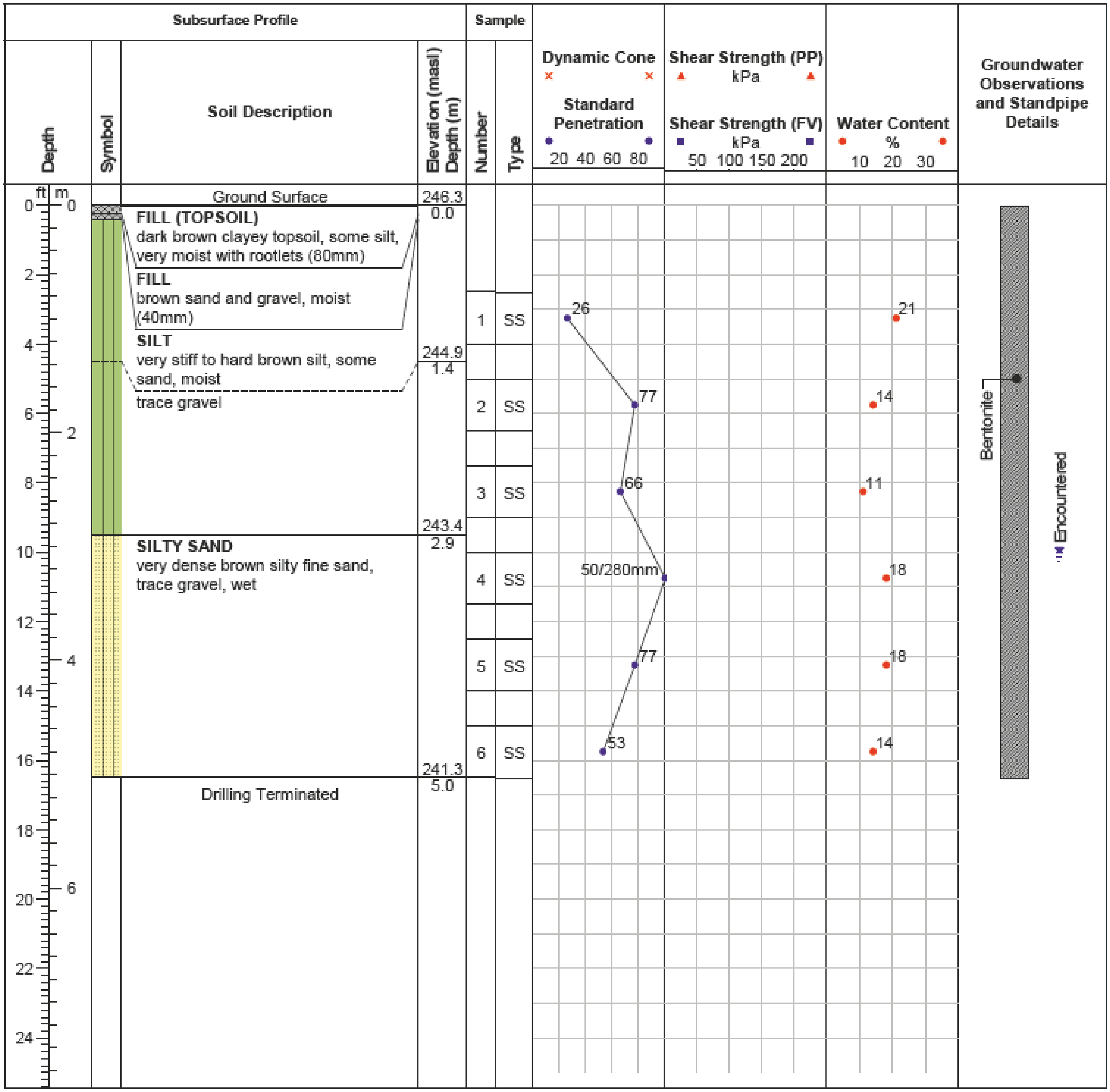
**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** N/A



| Elevation (masl) / Depth (m) | Soil Description |
|---|---|
| 246.3 | Ground Surface |
| 0.0 | **FILL (TOPSOIL)**<br>dark brown clayey topsoil, some silt, very moist with rootlets (80mm)<br>**FILL**<br>brown sand and gravel, moist (40mm)<br>**SILT**<br>very stiff to hard brown silt, some sand, moist |
| 244.9<br>1.4 | trace gravel |
| 243.4<br>2.9 | **SILTY SAND**<br>very dense brown silty fine sand, trace gravel, wet |
| 241.3<br>5.0 | Drilling Terminated |

| Number | Type | Standard Penetration | Water Content (%) |
|---|---|---|---|
| 1 | SS | 26 | 21 |
| 2 | SS | 77 | 14 |
| 3 | SS | 66 | 11 |
| 4 | SS | 50/280mm | 18 |
| 5 | SS | 77 | 18 |
| 6 | SS | 53 | 14 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

Water encountered at 3.0mbgs during drilling

**Sheet:** 1 of 1

**ID Number: BH106-19**

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

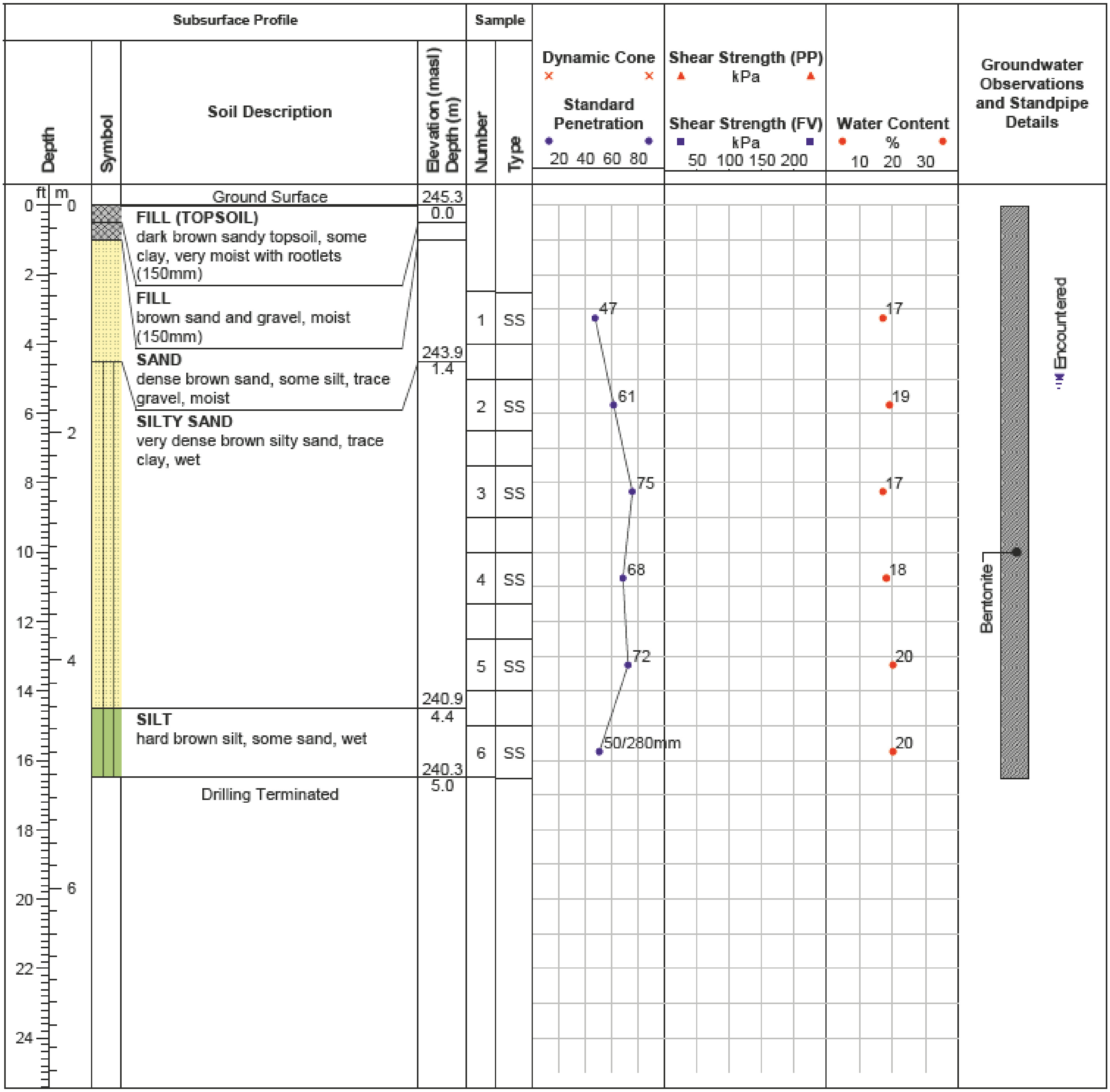
**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** N/A



| Soil Description | Elevation (masl)<br>Depth (m) |
|---|---|
| Ground Surface | 245.3<br>0.0 |
| **FILL (TOPSOIL)**<br>dark brown sandy topsoil, some clay, very moist with rootlets (150mm) | |
| **FILL**<br>brown sand and gravel, moist (150mm) | |
| **SAND**<br>dense brown sand, some silt, trace gravel, moist | 243.9<br>1.4 |
| **SILTY SAND**<br>very dense brown silty sand, trace clay, wet | |
| **SILT**<br>hard brown silt, some sand, wet | 240.9<br>4.4 |
| Drilling Terminated | 240.3<br>5.0 |

| Number | Type | Standard Penetration | Water Content (%) |
|---|---|---|---|
| 1 | SS | 47 | 17 |
| 2 | SS | 61 | 19 |
| 3 | SS | 75 | 17 |
| 4 | SS | 68 | 18 |
| 5 | SS | 72 | 20 |
| 6 | SS | 50/280mm | 20 |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

Water encountered at 1.5mbgs during drilling

**Sheet:** 1 of 1

## ID Number: MW107-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

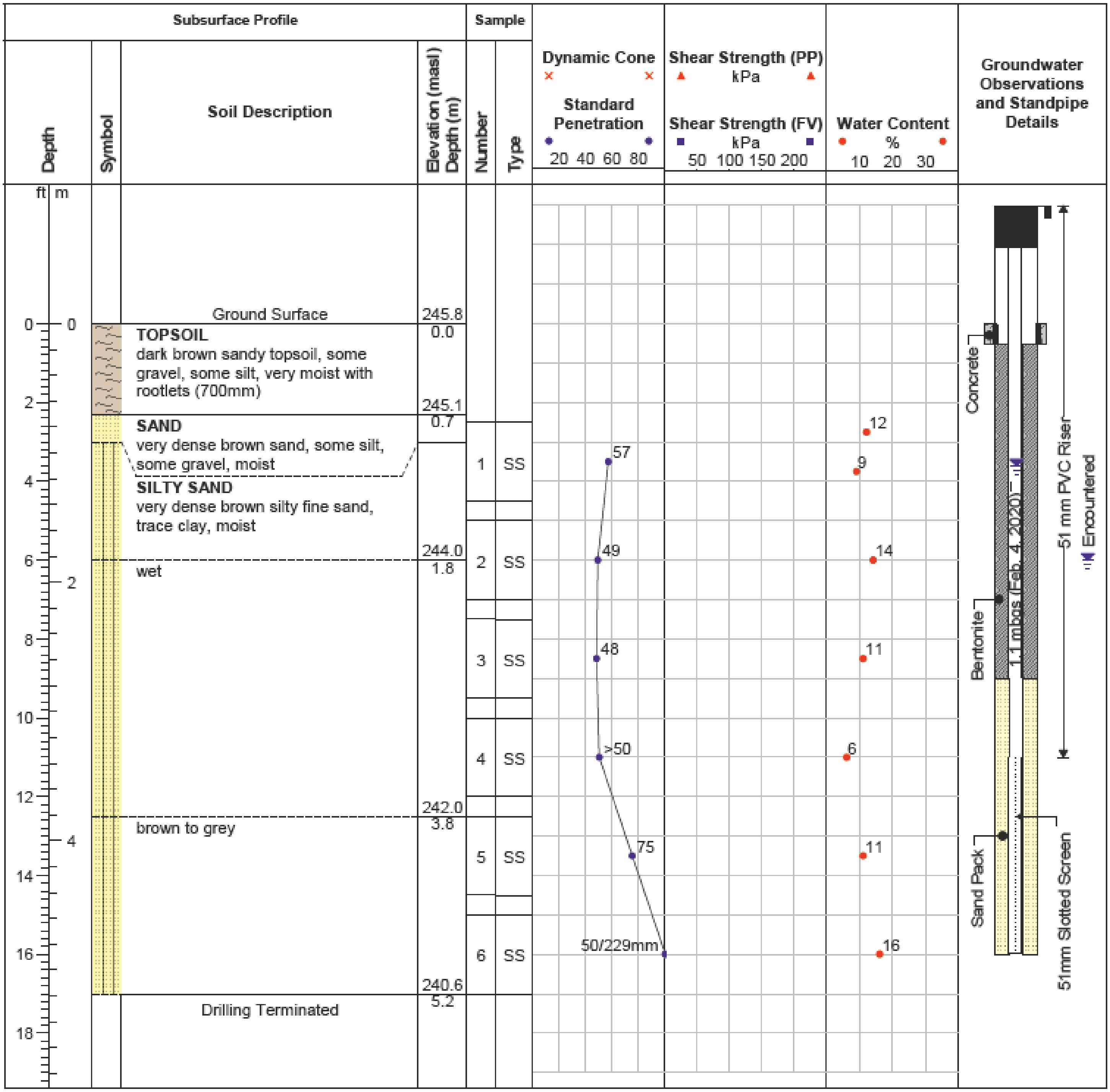
**Drill Date:** 12/18/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 247.12m asl
Water encountered at 1.8mbgs during drilling
Water level measured at 244.08m asl on January 7, 2020
Water level measured at 244.70m asl on February 4, 2020

## ID Number: MW108-19

**Project:** 10125 Oxbow Drive Development

**Project No:** 43705-301

**Client:** 2270942 Ontario Ltd.

**Site Location:** 10125 Oxbow Drive, Komoka, ON

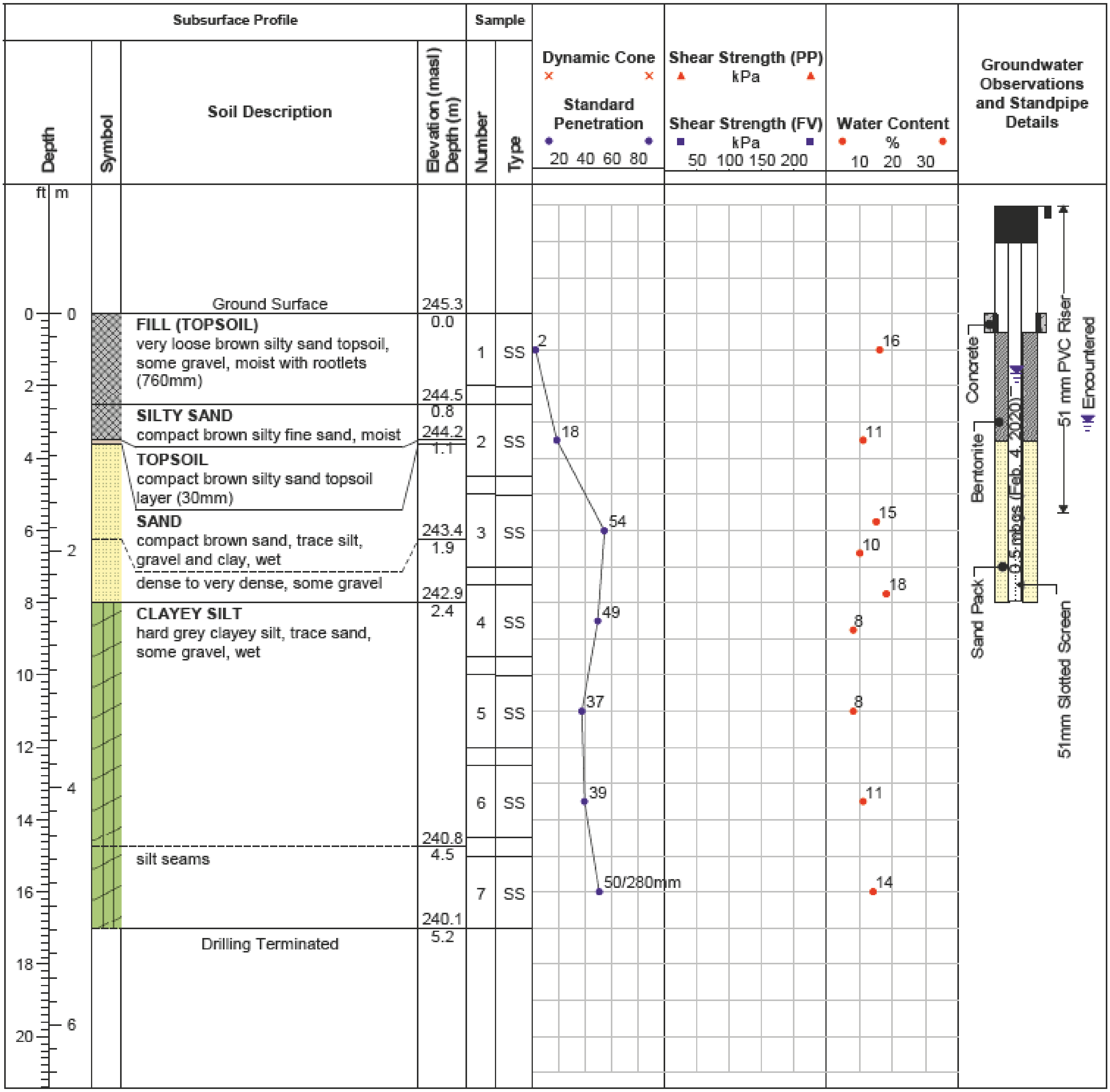
**Drill Date:** 12/12/2019

**Drilling Contractor:** London Soil Test Ltd.

**Drill Rig:** D50T Track

**Drill Method:** Hollow Stem Augers

**Protective Cover:** Monument Casing



| Soil Description | Elevation (masl) Depth (m) |
|---|---|
| Ground Surface | 245.3<br>0.0 |
| **FILL (TOPSOIL)** very loose brown silty sand topsoil, some gravel, moist with rootlets (760mm) | 244.5<br>0.8 |
| **SILTY SAND** compact brown silty fine sand, moist | 244.2<br>1.1 |
| **TOPSOIL** compact brown silty sand topsoil layer (30mm) | |
| **SAND** compact brown sand, trace silt, gravel and clay, wet | 243.4<br>1.9 |
| dense to very dense, some gravel | 242.9<br>2.4 |
| **CLAYEY SILT** hard grey clayey silt, trace sand, some gravel, wet | 240.8<br>4.5 |
| silt seams | 240.1<br>5.2 |
| Drilling Terminated | |

| Number | Type |
|---|---|
| 1 | SS |
| 2 | SS |
| 3 | SS |
| 4 | SS |
| 5 | SS |
| 6 | SS |
| 7 | SS |

**Field Technician:** M. Costello

**Drafted by:** M. Costello

**Reviewed by:** B. Thorner

**Sheet:** 1 of 1

Top of pipe elevation: 246.63m asl
Water encountered at 0.9mbgs during drilling
Water level measured at 244.45m asl on January 7, 2020
Water level measured at 244.76m asl on February 4, 2020

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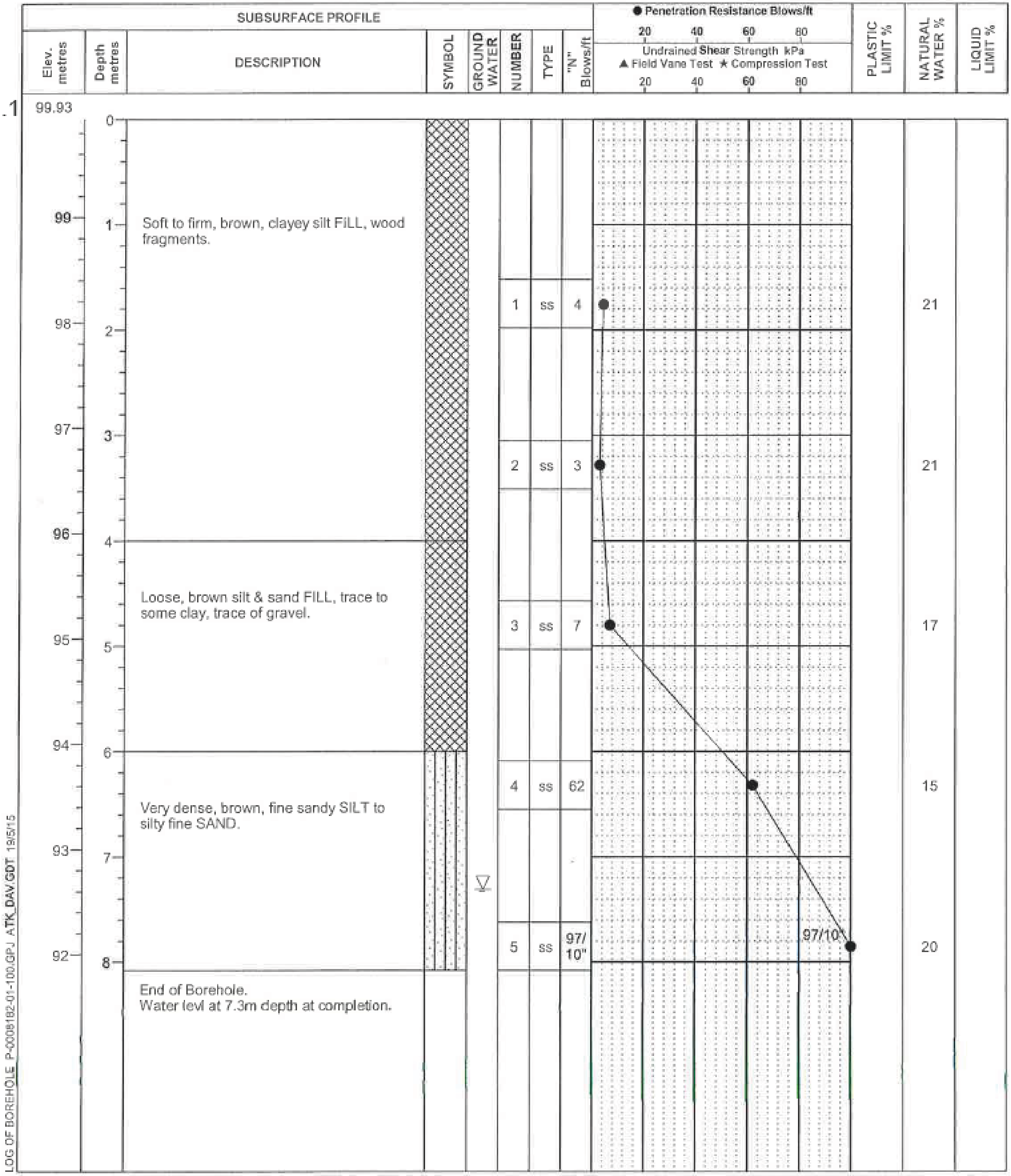
**Phone: 519-685-6400 Fax: 519-685-0943**

## LOG OF BOREHOLE NO.
## 01-15

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**Encl. No.** 1 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

251.1



| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.93 | 0 | Soft to firm, brown, clayey silt FILL, wood fragments. | | | 1 | ss | 4 | | 21 | |
| | | | | | 2 | ss | 3 | | 21 | |
| | | Loose, brown silt & sand FILL, trace to some clay, trace of gravel. | | | 3 | ss | 7 | | 17 | |
| | | Very dense, brown, fine sandy SILT to silty fine SAND. | | | 4 | ss | 62 | | 15 | |
| | | | | ▽ | | | | | | |
| | | | | | 5 | ss | 97/<br>10" | | 20 | |
| | | End of Borehole.<br>Water levl at 7.3m depth at completion. | | | | | | | | |

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**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 02-15

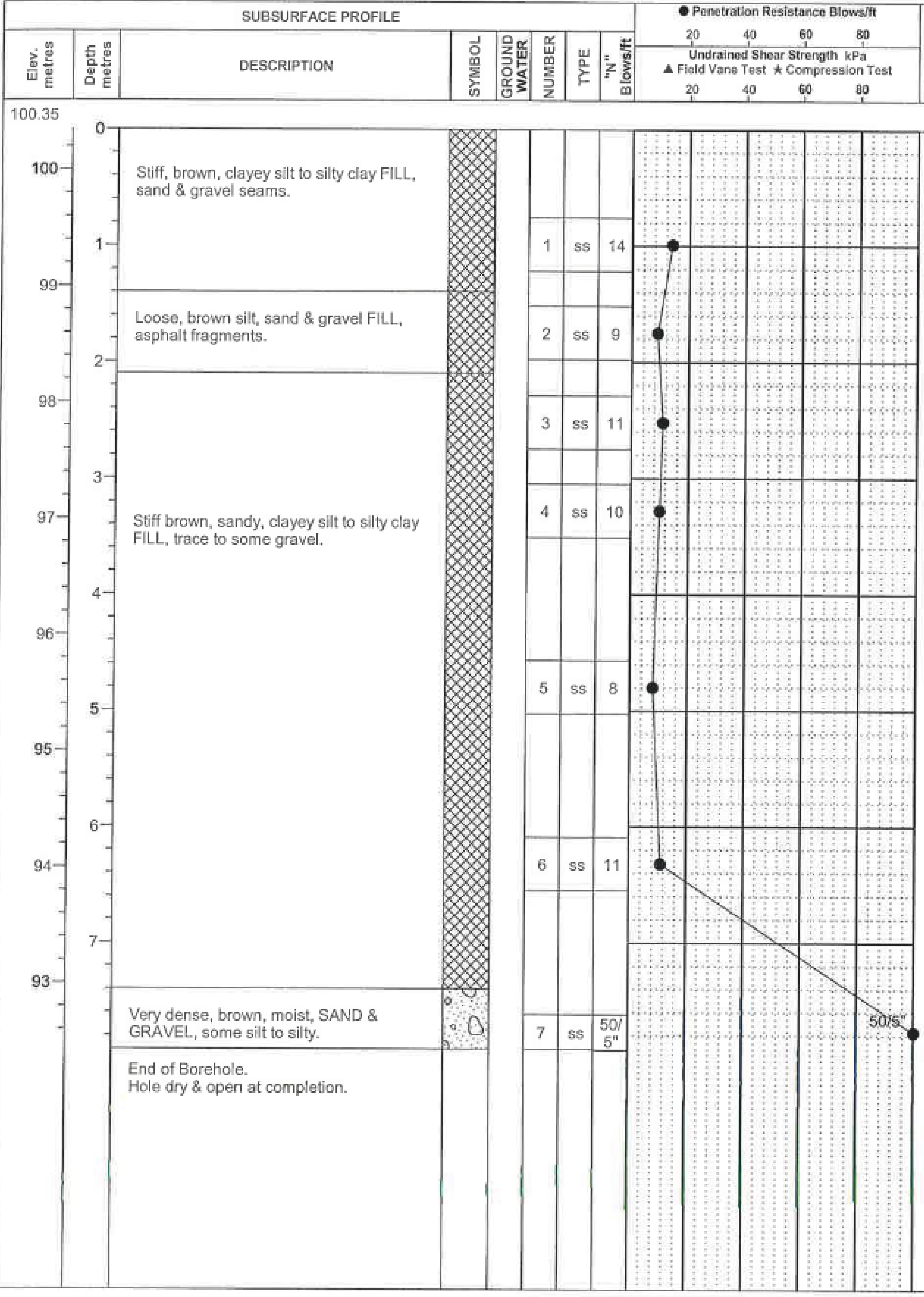
**Encl. No.** 2 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

251.5

SUBSURFACE PROFILE

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL |
|---|---|---|---|
| 100.35 | 0 | Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams. | ▩ |
| | | Loose, brown silt, sand & gravel FILL, asphalt fragments. | ▩ |
| | | Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel. | ▩ |
| | | Very dense, brown, moist, SAND & GRAVEL, some silt to silty. | |
| | | End of Borehole.<br>Hole dry & open at completion. | |

| NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|
| 1 | ss | 14 | | 17 | |
| 2 | ss | 9 | | 7 | |
| 3 | ss | 11 | | 16 | |
| 4 | ss | 10 | | 19 | |
| 5 | ss | 8 | | 12 | |
| 6 | ss | 11 | | 10 | |
| 7 | ss | 50/<br>5" | | 3 | |



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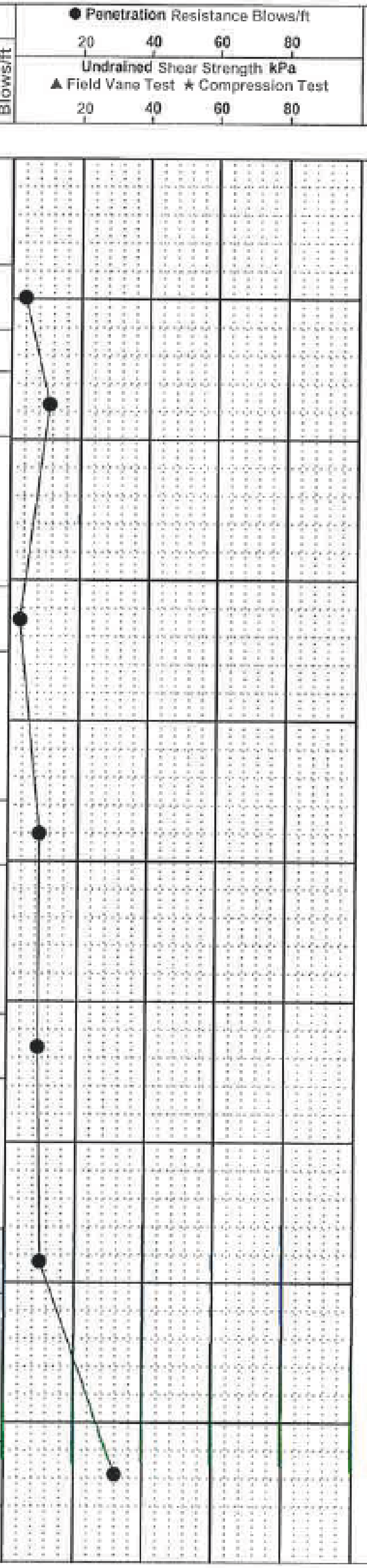
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 03-15

**Encl. No.** 3 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

252.2

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 101.06 | 0 | Loose, brown, gravelly silt & sand FILL, some clay. | | | 1 | ss | 4 | | 16 | |
| | | Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers. | | | 2 | ss | 11 | | 7 | |
| | | | | | 3 | ss | 3 | | 17 | |
| | | | | | 4 | ss | 9 | | 11 | |
| | | Loose, brown sand FILL, some silt. | | | 5 | ss | 9 | | 8 | |
| | | Loose to compact, brown sand & gravel FILL, trace to some silt. | | | 6 | ss | 10 | | 6 | |
| | | | | ∇ | | | | | | |
| | | Dense, grey SAND & GRAVEL, trace of silt. | | | 7 | ss | 32 | | 9 | |
| | | End of Borehole.<br>Water levl at 8.5m depth at completion. | | | | | | | | |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

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**Phone: 519-685-6400 Fax: 519-685-0943**

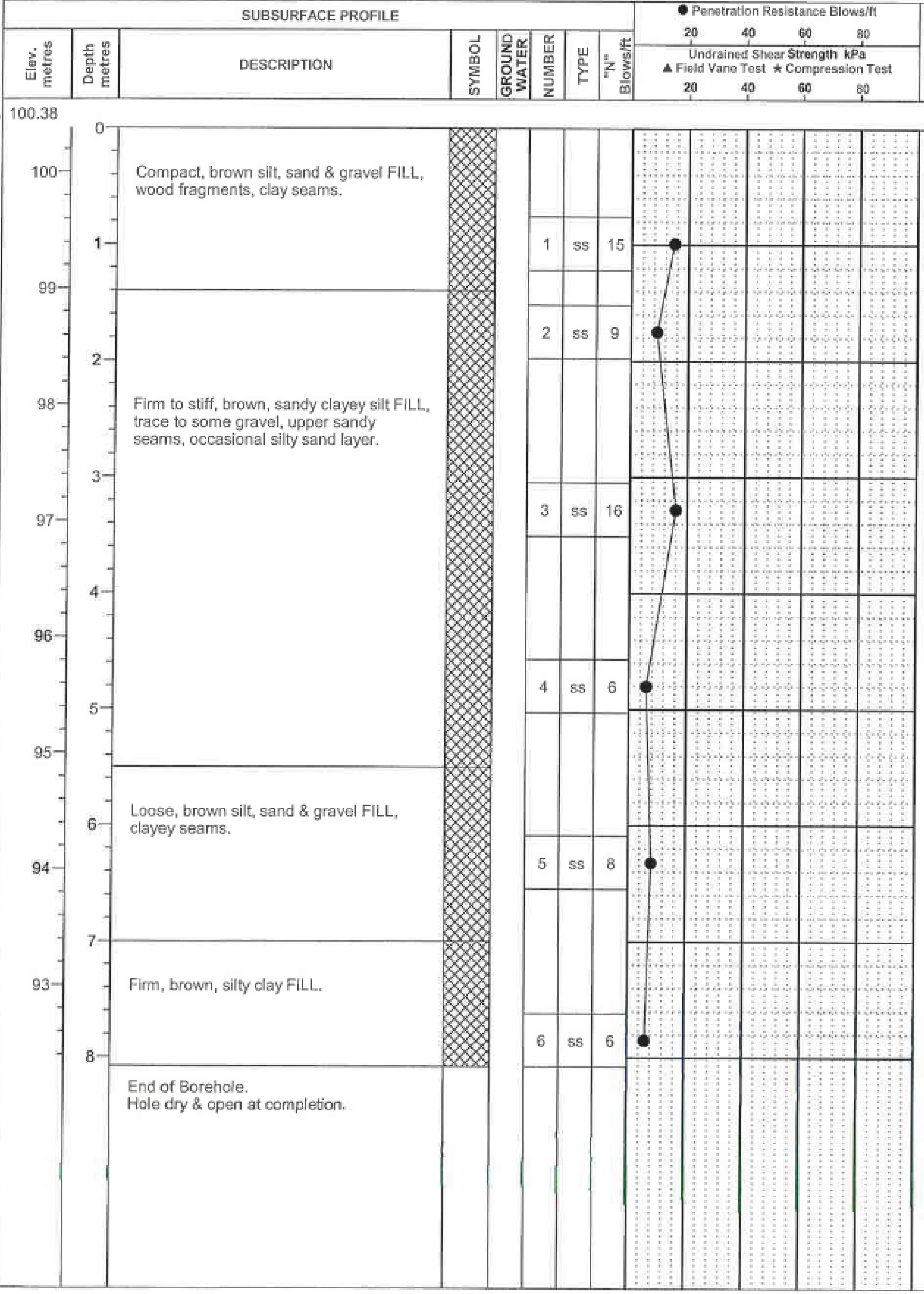
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 04-15

**Encl. No.** 4 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

251.5

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.38 | 0 | Compact, brown silt, sand & gravel FILL, wood fragments, clay seams. | ▩ | | 1 | ss | 15 | | 4 | |
| | | Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer. | ▩ | | 2 | ss | 9 | | 11 | |
| | | | ▩ | | 3 | ss | 16 | | 5 | |
| | | | ▩ | | 4 | ss | 6 | | 19 | |
| | | Loose, brown silt, sand & gravel FILL, clayey seams. | ▩ | | 5 | ss | 8 | | 17 | |
| | | Firm, brown, silty clay FILL. | ▩ | | 6 | ss | 6 | | 13 | |
| | | End of Borehole.<br>Hole dry & open at completion. | | | | | | | | |



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**LOG OF BOREHOLE NO.**

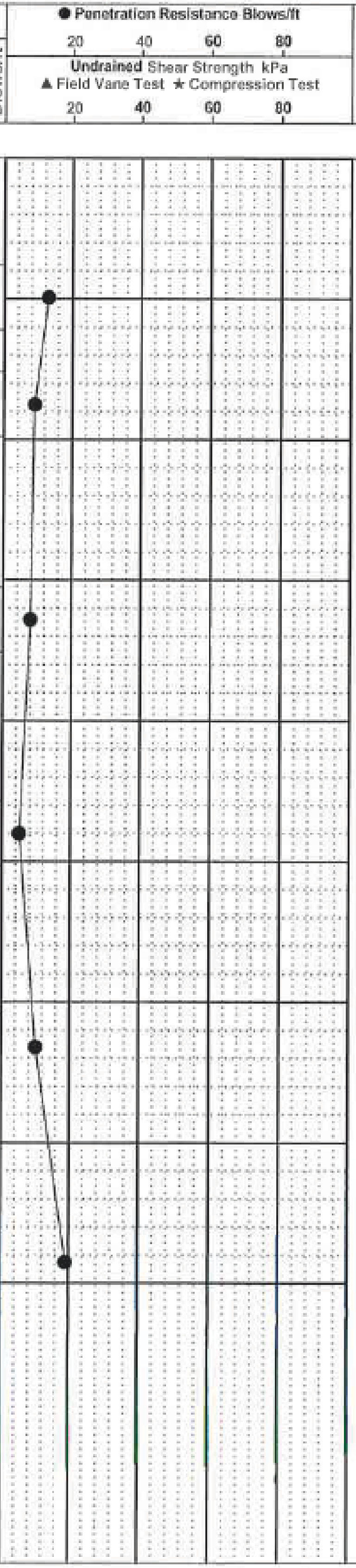
## 05-15

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**Encl. No.** 5 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

251.1

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.96 | 0 | Compact, dark brown silt, sand & gravel FILL, upper topsil seams. | | | 1 | ss | 13 | | 9 | |
| | | Loose, dark brown silt FILL. | | | 2 | ss | 9 | | 15 | |
| | | Loose, rusty brown silt & sand FILL. | | | 3 | ss | 8 | | 9 | |
| | | Loose, brown sand FILL, some silt & gravel. | | | 4 | ss | 5 | | 6 | |
| | | Loose to compact, brown sand FILL, some silt, trace to some gravel. | | | 5 | ss | 10 | | 8 | |
| | | Compact, grey SAND & GRAVEL, trace of silt. | | ▽ | 6 | ss | 19 | | 10 | |
| | | End of Borehole.<br>Water level at 7.2m depth at completion. | | | | | | | | |



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Phone: 519-685-6400 Fax: 519-685-0943

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

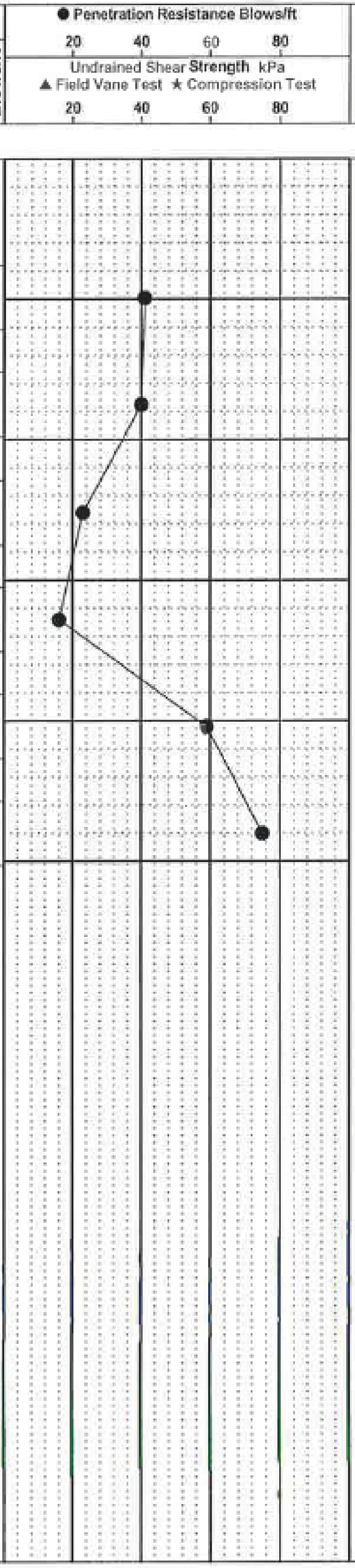
## LOG OF BOREHOLE NO.
## 06-15

**Encl. No.** 6 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

246.6

SUBSURFACE PROFILE

| Elev. metres | DESCRIPTION | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|
| 95.49 | Loose, dark brown, silty sand FILL, trace to some gravel. | | | | | | | |
| | Compact to dense, brown SAND & GRAVEL, trace to some silt. | | 1 | ss | 41 | | 2 | |
| | | | 2 | ss | 40 | | 2 | |
| | | | 3 | ss | 23 | | 9 | |
| | | ∇ | | | | | | |
| | Compact to very dense, brown SILT & fine SAND. | | 4 | ss | 16 | | 14 | |
| | | | 5 | ss | 59 | | 19 | |
| | | | 6 | ss | 75 | | 19 | |
| | End of Borehole.<br>Water level at 2.8m depth at completion. | | | | | | | |



Elev. metres: 95, 94, 93, 92, 91
Depth metres: 0, 1, 2, 3, 4, 5

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

**LVM**

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Phone: 519-685-6400 Fax: 519-685-0943

| | | | |
|---|---|---|---|
| **REF. NO.:** | P-0008182-01-100 | **Encl. No.** | 7 (Sheet 1 of 1) |
| **CLIENT:** | 2270942 Ontario Ltd. | **DRILLING DATA:** | Morooka |
| **PROJECT:** | Planned Residential Development | **METHOD:** | Solid Stem Augers |
| **LOCATION:** | 10125 Oxbow Drive, Komoka | **DIAMETER:** | 150mm |
| **DATUM ELEVATION:** | Top of Fire Hydrant Spindle, 100.0m | **DATE:** | Apr 14, 2015 |

## LOG OF BOREHOLE NO.
## 07-15

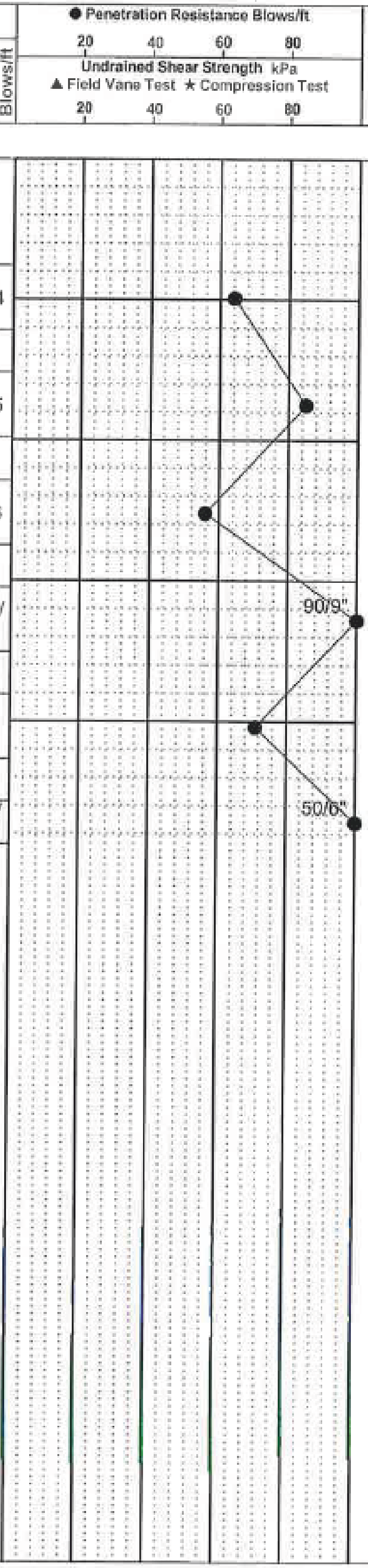
245.4

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER |
|---|---|---|---|---|
| 94.24 | 0 | 150mm TOPSOIL. | | |
| | | Very dense, brown SILT, upper sand seams. | | |
| | | Very dense, silty fine SAND, occasional silt seams. | | ∇ |
| | | End of Borehole.<br>Water level at 1.6m depth at completion. | | |

Elev. scale: 94, 93, 92, 91, 90 — Depth scale: 0, 1, 2, 3, 4

| NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|
| 1 | ss | 64 | | 13 | |
| 2 | ss | 85 | | 18 | |
| 3 | ss | 56 | | 18 | |
| 4 | ss | 90/ 9" | | 15 | |
| 5 | ss | 71 | | 20 | |
| 6 | ss | 50/ 6" | | 18 | |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

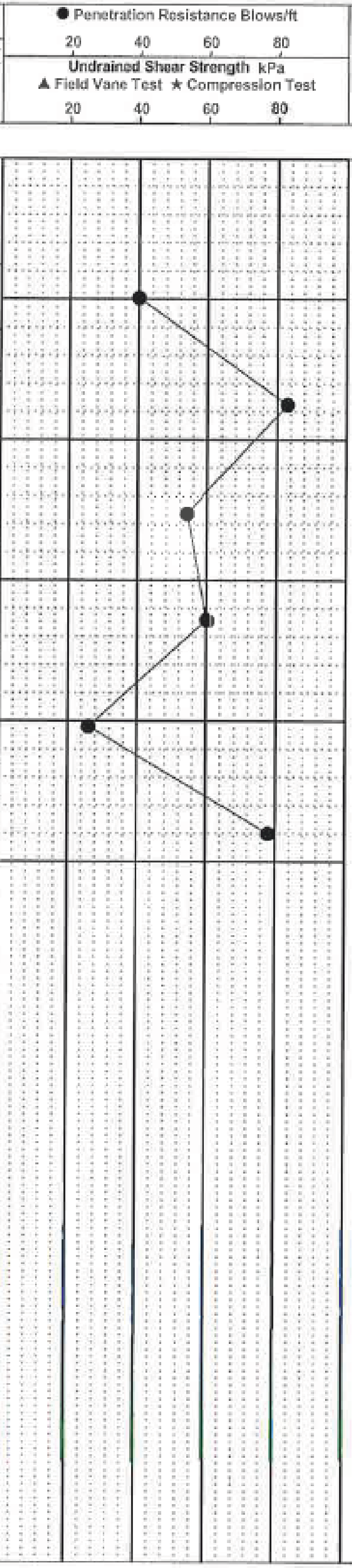
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 08-15

**Encl. No.** 8 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

245.5

| SUBSURFACE PROFILE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
| 94.33 | 0 | Dense, brown SAND & GRAVEL, trace to some silt. | | ∇ | 1 | ss | 40 | | 7 | |
| | | Very dense, brown SILT, sand seams. | | | 2 | ss | 83 | | 16 | |
| | | | | | 3 | ss | 54 | | 18 | |
| | | Very dense, brown SILT & fine SAND. | | | 4 | ss | 60 | | 18 | |
| | | Compact to very dense, brown, fine SAND, some silt to silty. | | | 5 | ss | 26 | | 18 | |
| | | | | | 6 | ss | 78 | | 16 | |
| | 5 | End of Borehole.<br>Water level at 1.0m depth at completion. | | | | | | | | |



LOG OF BOREHOLE P-0008182 01-100.GPJ ATK_DAV.GDT 19/5/15

**LVM**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

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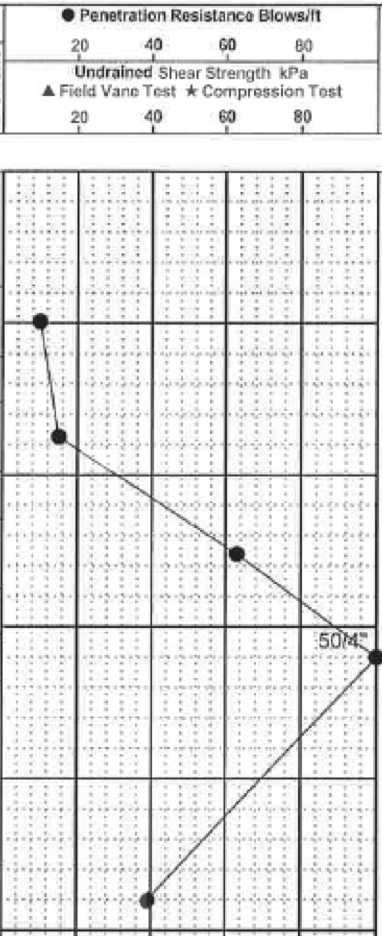
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 09-15

**Encl. No.** 9 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

244.1

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 93.02<br>93 | 0 | Compact, brown SAND & GRAVEL, trace to some silt. | | ▽ | | | | | | |
| 92 | 1 | | | | 1 | ss | 10 | | 13 | |
| | | | | | 2 | ss | 15 | | 6 | |
| 91 | 2 | | | | | | | | | |
| | | | | | 3 | ss | 63 | | 15 | |
| | | Very dense, brown SILT & fine SAND, clayey seam. | | | | | | | | |
| 90 | 3 | Very dense, brown SAND & GRAVEL, some silt. | | | 4 | ss | 50/ 4" | | 10 | |
| 89 | 4 | Very stiff to hard, grey, clayey SILT to silty CLAY till. | | | 5 | as | | | 9 | |
| | | | | | 6 | ss | 39 | | 12 | |
| 88 | 5 | End of Borehole.<br>Water level at 0.2m depth at completion. | | | | | | | | |



LVM

# 2270942 Ontario Ltd.

# Planned Residential Development
# 10125 Oxbow Drive
# Komoka, Ontario

## Geotechnical Engineering Report
## 161-P-0008182-01-100-GE-R-0001-00

LICENSED PROFESSIONAL ENGINEER
S. W. BURT
May 21/15
PROVINCE OF ONTARIO

Prepared by:

**Stephen W. Burt, P.Eng.**
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LVM

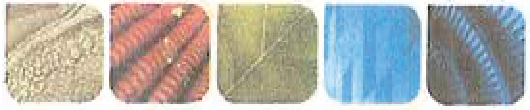
Soil and Materials Engineering
Environmental Engineering
Building Science
Supply Chain Quality

## 2270942 Ontario Ltd.

# Planned Residential Development
# 10125 Oxbow Drive
# Komoka, Ontario

## Geotechnical Engineering Report

Date: May 20, 2015
Ref. N°: 161-P-0008182-01-100-GE-R-0001-00



LVM

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Appendix 5 Benching of Earth Slopes

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\Z5_CAD\P-8182-01-100_DRAWING 2_ SITE PLAN.DWG

0 1 2 3 4 5 10 cm

NOTES :

1-REFERENCES : County of Middlesex Online Interactive Map (2010), Accessed April 2015.

2-TEMPORARY BENCHMARK : Top of Fire Hydrant Spindle Located NW of Intersection of Oxbow Drive. and Union St., Elevation 100.00 m (assumed local datum).

3-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 25 50 75 100 m

SCALE 1:2500

Project

**Planned Residential Development**

10125 Oxbow Drive, Komoka

Title

**Site Plan**

LVM

LVM
12-60 Meg Drive
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Prepared A.Stewart
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Discipline GEOTECHNICAL
Scale 1 : 2500
Date 2015-04-28

Project manager
R.Helwig
Sequence no.
02 of 02

| M. dept | Project | Disc. | Dwg.no. | Rev. |
|---|---|---|---|---|
| 161 | P-0008182-01-100 | GE | 002 | 00 |

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Test results mentioned herein are only valid for the sample(s) stated in this report.

LVM's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

2270942 Ontario Ltd.
42663 Huron-Bruce Road
R.R. #1
Wroxeter, Ontario N0G 2X0

Attention: Ms. Heather Johnston-Inglis, President

| REVISION AND PUBLICATION REGISTER | | |
|---|---|---|
| **Revision N°** | **Date** | **Modification And/Or Publication Details** |
| 00 | 2015-05-20 | Report Issued |
| | | |

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# INTRODUCTION

LVM, a division of EnGlobe Corp., (LVM) was retained by 2270942 Ontario Ltd. to perform a Geotechnical Investigation at 10125 Oxbow Drive, Komoka, Ontario, shown on the Location Plan, Drawing 1 in Appendix 1. This work was authorized by Ms. Heather Johnston-Inglis of 2270942 Ontario Ltd. on March 6, 2015.

The conception plan for the residential development includes creating 77 building lots as well as three condominium blocks. The purpose of this investigation was to determine the composition of the fill and native soils at the site and, based on that information, provide geotechnical recommendations for the reuse of the soil as engineered fill material.

# 1 INVESTIGATION PROCEDURE

## 1.1 FIELD PROGRAM

The fieldwork for this investigation was performed on April 14 and 15, 2015, and involved drilling nine boreholes located as shown on the Site Plan, Drawing 2 in Appendix 1.

The boreholes were advanced to sampling depths of 4.9 to 9.6 metres (m) using a power auger machine equipped with conventional soil sampling equipment, which was supplied and operated by a specialist drilling company.

Soil samples were recovered from the boreholes at frequent intervals of depth using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values are shown on the borehole logs in Appendix 2.

Groundwater observations were carried out in the boreholes during and upon completion of the drilling operations. The observations are summarized on the appended borehole logs.

The fieldwork was monitored throughout by a member of our engineering staff who directed the drilling and sampling procedures, documented the soil stratigraphies, and cared for the recovered soil samples.

The level of the ground surface at each borehole location was related to a local benchmark, which was taken as the top of the spindle of a fire hydrant located as shown on the Site Plan, Drawing 2 in Appendix 1. The benchmark was assigned an arbitrary elevation of 100.0 m.

## 1.2 LABORATORY TESTING

All soil samples recovered during this investigation were returned to our laboratory for visual examination and moisture content testing. The moisture content values are shown on the appended borehole logs.

Nine samples of the fill materials revealed in Boreholes 1 to 5 were submitted to the ALS Environmental London office and subjected to metals, inorganics, PHC and BTEX analyses. The Certificate of Analysis is provided in Appendix 4.

The soil samples will be stored for a period of three months from the date of this report. After this time, they will be discarded unless prior arrangements have been made for longer storage.

# 2 SUMMARIZED SUBSURFACE CONDITIONS

Refer to the borehole logs in Appendix 2 for descriptions of the soil stratigraphies, results of SPT testing, moisture content values, and groundwater observations. The following notes are intended only to amplify this data.

From the ground surface, Boreholes 1 to 6 revealed layers of soft to stiff clayey silt to silty clay fill and loose to compact silt, sand and gravel fill materials, and Borehole 4 was terminated within the fill at a depth of 8.1 m. The fill samples yielded moisture contents ranging from 4 to 21%. Borehole 7 revealed a 150mm thick surface layer of topsoil.

Beneath the fill and topsoil layers, and at the ground surface in Boreholes 8 and 9, layers of compact to very dense silt, sand and gravel materials were encountered, and Boreholes 1, 2, 3, and 5 to 8, were terminated within these layers at depths of 4.9 to 9.6 m. The silt and sand strata displayed natural moisture contents of 13 to 20%, and the sand and gravel displayed values of 6 to 13% near and below the groundwater levels and 2 to 3% above the groundwater level.

Borehole 9 penetrated the silt, sand and gravel layers at a depth of 3.5 m, and it was terminated within very stiff to hard clayey silt to silty clay till at a depth of 5.0 m. The two till samples yielded natural moisture contents of 9 and 12%.

At the completion of the drilling operations, groundwater levels were measured in Boreholes 1, 3, and 5 to 9 at depths of 0.2 to 8.5 m (Elevations 92.6 to 93.3), and groundwater seepage was not observed in Boreholes 2 and 4.

# 3 DISCUSSION AND RECOMMENDATIONS

## 3.1 EXCAVATIONS AND GROUNDWATER CONTROL

The soils revealed on this site which are not excessively wet can be classified as Type 3 soil in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Any saturated and submerged soil shall be classified as Type 4 soil.

The sides of open excavations within a Type 3 soil must be carried out using side slopes not steeper than 1 vertical to 1 horizontal from the bottom of the excavation. Type 4 may be dewatered to be classified as Type 3 soil, or be adequately braced, otherwise side slopes of 1 vertical to 3 horizontal or flatter will be required for excavations intersecting type 4 soil.

Based on the borehole findings it is anticipated that groundwater and surface water entering open excavations may be controlled by gravity drainage and filtered pumps up to 0.5 to 1.0 m below the groundwater table. The borehole findings indicate that the level of the prevailing groundwater table at the site is near Elevation 92.7. Lowering the water level by more than one metre will require a permit to take water (PTTW) and positive dewatering system installed by a specialist dewatering contractor.

Where groundwater seepage is occurring it will be necessary to provide stability by flattening the excavation side slopes.

## 3.2 SITE PREPARATION AND GRADING

It is understood that sand and gravel materials have been mined from the site and fill has been placed along the northwestern part of the site represented by Borehole 1 to 5 locations. Although final design grades had not been established at the time of this investigation, it is anticipated that low-lying areas would be filled by utilizing the fill material cut from the higher area in the northwest part of the site. It is recommended that houses and other structures be supported on engineered fill constructed with Granular 'B' type material with a maximum aggregate size of 50 mm. The borehole findings and grain size distribution analysis test results, shown graphically on Figures 1 and 2 in Appendix 3, indicate that the fill materials revealed in Boreholes 1 to 5 are generally not suitable for reuse as engineered fill. The onsite fill which is not excessively wet may be used as bulk fill. The bulk fill is not considered suitable for supporting house foundations or other structures, and reference is made to Section 3.3 'Engineered Fill' for preparation requirements for the construction of house foundations.

POND.

Site preparation would consist of stripping the surface topsoil layer from within fill placement areas to expose an approved inorganic native subgrade. The groundwater level within the pond will need to be dewatered to accommodate the placement and compaction of fill materials, and the use of well graded stoney Granular 'B' type material is recommended for the initial lift of fill placed on approved wet to saturated subgrades. During fill placement it is recommended that slopes steeper than 1 vertical to 3 horizontal (18 degrees) be benched in accordance with Ontario Provincial Standard Drawing (OPSD) 208.010 provided in Appendix 5. Within road way right-of-ways and house lot landscaped areas, bulk fill should be placed in controlled lifts and compacted throughout to at least 95% of the material's maximum standard Proctor dry density (MSPDD).

## 3.3 FOUNDATION DESIGN

It is anticipated that the residential development will feature buildings designed in accordance with Part 9 of the Ontario Building Code.

The topsoil and fill materials must be removed from new foundation areas, and the following table provides the highest founding levels at each borehole location where conventional spread footings founded on the approved native subgrades will provide a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Table 1 - Highest Foundation Founding Levels

| BOREHOLE | HIGHEST EL. / DEPTH FOR A SLS DESIGN PRESSURE OF 143 KPA (3,000 PSF) |
|---|---|
| 01-15 | 93.8 / 6.1 m |
| 02-15 | 92.7 / 7.6 m |
| 03-15 | 92.4 / 8.6 m |
| 04-15 | Below 92.3 / 8.1 m |
| 05-15 | 92.8 / 7.1 m |
| 06-15 | 94.7 / 0.8 m |
| 07-15 | 93.4 / 0.8 m |
| 08-15 | 93.5 / 0.8 m |
| 09-15 | 92.2 / 0.8 m |

at g/w elevation

For ultimate limit states design, a factored geotechnical resistance value ($\varphi R_n$) of 215 kPa (4,500 psf) may be used, where the resistance factor ($\varphi$) is equal to 0.5.

## 3.4 ENGINEERED FILL

In areas where bulk fill has been placed, sub-excavation may be required within the influence of footings to expose an approved native subgrade and a structural fill pad must be constructed or the footings stepped down by extending the foundation walls. It is recommended that the engineered fill consist of Granular 'B' type material with a maximum aggregate size of 50 mm. It is considered that some of the native sand and gravel and the lower layers of sand and gravel fill materials revealed in Boreholes 3 and 5 below Elevation 96 may be considered for use as engineered fill material, provided it is segregated for use without contamination with other materials. Engineered fill must extend outside the foundation area for a minimum horizontal distance equal to the depth of fill placed below the footing founding level. The engineered fill shall be placed in maximum 300 mm thick lifts, and each lift must be compacted to a minimum of 98% of its MSPDD under the direction and testing of the geotechnical consultant. Approved engineered fill can also support a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Where deep bulk fill requires excavation for the construction of engineered fill to extend onto adjacent building lots, constructing engineered fill pads on a lot by lot basis will not be feasible due to the risk of undermining pre-constructed house foundations. In this regard a strip of engineered fill will need to be constructed to provide support for the building envelopes over a row of building lots. Once final grades have been established, a review should be done by the geotechnical engineer to identify which building lots require construction of engineered fill pads and provide recommended construction methods.

The total and differential settlements of footings not more than three metres in width and subjected to the maximum allowable design pressure of 143 kPa (3,000 psf) are estimated to be less than 25 and 20 mm respectively.

To provide sufficient protection against heave due to frost action, all exterior footings and footings in non-heated areas must incorporate a minimum depth of soil cover of 1.2 m between the footing subgrade and the finished ground surface.

In order to minimize the disturbance of soil subgrades it is recommended that foundation excavations be carried out using a smooth-blade bucket.

## 3.5 ENVIRONMENTAL TESTING

Nine representative samples of fill from the boreholes were submitted to the ALS Environmental Laboratory in London and subjected to metals, inorganics, PHC and BTEX analyses, and the Certificate of Analysis is provided in Appendix 4. The test results indicate that the applicable Table 2 Soil Standards under Ont. Reg. 153/04 as amended have been exceeded for SAR and conductivity for the samples tested from Boreholes 3 and 4.

Elevated SAR and conductivity levels are indicative of salt impacts. Materials with salt impacts are phytotoxic to plants and must be placed at least 1.5 m below final grades. No other exceedances of the applicable MOE Table 2 soil standards were obtained.

# 4 STATEMENT OF LIMITATIONS

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, LVM, a division of EnGlobe Corp. should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its' agent and may not be used by a Third Party without the expressed written consent of LVM and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. LVM accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions. LVM will not be responsible to any party for damages incurred as a result of failing to notify LVM that differing site or subsurface conditions are present upon becoming aware of such conditions.

The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its' Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

# Appendix 1 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\25_CAD\P-8182-01-100_DRAWING 1_LOCATION PLAN.DWG

0 1 2 3 4 5 10 cm

0 100 200 300 400 500 m
SCALE 1:10000

NOTES :
1-REFERENCES : © OpenStreetMap contributors (2015).
2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

**Planned Residential Development**

10125 Oxbow Drive, Komoka

Title

**Location Plan**

LVM

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Drawn A.Stewart
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Scale 1 : 10000
Date 2015-04-28

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R.Helwig
Sequence no.
01 of 02

| M. dept. | Project | Disc. | Dwg no. | Rev. |
|---|---|---|---|---|
| 161 | P-0008182-01-100 | GE | 001 | 00 |

## Appendix 2 Boreholes

List of Abbreviations
Boreholes 01-15 to 09-15

# LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

| **Sample Types** | | **Soil Tests and Properties** | |
|---|---|---|---|
| AS | Auger Sample | SPT | Standard Penetration Test |
| CS | Chunk Sample | UC | Unconfined Compression |
| RC | Rock Core | FV | Field Vane Test |
| SS | Split Spoon | ø | Angle of internal friction |
| TW | Thinwall, Open | $\gamma$ | Unit weight |
| WS | Wash Sample | $w_p$ | Plastic limit |
| BS | Bulk Sample | $w$ | Water content |
| GS | Grab Sample | $w_l$ | Liquid limit |
| WC | Water Content Sample | $I_L$ | Liquidity index |
| TP | Thinwall, Piston | $I_p$ | Plasticity index |
| | | PP | Pocket penetrometer |

| **Penetration Resistances** | |
|---|---|
| Dynamic Penetration Resistance | The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60 ° cone a distance 300 m (12 in.).<br>The cone is attached to 'A' size drill rods and casing is not used. |
| Standard Penetration Resistance, N (ASTM D1586) | The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 m (12 in.) |
| WH | sampler advanced by static weight of hammer |
| PH | sampler advanced by hydraulic pressure |
| PM | sampler advanced by manual pressure |

| **Soil Description** | | |
|---|---|---|
| **Cohesionless Soils** | **SPT N-Value** | **Relative Density ($D_r$)** |
| **Compactness Condition** | (blows per 0.30 m) | (%) |
| Very Loose | 0 to 4 | 0 to 20 |
| Loose | 4 to 10 | 20 to 40 |
| Compact | 10 to 30 | 40 to 60 |
| Dense | 30 to 50 | 60 to 80 |
| Very Dense | over 50 | 80 to 100 |
| **Cohesive Soils** | **Undrained Shear Strength ($C_u$)** | |
| **Consistency** | **kPa** | **psf** |
| Very Soft | less than 12 | less than 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1000 |
| Stiff | 50 to 100 | 1000 to 2000 |
| Very Stiff | 100 to 200 | 2000 to 4000 |
| Hard | over 200 | over 4000 |
| DTPL | Drier than plastic limit | |
| APL | About plastic limit | |
| WTPL | Wetter than plastic limit | |

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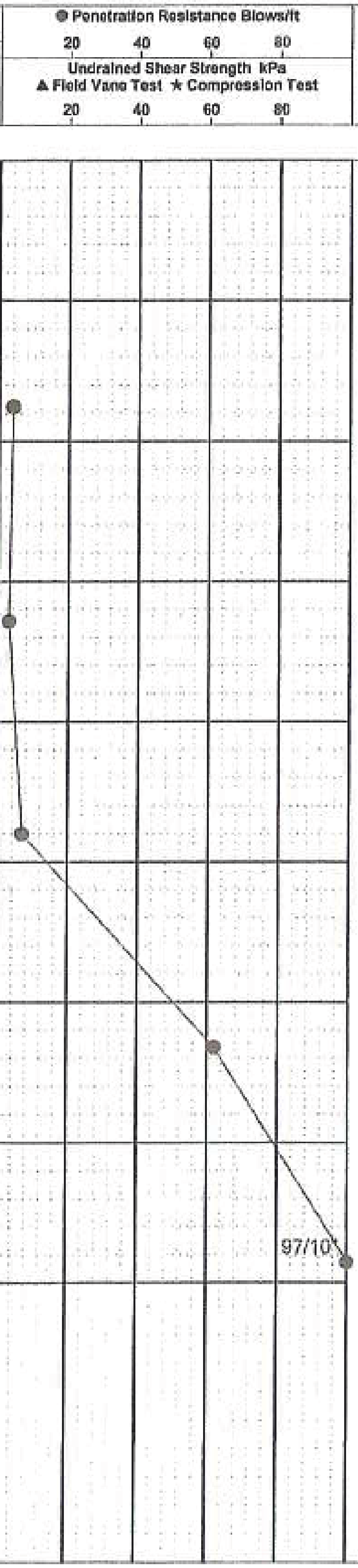
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO. 01-15

**Encl. No.** 1 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

SUBSURFACE PROFILE

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.93 | 0 | Soft to firm, brown, clayey silt FILL, wood fragments. | ▨ | | | | | | | |
| | | | | | 1 | ss | 4 | | 21 | |
| | | | | | 2 | ss | 3 | | 21 | |
| | 4 | Loose, brown silt & sand FILL, trace to some clay, trace of gravel. | ▨ | | | | | | | |
| | | | | | 3 | ss | 7 | | 17 | |
| | 6 | Very dense, brown, fine sandy SILT to silty fine SAND. | | | | | | | | |
| | | | | | 4 | ss | 62 | | 15 | |
| | | | | ▽ | | | | | | |
| | | | | | 5 | ss | 97/10" | | 20 | |
| | 8 | End of Borehole.<br>Water levl at 7.3m depth at completion. | | | | | | | | |



L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

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**REF. NO.:** P-0008182-01-100
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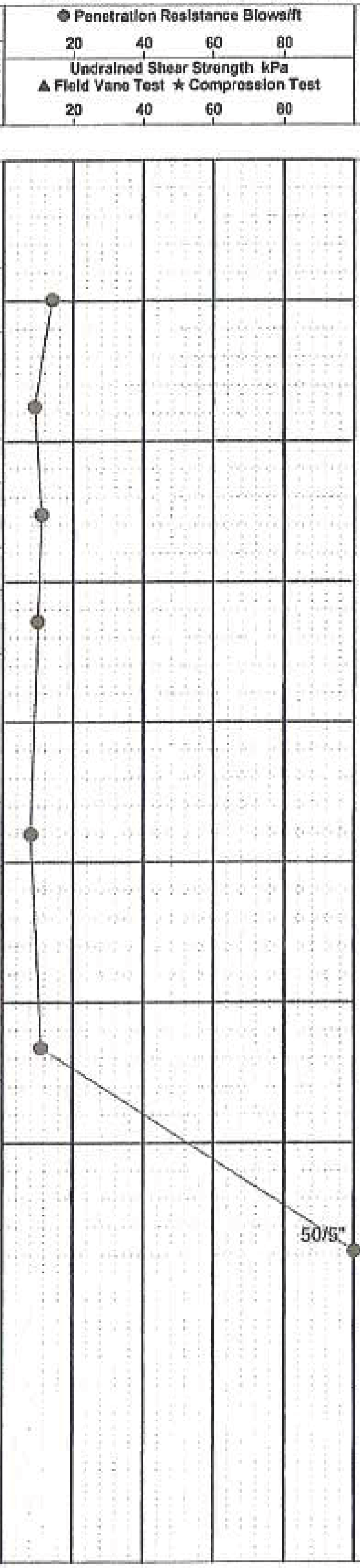
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 02-15

**Encl. No.** 2 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.35 | 0 | Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams. | ▩ | | 1 | ss | 14 | | 17 | |
| | | Loose, brown silt, sand & gravel FILL, asphalt fragments. | ▩ | | 2 | ss | 9 | | 7 | |
| | | Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel. | ▩ | | 3 | ss | 11 | | 16 | |
| | | | | | 4 | ss | 10 | | 19 | |
| | | | | | 5 | ss | 8 | | 12 | |
| | | | | | 6 | ss | 11 | | 10 | |
| | | Very dense, brown, moist, SAND & GRAVEL, some silt to silty. | | | 7 | ss | 50/ 5" | | 3 | |
| | | End of Borehole.<br>Hole dry & open at completion. | | | | | | | | |

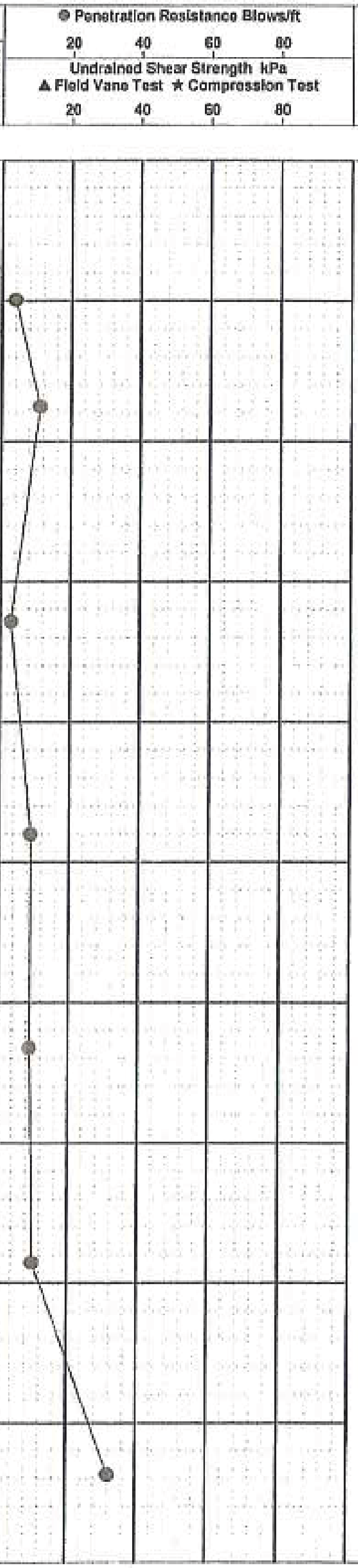


**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

# LOG OF BOREHOLE NO. 03-15

**Encl. No.** 3 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

| Elev. metres | Depth metres | DESCRIPTION | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|
| 101.06 | 0 | Loose, brown, gravelly silt & sand FILL, some clay. | | 1 | ss | 4 | | 16 | |
| | | Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers. | | 2 | ss | 11 | | 7 | |
| | | | | 3 | ss | 3 | | 17 | |
| | | | | 4 | ss | 9 | | 11 | |
| | | Loose, brown sand FILL, some silt. | | 5 | ss | 9 | | 8 | |
| | | Loose to compact, brown sand & gravel FILL, trace to some silt. | | 6 | ss | 10 | | 6 | |
| | | | ∇ | | | | | | |
| | | Dense, grey SAND & GRAVEL, trace of silt. | | 7 | ss | 32 | | 9 | |
| | | End of Borehole.<br>Water levl at 8.5m depth at completion. | | | | | | | |



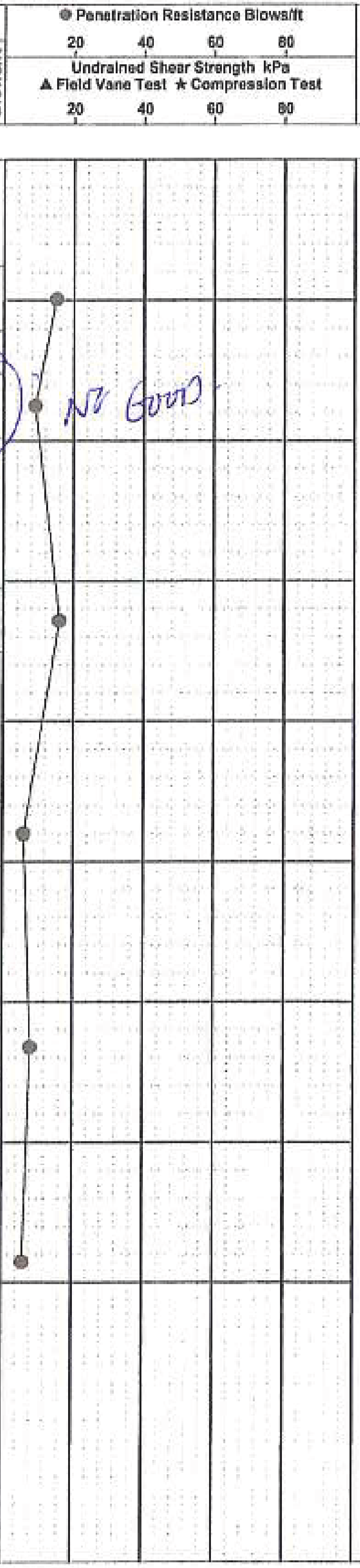
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

# LOG OF BOREHOLE NO.
# 04-15

**Encl. No.** 4 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

SUBSURFACE PROFILE

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 100.38 | 0 | Compact, brown silt, sand & gravel FILL, wood fragments, clay seams. | ▨ |  | 1 | ss | 15 |  | 4 |  |
|  |  | Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer. | ▨ |  | 2 | ss | 9 |  | 11 |  |
|  |  |  |  |  | 3 | ss | 16 |  | 5 |  |
|  |  |  |  |  | 4 | ss | 6 |  | 19 |  |
|  |  | Loose, brown silt, sand & gravel FILL, clayey seams. | ▨ |  | 5 | ss | 8 |  | 17 |  |
|  |  | Firm, brown, silty clay FILL. | ▨ |  | 6 | ss | 6 |  | 13 |  |
|  |  | End of Borehole.<br>Hole dry & open at completion. |  |  |  |  |  |  |  |  |



No Good

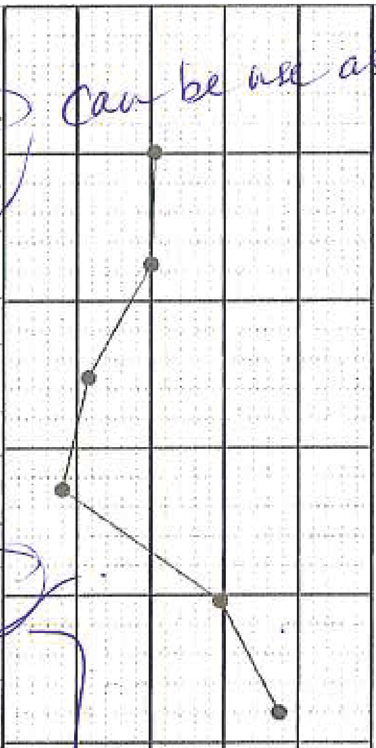
LVM
*CONSULTING SOILS AND MATERIALS ENGINEERS*
12 - 60 Meg Drive, London, ON, N6E 3T6
Phone: 519-685-6400 Fax: 519-685-0943

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

## LOG OF BOREHOLE NO.
## 06-15

**Encl. No.** 6 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

| SUBSURFACE PROFILE | | | | | | | | | ● Penetration Resistance Blows/ft 20 40 60 80 / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test 20 40 60 80 | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | | | | | |
| 95.49 | 0 | Loose, dark brown, silty sand FILL, trace to some gravel. Sieve. | | | | | | | Can be use as eng fill. | | | |
| | | Compact to dense, brown SAND & GRAVEL, trace to some silt. | | | 1 | SS | 41 | | | | 2 | |
| | | | | | 2 | SS | 40 | | | | 2 | |
| | | | | ▽ | 3 | SS | 23 | | | | 9 | |
| | | Compact to very dense, brown SILT & fine SAND. | | | 4 | SS | 16 | | | | 14 | |
| | | | | | 5 | SS | 50 | | | | 19 | |
| | | | | | 6 | SS | 75 | | | | 19 | |
| | 5 | End of Borehole.<br>Water level at 2.8m depth at completion. | | | | | | | can be used as eng fill. | | | |



LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

# L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

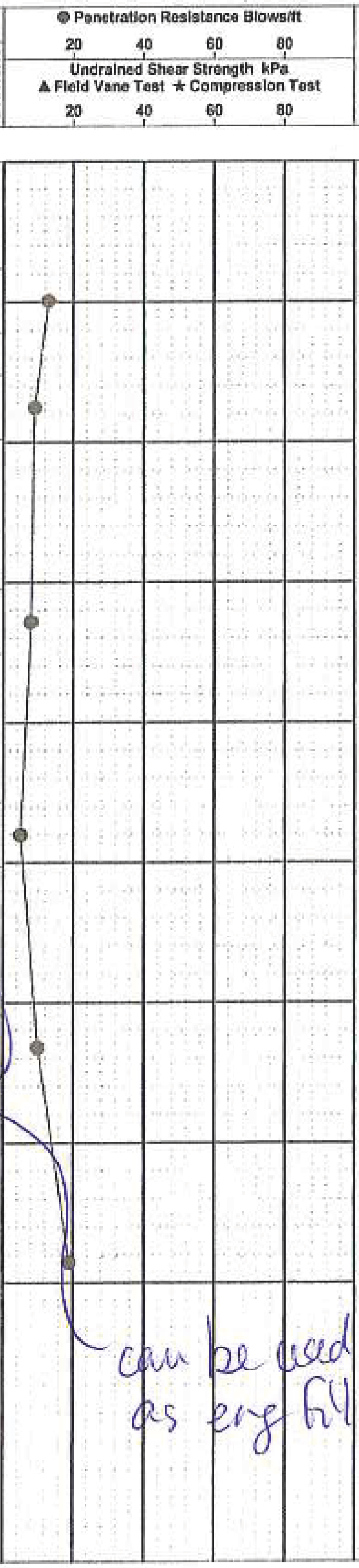
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**LOG OF BOREHOLE NO.**

## 05-15

**Encl. No.** 5 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 15, 2015

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 99.96 | 0 | Compact, dark brown silt, sand & gravel FILL, upper topsil seams. | ▨ | | | | | | | |
| 99 | 1 | | ▨ | | 1 | ss | 13 | | 9 | |
| | | Loose, dark brown silt FILL. | ▨ | | 2 | ss | 9 | | 15 | |
| 98 | 2 | | ▨ | | | | | | | |
| | | Loose, rusty brown silt & sand FILL. | ▨ | | | | | | | |
| 97 | 3 | | ▨ | | 3 | ss | 8 | | 9 | |
| 96 | 4 | | ▨ | | | | | | | |
| | | Loose, brown sand FILL, some silt & gravel. | ▨ | | 4 | ss | 5 | | 6 | |
| 95 | 5 | | ▨ | | | | | | | |
| 94 | 6 | Loose to compact, brown sand FILL, some silt, trace to some gravel. | ▨ | | 5 | ss | 10 | | 8 | |
| 93 | 7 | Compact, grey SAND & GRAVEL, trace of silt. | | ∇ | | | | | | |
| 92 | 8 | | | | 6 | ss | 19 | | 10 | |
| | | End of Borehole.<br>Water level at 7.2m depth at completion. | | | | | | | | |



can be used as eng fill.

LVM

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**12 - 60 Meg Drive, London, ON, N6E 3T6**

**Phone: 519-685-6400 Fax: 519-685-0943**

**LOG OF BOREHOLE NO.**

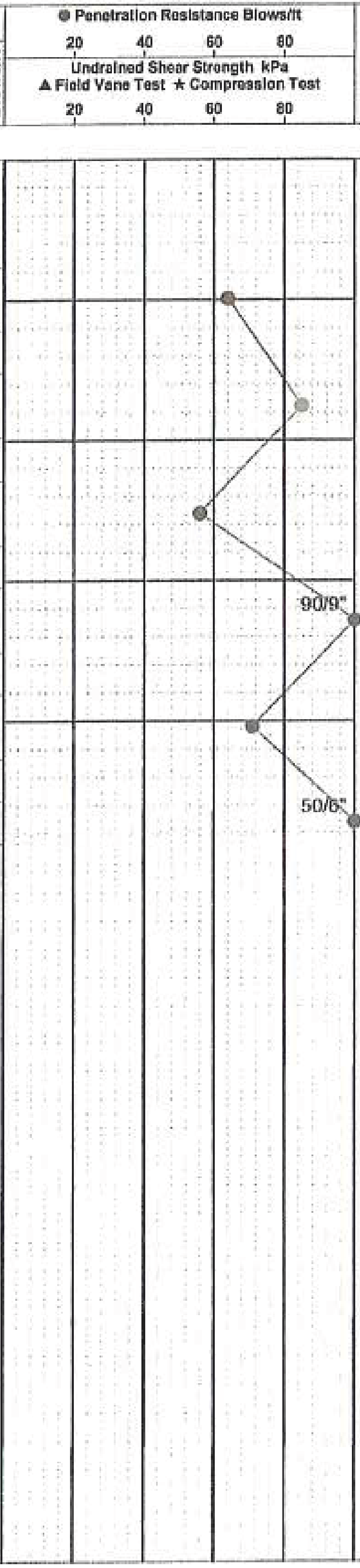
# 07-15

**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**Encl. No.** 7 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 94.24 | 0 | 150mm TOPSOIL. | | | | | | | | |
| | | Very dense, brown SILT, upper sand seams. | | | 1 | ss | 64 | | 13 | |
| | | Very dense, silty fine SAND, occasional silt seams. | | ∇ | 2 | ss | 85 | | 18 | |
| | | | | | 3 | ss | 56 | | 18 | |
| | | | | | 4 | ss | 90/<br>9" | | 15 | |
| | | | | | 5 | ss | 71 | | 20 | |
| | | | | | 6 | ss | 50/<br>6" | | 18 | |
| | | End of Borehole.<br>Water level at 1.6m depth at completion. | | | | | | | | |



**LVM**

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6** **Phone: 519-685-6400 Fax: 519-685-0943**

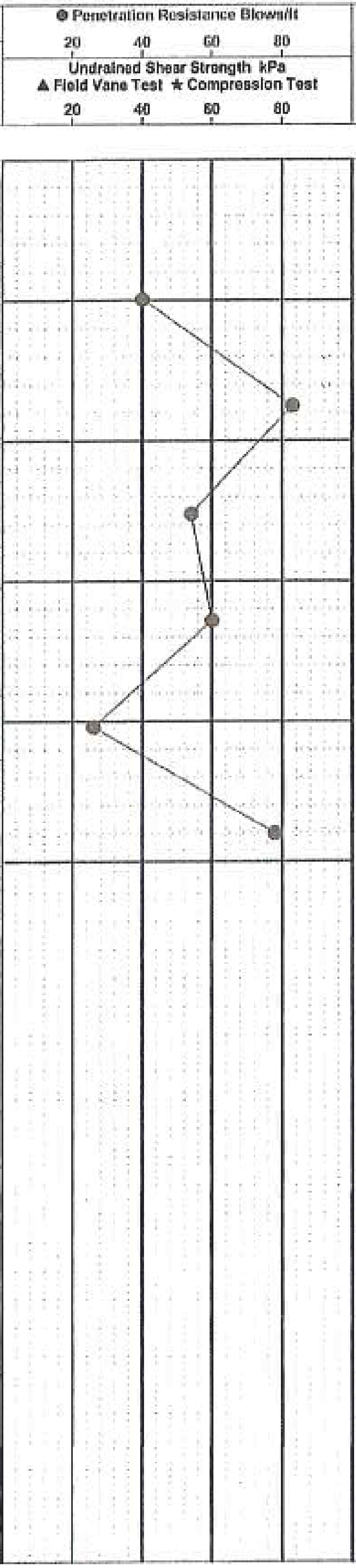
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

**LOG OF BOREHOLE NO.**

## 08-15

**Encl. No.** 8 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

| Elev. metres | Depth metres | DESCRIPTION | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|
| 94.33 | 0 | Dense, brown SAND & GRAVEL, trace to some silt. | ∇ | 1 | ss | 40 | | 7 | |
| | | Very dense, brown SILT, sand seams. | | 2 | ss | 83 | | 16 | |
| | | | | 3 | ss | 54 | | 18 | |
| | 3 | Very dense, brown SILT & fine SAND. | | 4 | ss | 60 | | 18 | |
| | | Compact to very dense, brown, fine SAND, some silt to silty. | | 5 | ss | 26 | | 18 | |
| | | | | 6 | ss | 78 | | 16 | |
| | 5 | End of Borehole.<br>Water level at 1.0m depth at completion. | | | | | | | |



L V M

*CONSULTING SOILS AND MATERIALS ENGINEERS*

**12 - 60 Meg Drive, London, ON, N6E 3T6**
**Phone: 519-685-6400 Fax: 519-685-0943**

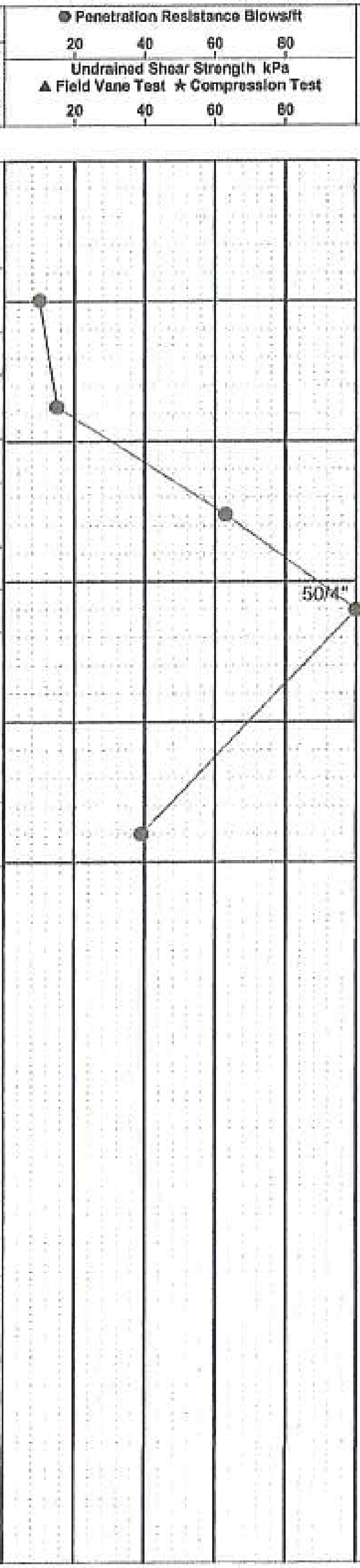
**REF. NO.:** P-0008182-01-100
**CLIENT:** 2270942 Ontario Ltd.
**PROJECT:** Planned Residential Development
**LOCATION:** 10125 Oxbow Drive, Komoka
**DATUM ELEVATION:** Top of Fire Hydrant Spindle, 100.0m

# LOG OF BOREHOLE NO.
# 09-15

**Encl. No.** 9 (Sheet 1 of 1)
**DRILLING DATA:** Morooka
**METHOD:** Solid Stem Augers
**DIAMETER:** 150mm
**DATE:** Apr 14, 2015

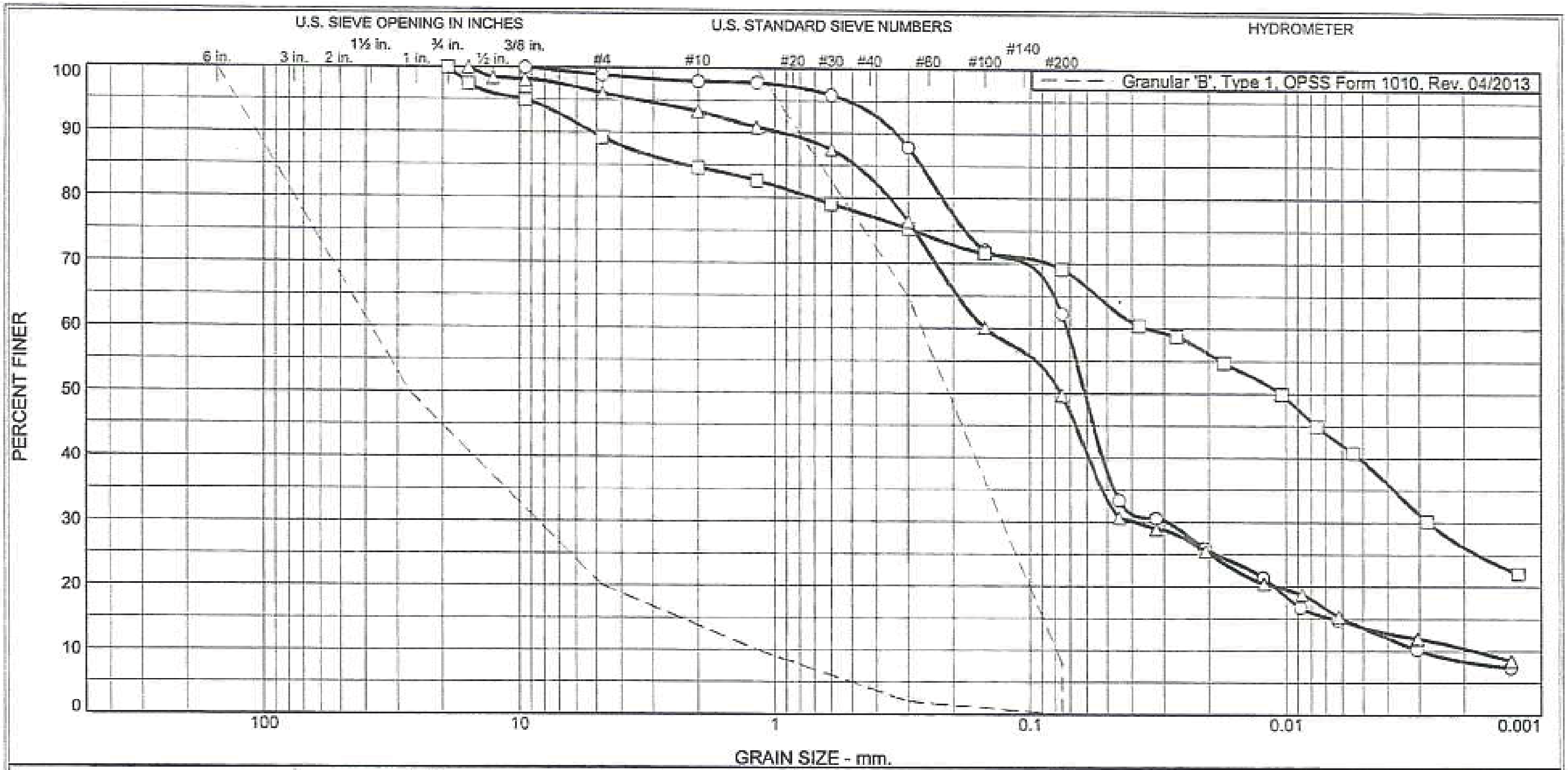
**SUBSURFACE PROFILE**

| Elev. metres | Depth metres | DESCRIPTION | SYMBOL | GROUND WATER | NUMBER | TYPE | "N" Blows/ft | PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT % |
|---|---|---|---|---|---|---|---|---|---|---|
| 93.02<br>93 | 0 | Compact, brown SAND & GRAVEL, trace to some silt. | | ▽ | | | | | | |
| 92 | 1 | | | | 1 | ss | 10 | | 13 | |
| | | | | | 2 | ss | 15 | | 6 | |
| 91 | 2 | | | | | | | | | |
| | | | | | 3 | ss | 63 | | 15 | |
| | | Very dense, brown SILT & fine SAND, clayey seam. | | | | | | | | |
| 90 | 3 | Very dense, brown SAND & GRAVEL, some silt. | | | 4 | ss | 50/ 4" | | 10 | |
| 89 | 4 | Very stiff to hard, grey, clayey SILT to silty CLAY till. | | | 5 | as | | | 9 | |
| | | | | | 6 | ss | 39 | | 12 | |
| 88 | 5 | End of Borehole.<br>Water level at 0.2m depth at completion. | | | | | | | | |



# Appendix 3 Grain Size Distribution Analyses

Figures 1 and 2: Grain Size Distribution Analyses



| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |

| | Location | Source | Sample # | Depth/Elev. | Sample Information |
|---|---|---|---|---|---|
| ○ | Borehole 01-15 | | Sample 3 | 4.8m / 95.1 | Silt & Sand FILL, some clay, trace gravel. |
| □ | Borehole 02-15 | | Sample 4 | 3.3m / 97.0 | Sandy, silty clay FILL, some gravel. |
| △ | Borehole 03-15 | | Sample 3 | 3.3m / 97.8 | Silt & Sand FILL, traces of clay & gravel. |
| | | | | | |
| | | | | | |

**Project No.** P-0008182-01-100 **Client** 2270942 Ontario Ltd.

**Figure 1**

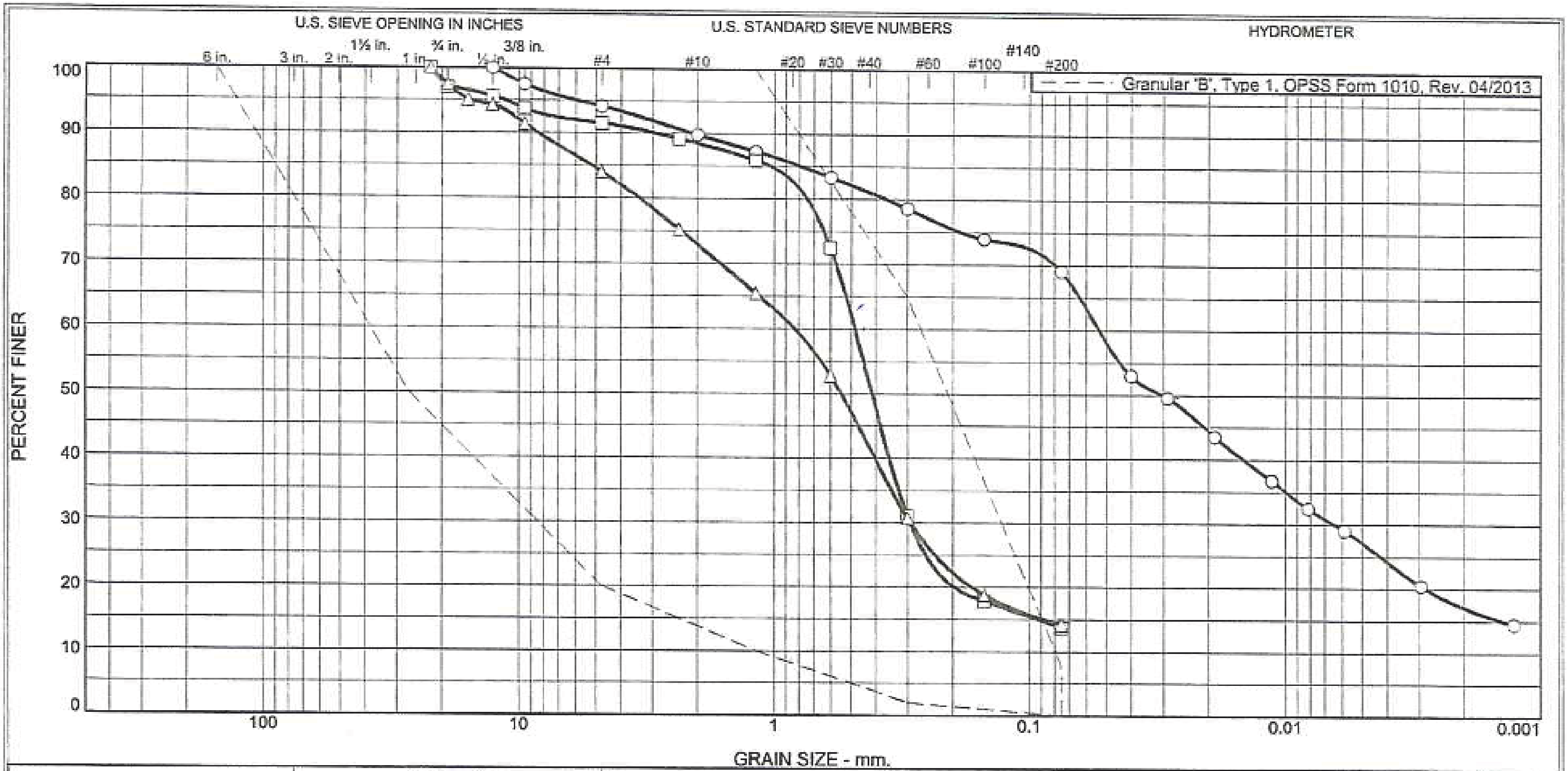
**LVM, a division of EnGlobe Corp.**

Grain Size Analysis

**Planned Residential Development, 10125 Oxbow Drive, Komoka**

**London, Ontario**

**Tested By:** AH/JH **Checked By:** SB



| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |

| | Location | Source | Sample # | Depth/Elev. | Sample Information |
|---|---|---|---|---|---|
| ○ | Borehole 04-15 | | Sample 2 | 1.7m / 98.7 | Sandy, clayey silt FILL, trace gravel. |
| □ | Borehole 05-15 | | Sample 5 | 6.3m / 93.7 | Sand FILL, some silt, trace gravel. |
| △ | Borehole 06-15 | | Sample 1 | 1.0m / 94.5 | SAND, some silt, some gravel.<br>FILL |

**Project No.** P-0008182-01-100 **Client** 2270942 Ontario Ltd.

**Figure 2**

Grain Size Analysis

**Planned Residential Development, 10125 Oxbow Drive, Komoka**

**LVM, a division of EnGlobe Corp.**

**London, Ontario**

**Tested By:** AH/JH **Checked By:** SB

# Appendix 4 Chemical Analysis

ALS Work Order: L1600418

LVM, a Division of EnGlobe Corp.
ATTN: ROB HELWIG
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

Date Received: 17-APR-15
Report Date: 23-APR-15 14:13 (MT)
Version: FINAL

Client Phone: 519-685-6400

# Certificate of Analysis

**Lab Work Order #: L1600418**
Project P.O. #: A01072
Job Reference: P-8182-0-01-100
C of C Numbers:
Legal Site Desc:

Gayle Braun

Gayle Braun
Senior Account Manager

# ANALYTICAL REPORT

## SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

| | | | | ALS ID<br>Sampled Date<br>Sampled Time<br>Sample ID | L1600418-1<br>14-APR-15<br>12:00<br>BH1 SA1 | L1600418-2<br>14-APR-15<br>12:00<br>BH1 SA2 | L1600418-3<br>15-APR-15<br>12:00<br>BH2 SA2 | L1600418-4<br>15-APR-15<br>12:00<br>BH2 SA5 | L1600418-5<br>15-APR-15<br>12:00<br>BH3 SA2 | L1600418-6<br>15-APR-15<br>12:00<br>BH3 SA4 | L1600418-7<br>14-APR-15<br>12:00<br>BH4 SA1 | L1600418-8<br>14-APR-15<br>12:00<br>BH4 SA3 | L1600418-9<br>15-APR-15<br>12:00<br>BH5 SA1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grouping | Analyte | Unit | Guide Limits #1 | #2 | | | | | | | | | |
| Physical Tests | Conductivity | mS/cm | 0.7 | - | 0.180 | 0.206 | 0.543 | 0.334 | 0.750 | 0.155 | 0.703 | 0.369 | 0.252 |
| | % Moisture | % | - | - | 18.5 | 17.5 | 12.5 | 17.8 | 10.7 | 10.9 | 10.4 | 12.0 | 9.37 |
| | pH | pH units | - | - | 7.31 | 7.05 | 7.73 | 7.60 | 7.81 | 7.32 | 7.53 | 7.67 | 7.35 |
| Cyanides | Cyanide, Weak Acid Diss | ug/g | 0.051 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Saturated Paste Extractables | SAR | SAR | 5 | - | <0.10 | <0.10 | 4.90 | 2.65 | 7.68 | 0.27 | 7.55 | 2.10 | 0.48 |
| | Calcium (Ca) | mg/L | - | - | 26.6 | 28.1 | 34.5 | 26.6 | 32.5 | 20.0 | 18.6 | 27.4 | 29.9 |
| | Magnesium (Mg) | mg/L | - | - | 2.26 | 2.74 | 1.17 | 1.75 | 1.21 | 1.65 | 1.35 | 2.26 | 3.25 |
| | Sodium (Na) | mg/L | - | - | 1.13 | 1.61 | 108 | 52.3 | 164 | 4.70 | 125 | 42.5 | 10.4 |
| Metals | Antimony (Sb) | ug/g | 7.5 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Arsenic (As) | ug/g | 18 | - | 3.7 | 3.8 | 3.9 | 4.0 | 3.8 | 3.2 | 3.2 | 2.9 | 3.4 |
| | Barium (Ba) | ug/g | 390 | - | 52.2 | 55.3 | 58.0 | 65.4 | 47.3 | 41.6 | 40.1 | 57.4 | 43.0 |
| | Beryllium (Be) | ug/g | 4 | - | <0.50 | <0.50 | <0.50 | 0.56 | <0.50 | <0.50 | <0.50 | 0.51 | <0.50 |
| | Boron (B) | ug/g | 120 | - | 5.9 | 5.9 | 11.9 | 13.2 | 10.2 | 5.1 | 10.2 | 15.7 | 8.9 |
| | Boron (B), Hot Water Ext. | ug/g | 1.5 | - | 0.46 | 0.46 | 0.15 | 0.19 | 0.22 | 0.18 | 0.14 | 0.84 | 0.25 |
| | Cadmium (Cd) | ug/g | 1.2 | - | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| | Chromium (Cr) | ug/g | 160 | - | 28.6 | 28.8 | 20.7 | 22.5 | 17.4 | 14.7 | 15.5 | 21.1 | 16.2 |
| | Cobalt (Co) | ug/g | 22 | - | 5.8 | 6.6 | 7.2 | 7.7 | 5.8 | 5.0 | 5.6 | 6.6 | 5.0 |
| | Copper (Cu) | ug/g | 140 | - | 10.5 | 11.6 | 16.3 | 14.8 | 16.5 | 11.2 | 12.5 | 13.2 | 11.7 |
| | Lead (Pb) | ug/g | 120 | - | 12.5 | 12.4 | 12.6 | 15.1 | 11.9 | 10.6 | 9.9 | 7.5 | 13.6 |
| | Mercury (Hg) | ug/g | 0.27 | - | 0.0634 | 0.0623 | 0.0226 | 0.0260 | 0.0243 | 0.0260 | 0.0165 | 0.0145 | 0.0454 |
| | Molybdenum (Mo) | ug/g | 6.9 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.2 | <1.0 |
| | Nickel (Ni) | ug/g | 100 | - | 11.3 | 12.8 | 17.3 | 19.0 | 14.1 | 10.2 | 13.7 | 16.3 | 11.0 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

# ANALYTICAL REPORT

## SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

| | | | | ALS ID | L1600418-1 | L1600418-2 | L1600418-3 | L1600418-4 | L1600418-5 | L1600418-6 | L1600418-7 | L1600418-8 | L1600418-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampled Date | 14-APR-15 | 14-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 14-APR-15 | 14-APR-15 | 15-APR-15 |
| | | | | Sampled Time | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 |
| | | | | Sample ID | BH1 SA1 | BH1 SA2 | BH2 SA2 | BH2 SA5 | BH3 SA2 | BH3 SA4 | BH4 SA1 | BH4 SA3 | BH5 SA1 |
| Grouping | Analyte | Unit | Guide Limits #1 | Guide Limits #2 | | | | | | | | | |
| **Metals** | Selenium (Se) | ug/g | 2.4 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Silver (Ag) | ug/g | 20 | - | 0.29 | 0.25 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| | Thallium (Tl) | ug/g | 1 | - | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| | Uranium (U) | ug/g | 23 | - | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| | Vanadium (V) | ug/g | 86 | - | 28.9 | 31.3 | 30.8 | 32.4 | 28.0 | 26.2 | 23.2 | 26.7 | 31.5 |
| | Zinc (Zn) | ug/g | 340 | - | 44.2 | 48.0 | 52.3 | 56.1 | 53.5 | 49.9 | 42.2 | 47.8 | 44.7 |
| **Speciated Metals** | Chromium, Hexavalent | ug/g | 8 | - | <0.20 | <0.20 | <0.20 | 0.41 | 0.34 | <0.20 | <0.20 | 0.53 | <0.20 |
| **Volatile Organic Compounds** | Benzene | ug/g | 0.21 | - | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 | <0.0068 |
| | Ethylbenzene | ug/g | 1.1 | - | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 | <0.018 |
| | Toluene | ug/g | 2.3 | - | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 | <0.080 |
| | o-Xylene | ug/g | - | - | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| | m+p-Xylenes | ug/g | - | - | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 | <0.030 |
| | Xylenes (Total) | ug/g | 3.1 | - | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| | Surrogate: 4-Bromofluorobenzene | % | - | - | 99.9 | 99.2 | 96.6 | 94.7 | 97.1 | 97.8 | 97.1 | 100.3 | 98.6 |
| | Surrogate: 1,4-Difluorobenzene | % | - | - | 101.3 | 101.2 | 101.1 | 100.3 | 100.5 | 102.4 | 99.8 | 100.7 | 101.1 |
| **Hydrocarbons** | F1 (C6-C10) | ug/g | 55 | - | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| | F1-BTEX | ug/g | 55 | - | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| | F2 (C10-C16) | ug/g | 98 | - | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 |
| | F3 (C16-C34) | ug/g | 300 | - | <50 | <50 | 56 | 81 | 96 | <50 | <50 | <50 | <50 |
| | F4 (C34-C50) | ug/g | 2800 | - | <50 | <50 | 114 | 256 | 271 | <50 | 136 | <50 | <50 |
| | F4G-SG (GHH-Silica) | mg/kg | 2800 | - | | | | | 980 | | | | |
| | Total Hydrocarbons (C6-C50) | ug/g | - | - | <72 | <72 | 171 | 337 | 367 | <72 | 136 | <72 | <72 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

# ANALYTICAL REPORT

## SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

| | | | | ALS ID | L1600418-1 | L1600418-2 | L1600418-3 | L1600418-4 | L1600418-5 | L1600418-6 | L1600418-7 | L1600418-8 | L1600418-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sampled Date | 14-APR-15 | 14-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 15-APR-15 | 14-APR-15 | 14-APR-15 | 15-APR-15 |
| | | | | Sampled Time | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 | 12:00 |
| | | | | Sample ID | BH1 SA1 | BH1 SA2 | BH2 SA2 | BH2 SA5 | BH3 SA2 | BH3 SA4 | BH4 SA1 | BH4 SA3 | BH5 SA1 |
| | | | Guide Limits | | | | | | | | | | |
| Grouping | Analyte | Unit | #1 | #2 | | | | | | | | | |
| Hydrocarbons | Chrom. to baseline at nC50 | | - | - | YES | YES | YES | YES | NO | YES | YES | YES | YES |
| | Surrogate: 2-Bromobenzotrifluoride | % | - | - | 75.4 | 76.3 | 72.4 | 74.5 | 76.6 | 75.2 | 74.9 | 76.9 | 76.1 |
| | Surrogate: 3,4-Dichlorotoluene | % | - | - | 86.4 | 89.8 | 95.5 | 85.5 | 96.1 | 92.1 | 89.2 | 91.9 | 93.1 |

**Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)**

🟨 Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
🟥 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

## Summary of Guideline Exceedances

| Guideline<br>ALS ID | Client ID | Grouping | Analyte | Result | Guideline Limit | Unit |
|---|---|---|---|---|---|---|
| **Ontario Regulation 153/04 - April 15, 2011 Standards - T2-Soil-Res/Park/Inst. Property Use (Coarse)** | | | | | | |
| L1600418-5 | BH3 SA2 | Physical Tests | Conductivity | 0.750 | 0.7 | mS/cm |
| | | Saturated Paste Extractables | SAR | 7.68 | 5 | SAR |
| L1600418-7 | BH4 SA1 | Physical Tests | Conductivity | 0.703 | 0.7 | mS/cm |
| | | Saturated Paste Extractables | SAR | 7.55 | 5 | SAR |

# Reference Information

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|
| **B-HWS-R511-WT** | Soil | Boron-HWE-O.Reg 153/04 (July 2011) | HW EXTR, EPA 6010B |

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **BTX-511-HS-WT** | Soil | BTEX-O.Reg 153/04 (July 2011) | SW846 8260 |

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **CN-WAD-R511-WT** | Soil | Cyanide (WAD)-O.Reg 153/04 (July 2011) | MOE 3015/APHA 4500CN I-WAD |

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **CR-CR6-IC-WT** | Soil | Hexavalent Chromium in Soil | SW846 3060A/7199 |

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **EC-R511-WT** | Soil | Conductivity-O.Reg 153/04 (July 2011) | MOEE E3138 |

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **F1-F4-511-CALC-WT** | Soil | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-S |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:

# Reference Information

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|

1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| **F1-HS-511-WT** | Soil | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **F2-F4-511-WT** | Soil | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **F4G-ADD-511-WT** | Soil | F4G SG-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

F4G, gravimetric analysis, is determined if the chromatogram does not return to baseline at or before C50. A soil sample is extracted with a solvent mix, the solvent is evaporated and the weight of the residue is determined.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **HG-200.2-CVAA-WT** | Soil | Mercury in Soil by CVAAS | EPA 200.2/1631E (mod) |

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **MET-200.2-CCMS-WT** | Soil | Metals in Soil by CRC ICPMS | EPA 200.2/6020A (mod) |

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| **MOISTURE-WT** | Soil | % Moisture | Gravimetric: Oven Dried |
| **PH-R511-WT** | Soil | pH-O.Reg 153/04 (July 2011) | MOEE E3137A |

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **SAR-R511-WT** | Soil | SAR-O.Reg 153/04 (July 2011) | SW846 6010C |

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

# Reference Information

**Methods Listed** (if applicable):

| ALS Test Code | Matrix | Test Description | Method Reference** |
|---|---|---|---|

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| **XYLENES-SUM-CALC-WT** | Soil | Sum of Xylene Isomer Concentrations | CALCULATION |

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

| Laboratory Definition Code | Laboratory Location |
|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA |

## GLOSSARY OF REPORT TERMS

*Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.*

*mg/kg - milligrams per kilogram based on dry weight of sample*
*mg/kg wwt - milligrams per kilogram based on wet weight of sample*
*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight*
*mg/L - unit of concentration based on volume, parts per million.*
*< - Less than.*
*D.L. - The reporting limit.*
*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*
*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*
*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

*Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.*

ALS Environmental

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| B-HWS-R511-WT | Soil | | | | | | | |
| **Batch R3177129** | | | | | | | | |
| **WG2073524-3 DUP** | | **L1600218-19** | | | | | | |
| Boron (B), Hot Water Ext. | | 0.21 | 0.21 | | ug/g | 1.7 | 40 | 21-APR-15 |
| **WG2073524-2 IRM** | | **SALINITY_SOIL4** | | | | | | |
| Boron (B), Hot Water Ext. | | | 85.4 | | % | | 70-130 | 21-APR-15 |
| **WG2073524-1 MB** | | | | | | | | |
| Boron (B), Hot Water Ext. | | | <0.10 | | ug/g | | 0.1 | 21-APR-15 |
| **WG2073524-4 MS** | | **L1600218-19** | | | | | | |
| Boron (B), Hot Water Ext. | | | 84.4 | | % | | 60-140 | 21-APR-15 |
| BTX-511-HS-WT | Soil | | | | | | | |
| **Batch R3176973** | | | | | | | | |
| **WG2073160-3 DUP** | | **WG2073160-5** | | | | | | |
| Benzene | | <0.0068 | <0.0068 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| Ethylbenzene | | <0.018 | <0.018 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| m+p-Xylenes | | <0.030 | <0.030 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| o-Xylene | | <0.020 | <0.020 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| Toluene | | <0.080 | <0.080 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| **WG2073160-2 LCS** | | | | | | | | |
| Benzene | | | 99.4 | | % | | 70-130 | 21-APR-15 |
| Ethylbenzene | | | 95.0 | | % | | 70-130 | 21-APR-15 |
| m+p-Xylenes | | | 95.6 | | % | | 70-130 | 21-APR-15 |
| o-Xylene | | | 96.0 | | % | | 70-130 | 21-APR-15 |
| Toluene | | | 96.6 | | % | | 70-130 | 21-APR-15 |
| **WG2073160-1 MB** | | | | | | | | |
| Benzene | | | <0.0068 | | ug/g | | 0.0068 | 20-APR-15 |
| Ethylbenzene | | | <0.018 | | ug/g | | 0.018 | 20-APR-15 |
| m+p-Xylenes | | | <0.030 | | ug/g | | 0.03 | 20-APR-15 |
| o-Xylene | | | <0.020 | | ug/g | | 0.02 | 20-APR-15 |
| Toluene | | | <0.080 | | ug/g | | 0.08 | 20-APR-15 |
| Surrogate: 1,4-Difluorobenzene | | | 101.4 | | % | | 70-130 | 20-APR-15 |
| Surrogate: 4-Bromofluorobenzene | | | 102.0 | | % | | 70-130 | 20-APR-15 |
| **WG2073160-4 MS** | | **WG2073160-5** | | | | | | |
| Benzene | | | 96.0 | | % | | 60-140 | 20-APR-15 |
| Ethylbenzene | | | 97.7 | | % | | 60-140 | 20-APR-15 |
| m+p-Xylenes | | | 99.8 | | % | | 60-140 | 20-APR-15 |
| o-Xylene | | | 95.3 | | % | | 60-140 | 20-APR-15 |
| Toluene | | | 95.7 | | % | | 60-140 | 20-APR-15 |

ALS Environmental

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| BTX-511-HS-WT | Soil | | | | | | | |
| **Batch** R3176999 | | | | | | | | |
| **WG2073262-3 DUP** | | L1600418-8 | | | | | | |
| Benzene | | <0.0068 | <0.0068 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| Ethylbenzene | | <0.018 | <0.018 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| m+p-Xylenes | | <0.030 | <0.030 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| o-Xylene | | <0.020 | <0.020 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| Toluene | | <0.080 | <0.080 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |
| **WG2073262-2 LCS** | | | | | | | | |
| Benzene | | | 99.8 | | % | | 70-130 | 21-APR-15 |
| Ethylbenzene | | | 93.9 | | % | | 70-130 | 21-APR-15 |
| m+p-Xylenes | | | 97.2 | | % | | 70-130 | 21-APR-15 |
| o-Xylene | | | 94.3 | | % | | 70-130 | 21-APR-15 |
| Toluene | | | 94.2 | | % | | 70-130 | 21-APR-15 |
| **WG2073262-1 MB** | | | | | | | | |
| Benzene | | | <0.0068 | | ug/g | | 0.0068 | 21-APR-15 |
| Ethylbenzene | | | <0.018 | | ug/g | | 0.018 | 21-APR-15 |
| m+p-Xylenes | | | <0.030 | | ug/g | | 0.03 | 21-APR-15 |
| o-Xylene | | | <0.020 | | ug/g | | 0.02 | 21-APR-15 |
| Toluene | | | <0.080 | | ug/g | | 0.08 | 21-APR-15 |
| Surrogate: 1,4-Difluorobenzene | | | 94.9 | | % | | 70-130 | 21-APR-15 |
| Surrogate: 4-Bromofluorobenzene | | | 89.0 | | % | | 70-130 | 21-APR-15 |
| **WG2073262-4 MS** | | L1600418-8 | | | | | | |
| Benzene | | | 102.4 | | % | | 60-140 | 21-APR-15 |
| Ethylbenzene | | | 96.1 | | % | | 60-140 | 21-APR-15 |
| m+p-Xylenes | | | 98.4 | | % | | 60-140 | 21-APR-15 |
| o-Xylene | | | 98.3 | | % | | 60-140 | 21-APR-15 |
| Toluene | | | 97.3 | | % | | 60-140 | 21-APR-15 |
| CN-WAD-R511-WT | Soil | | | | | | | |
| **Batch** R3177212 | | | | | | | | |
| **WG2072484-3 DUP** | | L1600418-1 | | | | | | |
| Cyanide, Weak Acid Diss | | <0.050 | <0.050 | RPD-NA | ug/g | N/A | 35 | 20-APR-15 |
| **WG2072484-2 LCS** | | | | | | | | |
| Cyanide, Weak Acid Diss | | | 98.5 | | % | | 80-120 | 20-APR-15 |
| **WG2072484-1 MB** | | | | | | | | |
| Cyanide, Weak Acid Diss | | | <0.050 | | ug/g | | 0.05 | 20-APR-15 |
| **WG2072484-4 MS** | | L1600418-1 | | | | | | |
| Cyanide, Weak Acid Diss | | | 90.8 | | % | | 70-130 | 20-APR-15 |

ALS Environmental

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| CR-CR6-IC-WT | Soil | | | | | | | |
| **Batch R3176826** | | | | | | | | |
| **WG2072597-3 CRM** | | **WT-SQC012** | | | | | | |
| Chromium, Hexavalent | | | 88.6 | | % | | 70-130 | 20-APR-15 |
| **WG2072597-4 DUP** | | **L1600485-1** | | | | | | |
| Chromium, Hexavalent | | 0.26 | 0.25 | | ug/g | 4.3 | 25 | 20-APR-15 |
| **WG2072597-2 LCS** | | | | | | | | |
| Chromium, Hexavalent | | | 95.4 | | % | | 70-130 | 20-APR-15 |
| **WG2072597-1 MB** | | | | | | | | |
| Chromium, Hexavalent | | | <0.20 | | ug/g | | 0.2 | 20-APR-15 |
| EC-R511-WT | Soil | | | | | | | |
| **Batch R3177103** | | | | | | | | |
| **WG2073525-4 DUP** | | **WG2073525-3** | | | | | | |
| Conductivity | | 0.0970 | 0.0990 | | mS/cm | 2.0 | 20 | 21-APR-15 |
| **WG2073883-1 LCS** | | | | | | | | |
| Conductivity | | | 99.8 | | % | | 90-110 | 21-APR-15 |
| **WG2073883-2 LCS** | | | | | | | | |
| Conductivity | | | 98.0 | | % | | 90-110 | 21-APR-15 |
| **WG2073525-1 MB** | | | | | | | | |
| Conductivity | | | <0.0040 | | mS/cm | | 0.004 | 21-APR-15 |
| F1-HS-511-WT | Soil | | | | | | | |
| **Batch R3176973** | | | | | | | | |
| **WG2073160-3 DUP** | | **WG2073160-5** | | | | | | |
| F1 (C6-C10) | | <5.0 | <5.0 | RPD-NA | ug/g | N/A | 50 | 20-APR-15 |
| **WG2073160-2 LCS** | | | | | | | | |
| F1 (C6-C10) | | | 102.0 | | % | | 80-120 | 20-APR-15 |
| **WG2073160-1 MB** | | | | | | | | |
| F1 (C6-C10) | | | <5.0 | | ug/g | | 5 | 20-APR-15 |
| Surrogate: 3,4-Dichlorotoluene | | | 85.3 | | % | | 60-140 | 20-APR-15 |
| **WG2073160-7 MS** | | **WG2073160-6** | | | | | | |
| F1 (C6-C10) | | | 94.5 | | % | | 60-140 | 20-APR-15 |
| **Batch R3176999** | | | | | | | | |
| **WG2073262-3 DUP** | | **L1600418-8** | | | | | | |
| F1 (C6-C10) | | <5.0 | <5.0 | RPD-NA | ug/g | N/A | 50 | 21-APR-15 |
| **WG2073262-2 LCS** | | | | | | | | |
| F1 (C6-C10) | | | 102.8 | | % | | 80-120 | 21-APR-15 |
| **WG2073262-1 MB** | | | | | | | | |
| F1 (C6-C10) | | | <5.0 | | ug/g | | 5 | 21-APR-15 |
| Surrogate: 3,4-Dichlorotoluene | | | 97.4 | | % | | 60-140 | 21-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| F1-HS-511-WT | Soil | | | | | | | |
| **Batch R3176999** | | | | | | | | |
| **WG2073262-7 MS** | | **L1600418-9** | | | | | | |
| F1 (C6-C10) | | | 113.4 | | % | | 60-140 | 21-APR-15 |
| F2-F4-511-WT | Soil | | | | | | | |
| **Batch R3176940** | | | | | | | | |
| **WG2072486-3 CRM** | | **ALS PHC2 IRM** | | | | | | |
| F2 (C10-C16) | | | 96.8 | | % | | 70-130 | 20-APR-15 |
| F3 (C16-C34) | | | 113.5 | | % | | 70-130 | 20-APR-15 |
| F4 (C34-C50) | | | 119.5 | | % | | 70-130 | 20-APR-15 |
| **WG2073249-1 CVS** | | | | | | | | |
| F2 (C10-C16) | | | 109.8 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 110.3 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 115.5 | | % | | 80-120 | 20-APR-15 |
| **WG2073249-2 CVS** | | | | | | | | |
| F2 (C10-C16) | | | 108.6 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 109.7 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 114.8 | | % | | 80-120 | 20-APR-15 |
| **WG2073249-3 CVS** | | | | | | | | |
| F2 (C10-C16) | | | 108.2 | | % | | 80-120 | 21-APR-15 |
| F3 (C16-C34) | | | 110.1 | | % | | 80-120 | 21-APR-15 |
| F4 (C34-C50) | | | 114.2 | | % | | 80-120 | 21-APR-15 |
| **WG2072486-5 DUP** | | **WG2072486-4** | | | | | | |
| F2 (C10-C16) | | 950 | 1060 | | ug/g | 11 | 40 | 20-APR-15 |
| F3 (C16-C34) | | 719 | 734 | | ug/g | 2.2 | 40 | 20-APR-15 |
| F4 (C34-C50) | | <50 | <50 | RPD-NA | ug/g | N/A | 40 | 20-APR-15 |
| **WG2072486-2 LCS** | | | | | | | | |
| F2 (C10-C16) | | | 89.9 | | % | | 80-120 | 20-APR-15 |
| F3 (C16-C34) | | | 99.5 | | % | | 80-120 | 20-APR-15 |
| F4 (C34-C50) | | | 100.1 | | % | | 80-120 | 20-APR-15 |
| **WG2072486-1 MB** | | | | | | | | |
| F2 (C10-C16) | | | <10 | | ug/g | | 10 | 20-APR-15 |
| F3 (C16-C34) | | | <50 | | ug/g | | 50 | 20-APR-15 |
| F4 (C34-C50) | | | <50 | | ug/g | | 50 | 20-APR-15 |
| Surrogate: 2-Bromobenzotrifluoride | | | 72.5 | | % | | 60-140 | 20-APR-15 |
| F4G-ADD-511-WT | Soil | | | | | | | |

ALS Environmental

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| F4G-ADD-511-WT | Soil | | | | | | | |
| **Batch R3177419** | | | | | | | | |
| **WG2074262-2 LCS**<br>F4G-SG (GHH-Silica) | | | 80.1 | | % | | 60-140 | 19-APR-15 |
| **WG2074262-3 LCSD**<br>F4G-SG (GHH-Silica) | | **WG2074262-2**<br>80.1 | 84.0 | | % | 4.7 | 50 | 19-APR-15 |
| **WG2074262-1 MB**<br>F4G-SG (GHH-Silica) | | | <250 | | mg/kg | | 250 | 19-APR-15 |
| HG-200.2-CVAA-WT | Soil | | | | | | | |
| **Batch R3176925** | | | | | | | | |
| **WG2073530-2 CRM**<br>Mercury (Hg) | | **WT-CANMET-TILL1** | 85.8 | | % | | 70-130 | 21-APR-15 |
| **WG2073530-6 DUP**<br>Mercury (Hg) | | **L1600418-1**<br>0.0634 | 0.0640 | | ug/g | 0.9 | 40 | 21-APR-15 |
| **WG2073530-4 LCS**<br>Mercury (Hg) | | | 101.0 | | % | | 80-120 | 21-APR-15 |
| **WG2073530-1 MB**<br>Mercury (Hg) | | | <0.0050 | | mg/kg | | 0.005 | 21-APR-15 |
| **Batch R3176927** | | | | | | | | |
| **WG2073531-2 CRM**<br>Mercury (Hg) | | **WT-CANMET-TILL1** | 90.3 | | % | | 70-130 | 21-APR-15 |
| **WG2073531-6 DUP**<br>Mercury (Hg) | | **L1600418-7**<br>0.0165 | 0.0156 | | ug/g | 5.5 | 40 | 21-APR-15 |
| **WG2073531-4 LCS**<br>Mercury (Hg) | | | 98.0 | | % | | 80-120 | 21-APR-15 |
| **WG2073531-1 MB**<br>Mercury (Hg) | | | <0.0050 | | mg/kg | | 0.005 | 21-APR-15 |
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177896** | | | | | | | | |
| **WG2073530-2 CRM**<br>Antimony (Sb) | | **WT-CANMET-TILL1** | 101.0 | | % | | 70-130 | 21-APR-15 |
| Arsenic (As) | | | 111.4 | | % | | 70-130 | 21-APR-15 |
| Barium (Ba) | | | 109.7 | | % | | 70-130 | 21-APR-15 |
| Beryllium (Be) | | | 100.4 | | % | | 70-130 | 21-APR-15 |
| Boron (B) | | | 99.2 | | % | | 70-130 | 21-APR-15 |
| Cadmium (Cd) | | | 104.5 | | % | | 70-130 | 21-APR-15 |
| Chromium (Cr) | | | 118.1 | | % | | 70-130 | 21-APR-15 |
| Cobalt (Co) | | | 111.3 | | % | | 70-130 | 21-APR-15 |
| Copper (Cu) | | | 108.3 | | % | | 70-130 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177896** | | | | | | | | |
| **WG2073530-2 CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Lead (Pb) | | | 95.6 | | % | | 70-130 | 21-APR-15 |
| Molybdenum (Mo) | | | 88.0 | | % | | 70-130 | 21-APR-15 |
| Nickel (Ni) | | | 113.1 | | % | | 70-130 | 21-APR-15 |
| Selenium (Se) | | | 95.2 | | % | | 70-130 | 21-APR-15 |
| Silver (Ag) | | | 100.0 | | % | | 70-130 | 21-APR-15 |
| Thallium (Tl) | | | 98.7 | | % | | 70-130 | 21-APR-15 |
| Uranium (U) | | | 112.2 | | % | | 70-130 | 21-APR-15 |
| Vanadium (V) | | | 119.4 | | % | | 70-130 | 21-APR-15 |
| Zinc (Zn) | | | 111.0 | | % | | 70-130 | 21-APR-15 |
| **WG2073530-6 DUP** | | **L1600418-1** | | | | | | |
| Antimony (Sb) | | <1.0 | 0.15 | | ug/g | 17 | 30 | 21-APR-15 |
| Arsenic (As) | | 3.7 | 3.71 | | ug/g | 0.6 | 30 | 21-APR-15 |
| Barium (Ba) | | 52.2 | 53.0 | | ug/g | 1.4 | 40 | 21-APR-15 |
| Beryllium (Be) | | <0.50 | 0.41 | | ug/g | 11 | 30 | 21-APR-15 |
| Boron (B) | | 5.9 | <5.0 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Cadmium (Cd) | | <0.50 | 0.282 | | ug/g | 7.5 | 30 | 21-APR-15 |
| Chromium (Cr) | | 26.6 | 27.9 | | ug/g | 2.4 | 30 | 21-APR-15 |
| Cobalt (Co) | | 5.8 | 5.87 | | ug/g | 1.1 | 30 | 21-APR-15 |
| Copper (Cu) | | 10.5 | 10.6 | | ug/g | 0.6 | 30 | 21-APR-15 |
| Lead (Pb) | | 12.5 | 12.6 | | ug/g | 0.4 | 40 | 21-APR-15 |
| Molybdenum (Mo) | | <1.0 | 0.31 | | ug/g | 4.4 | 40 | 21-APR-15 |
| Nickel (Ni) | | 11.3 | 11.8 | | ug/g | 4.0 | 30 | 21-APR-15 |
| Selenium (Se) | | <1.0 | <0.20 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Silver (Ag) | | 0.29 | 0.29 | | ug/g | 0.9 | 40 | 21-APR-15 |
| Thallium (Tl) | | <0.50 | 0.096 | | ug/g | 4.5 | 30 | 21-APR-15 |
| Uranium (U) | | <1.0 | 0.527 | | ug/g | 2.2 | 30 | 21-APR-15 |
| Vanadium (V) | | 28.9 | 28.9 | | ug/g | 0.2 | 30 | 21-APR-15 |
| Zinc (Zn) | | 44.2 | 45.6 | | ug/g | 3.1 | 30 | 21-APR-15 |
| **WG2073530-3 LCS** | | | | | | | | |
| Antimony (Sb) | | | 101.7 | | % | | 80-120 | 21-APR-15 |
| Arsenic (As) | | | 95.2 | | % | | 80-120 | 21-APR-15 |
| Barium (Ba) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Beryllium (Be) | | | 92.5 | | % | | 80-120 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177896** | | | | | | | | |
| **WG2073530-3 LCS** | | | | | | | | |
| Boron (B) | | | 93.9 | | % | | 80-120 | 21-APR-15 |
| Cadmium (Cd) | | | 96.1 | | % | | 80-120 | 21-APR-15 |
| Chromium (Cr) | | | 95.8 | | % | | 80-120 | 21-APR-15 |
| Cobalt (Co) | | | 95.5 | | % | | 80-120 | 21-APR-15 |
| Copper (Cu) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Lead (Pb) | | | 99.0 | | % | | 80-120 | 21-APR-15 |
| Molybdenum (Mo) | | | 94.5 | | % | | 80-120 | 21-APR-15 |
| Nickel (Ni) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Selenium (Se) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Silver (Ag) | | | 93.7 | | % | | 80-120 | 21-APR-15 |
| Thallium (Tl) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Uranium (U) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Vanadium (V) | | | 97.9 | | % | | 80-120 | 21-APR-15 |
| Zinc (Zn) | | | 92.1 | | % | | 80-120 | 21-APR-15 |
| **WG2073530-1 MB** | | | | | | | | |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Arsenic (As) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Beryllium (Be) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Boron (B) | | | <5.0 | | mg/kg | | 5 | 21-APR-15 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 21-APR-15 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Copper (Cu) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Molybdenum (Mo) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Nickel (Ni) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Selenium (Se) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Silver (Ag) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Thallium (Tl) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Uranium (U) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Vanadium (V) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177901** | | | | | | | | |
| **WG2073531-2** **CRM** | | **WT-CANMET-TILL1** | | | | | | |
| Antimony (Sb) | | | 93.1 | | % | | 70-130 | 21-APR-15 |
| Arsenic (As) | | | 97.4 | | % | | 70-130 | 21-APR-15 |
| Barium (Ba) | | | 94.2 | | % | | 70-130 | 21-APR-15 |
| Beryllium (Be) | | | 94.1 | | % | | 70-130 | 21-APR-15 |
| Boron (B) | | | 120.4 | | % | | 70-130 | 21-APR-15 |
| Cadmium (Cd) | | | 90.3 | | % | | 70-130 | 21-APR-15 |
| Chromium (Cr) | | | 104.8 | | % | | 70-130 | 21-APR-15 |
| Cobalt (Co) | | | 96.7 | | % | | 70-130 | 21-APR-15 |
| Copper (Cu) | | | 93.3 | | % | | 70-130 | 21-APR-15 |
| Lead (Pb) | | | 83.8 | | % | | 70-130 | 21-APR-15 |
| Molybdenum (Mo) | | | 85.3 | | % | | 70-130 | 21-APR-15 |
| Nickel (Ni) | | | 99.0 | | % | | 70-130 | 21-APR-15 |
| Selenium (Se) | | | 95.0 | | % | | 70-130 | 21-APR-15 |
| Silver (Ag) | | | 90.6 | | % | | 70-130 | 21-APR-15 |
| Thallium (Tl) | | | 92.2 | | % | | 70-130 | 21-APR-15 |
| Uranium (U) | | | 98.0 | | % | | 70-130 | 21-APR-15 |
| Vanadium (V) | | | 106.2 | | % | | 70-130 | 21-APR-15 |
| Zinc (Zn) | | | 96.5 | | % | | 70-130 | 21-APR-15 |
| **WG2073531-6** **DUP** | | **L1600418-7** | | | | | | |
| Antimony (Sb) | | <1.0 | <0.10 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Arsenic (As) | | 3.2 | 2.97 | | ug/g | 7.4 | 30 | 21-APR-15 |
| Barium (Ba) | | 40.1 | 38.0 | | ug/g | 5.3 | 40 | 21-APR-15 |
| Beryllium (Be) | | <0.50 | 0.33 | | ug/g | 7.2 | 30 | 21-APR-15 |
| Boron (B) | | 10.2 | 9.5 | | ug/g | 7.3 | 30 | 21-APR-15 |
| Cadmium (Cd) | | <0.50 | 0.102 | | ug/g | 6.2 | 30 | 21-APR-15 |
| Chromium (Cr) | | 15.5 | 14.3 | | ug/g | 7.7 | 30 | 21-APR-15 |
| Cobalt (Co) | | 5.6 | 5.26 | | ug/g | 5.4 | 30 | 21-APR-15 |
| Copper (Cu) | | 12.5 | 12.0 | | ug/g | 3.9 | 30 | 21-APR-15 |
| Lead (Pb) | | 9.9 | 9.38 | | ug/g | 5.0 | 40 | 21-APR-15 |
| Molybdenum (Mo) | | <1.0 | 0.40 | | ug/g | 11 | 40 | 21-APR-15 |
| Nickel (Ni) | | 13.7 | 13.2 | | ug/g | 4.1 | 30 | 21-APR-15 |
| Selenium (Se) | | <1.0 | <0.20 | RPD-NA | ug/g | N/A | 30 | 21-APR-15 |
| Silver (Ag) | | <0.20 | <0.10 | RPD-NA | ug/g | N/A | 40 | 21-APR-15 |

# Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch** **R3177901** | | | | | | | | |
| **WG2073531-6** **DUP** | | **L1600418-7** | | | | | | |
| Thallium (Tl) | | <0.50 | 0.089 | | ug/g | 8.5 | 30 | 21-APR-15 |
| Uranium (U) | | <1.0 | 0.632 | | ug/g | 2.4 | 30 | 21-APR-15 |
| Vanadium (V) | | 23.2 | 21.4 | | ug/g | 8.0 | 30 | 21-APR-15 |
| Zinc (Zn) | | 42.2 | 39.5 | | ug/g | 6.6 | 30 | 21-APR-15 |
| **WG2073531-3** **LCS** | | | | | | | | |
| Antimony (Sb) | | | 101.7 | | % | | 80-120 | 21-APR-15 |
| Arsenic (As) | | | 95.2 | | % | | 80-120 | 21-APR-15 |
| Barium (Ba) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Beryllium (Be) | | | 92.5 | | % | | 80-120 | 21-APR-15 |
| Boron (B) | | | 93.9 | | % | | 80-120 | 21-APR-15 |
| Cadmium (Cd) | | | 96.1 | | % | | 80-120 | 21-APR-15 |
| Chromium (Cr) | | | 95.8 | | % | | 80-120 | 21-APR-15 |
| Cobalt (Co) | | | 95.5 | | % | | 80-120 | 21-APR-15 |
| Copper (Cu) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Lead (Pb) | | | 99.0 | | % | | 80-120 | 21-APR-15 |
| Molybdenum (Mo) | | | 94.5 | | % | | 80-120 | 21-APR-15 |
| Nickel (Ni) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Selenium (Se) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Silver (Ag) | | | 93.7 | | % | | 80-120 | 21-APR-15 |
| Thallium (Tl) | | | 95.6 | | % | | 80-120 | 21-APR-15 |
| Uranium (U) | | | 93.6 | | % | | 80-120 | 21-APR-15 |
| Vanadium (V) | | | 97.9 | | % | | 80-120 | 21-APR-15 |
| Zinc (Zn) | | | 92.1 | | % | | 80-120 | 21-APR-15 |
| **WG2073531-1** **MB** | | | | | | | | |
| Antimony (Sb) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Arsenic (As) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Barium (Ba) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Beryllium (Be) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Boron (B) | | | <5.0 | | mg/kg | | 5 | 21-APR-15 |
| Cadmium (Cd) | | | <0.020 | | mg/kg | | 0.02 | 21-APR-15 |
| Chromium (Cr) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Cobalt (Co) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Copper (Cu) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Lead (Pb) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| MET-200.2-CCMS-WT | Soil | | | | | | | |
| **Batch R3177901** | | | | | | | | |
| **WG2073531-1 MB** | | | | | | | | |
| Molybdenum (Mo) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Nickel (Ni) | | | <0.50 | | mg/kg | | 0.5 | 21-APR-15 |
| Selenium (Se) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Silver (Ag) | | | <0.10 | | mg/kg | | 0.1 | 21-APR-15 |
| Thallium (Tl) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Uranium (U) | | | <0.050 | | mg/kg | | 0.05 | 21-APR-15 |
| Vanadium (V) | | | <0.20 | | mg/kg | | 0.2 | 21-APR-15 |
| Zinc (Zn) | | | <2.0 | | mg/kg | | 2 | 21-APR-15 |
| MOISTURE-WT | Soil | | | | | | | |
| **Batch R3176280** | | | | | | | | |
| **WG2072498-3 DUP** | | **L1600509-4** | | | | | | |
| % Moisture | | 13.2 | 13.4 | | % | 2.0 | 20 | 19-APR-15 |
| **WG2072498-2 LCS** | | | | | | | | |
| % Moisture | | | 100.0 | | % | | 70-130 | 19-APR-15 |
| **WG2072498-1 MB** | | | | | | | | |
| % Moisture | | | <0.10 | | % | | 0.1 | 19-APR-15 |
| **Batch R3176283** | | | | | | | | |
| **WG2072503-3 DUP** | | **L1587803-21** | | | | | | |
| % Moisture | | 10.5 | 10.3 | | % | 1.3 | 20 | 19-APR-15 |
| **WG2072503-2 LCS** | | | | | | | | |
| % Moisture | | | 99.9 | | % | | 70-130 | 19-APR-15 |
| **WG2072503-1 MB** | | | | | | | | |
| % Moisture | | | <0.10 | | % | | 0.1 | 19-APR-15 |
| PH-R511-WT | Soil | | | | | | | |
| **Batch R3176288** | | | | | | | | |
| **WG2072483-1 DUP** | | **L1600418-1** | | | | | | |
| pH | | 7.31 | 7.17 | J | pH units | 0.14 | 0.3 | 20-APR-15 |
| **WG2072952-1 LCS** | | | | | | | | |
| pH | | | 7.03 | | pH units | | 6.7-7.3 | 20-APR-15 |
| SAR-R511-WT | Soil | | | | | | | |
| **Batch R3177137** | | | | | | | | |
| **WG2073525-4 DUP** | | **WG2073525-3** | | | | | | |
| Calcium (Ca) | | 14.2 | 12.4 | | mg/L | 14 | 40 | 21-APR-15 |
| Sodium (Na) | | 3.85 | 3.94 | | mg/L | 2.3 | 40 | 21-APR-15 |
| Magnesium (Mg) | | 1.67 | 1.48 | | mg/L | 12 | 40 | 21-APR-15 |

# Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

**Client:** LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

**Contact:** ROB HELWIG

| Test | Matrix | Reference | Result | Qualifier | Units | RPD | Limit | Analyzed |
|---|---|---|---|---|---|---|---|---|
| SAR-R511-WT | Soil | | | | | | | |
| **Batch** R3177137 | | | | | | | | |
| **WG2073525-2 IRM** | | **WT SAR1** | | | | | | |
| Calcium (Ca) | | | 83.1 | | % | | 70-130 | 21-APR-15 |
| Sodium (Na) | | | 90.0 | | % | | 70-130 | 21-APR-15 |
| Magnesium (Mg) | | | 83.4 | | % | | 70-130 | 21-APR-15 |
| **WG2073525-1 MB** | | | | | | | | |
| Calcium (Ca) | | | <0.10 | | mg/L | | 0.1 | 21-APR-15 |
| Sodium (Na) | | | <0.50 | | mg/L | | 0.5 | 21-APR-15 |
| Magnesium (Mg) | | | <0.10 | | mg/L | | 0.1 | 21-APR-15 |

**Legend:**

| | |
|---|---|
| Limit | ALS Control Limit (Data Quality Objectives) |
| DUP | Duplicate |
| RPD | Relative Percent Difference |
| N/A | Not Available |
| LCS | Laboratory Control Sample |
| SRM | Standard Reference Material |
| MS | Matrix Spike |
| MSD | Matrix Spike Duplicate |
| ADE | Average Desorption Efficiency |
| MB | Method Blank |
| IRM | Internal Reference Material |
| CRM | Certified Reference Material |
| CCV | Continuing Calibration Verification |
| CVS | Calibration Verification Standard |
| LCSD | Laboratory Control Sample Duplicate |

**Sample Parameter Qualifier Definitions:**

| Qualifier | Description |
|---|---|
| J | Duplicate results and limits are expressed in terms of absolute difference. |
| RPD-NA | Relative Percent Difference Not Available due to result(s) being less than detection limit. |

**Hold Time Exceedances:**

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

118516

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

# CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

C of C # 00000

Page 1 of 1

*Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.*

| Specify date required | Service requested | | |
|---|---|---|---|
| | *5 day (regular)* | ☒ | *2 day TAT (50%)* |
| | | | *Next day TAT (100%)* |
| | *3-4 day (25%)* | | *Same day TAT (200%)* |

COMPANY NAME: LVM
OFFICE: London
PROJECT MANAGER: Rob Helwig
PROJECT #: P-8182-001-100
PHONE: 519-685-6400
FAX: 519-685-0943
ACCOUNT #:
QUOTATION #:
PO #: A01072

CRITERIA — Criteria on report YES ✓ NO ___
Reg 153/04 ☐ Reg 511/09 ☒
Table 1 [✓ 2] 3 4 5 6 7 8 9
TCLP ___ MISA ___ PWQO ___
ODWS ___ OTHER ___

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX ___ BOTH ___
SELECT: PDF ___ DIGITAL ___ BOTH ___
EMAIL 1 ___
EMAIL 2 ___

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <— (F, P, F/P)
SUBMISSION #: L1600418
ENTERED BY: PStastny
DATE/TIME ENTERED: 17 Apr-15
BIN #:

SAMPLING INFORMATION — ANALYSIS REQUEST

| Date (dd-mm-yy) | Time (24hr) (hh:mm) | COMP | GRAB | WATER | SOIL | OTHER | SAMPLE DESCRIPTION TO APPEAR ON REPORT | NUMBER OF CONTAINERS | METALS+INORGANICS | PHC F1-F4 | BTEX | COMMENTS | LAB ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14/04/15 | | | | | ✓ | | BH1 Sa1 | 4 | ✓ | ✓ | ✓ | | -1 |
| 14/04/15 | | | | | ✓ | | BH1 Sa2 | | ✓ | ✓ | ✓ | | -2 |
| 15/04/15 | | | | | ✓ | | BH2 Sa2 | | ✓ | ✓ | ✓ | | -3 |
| 15/04/15 | | | | | ✓ | | BH2 Sa5 | | ✓ | ✓ | ✓ | | -4 |
| 15/04/15 | | | | | ✓ | | BH3 Sa2 | | ✓ | ✓ | ✓ | | -5 |
| 15/04/15 | | | | | ✓ | | BH3 Sa4 | | ✓ | ✓ | ✓ | | -6 |
| 14/04/15 | | | | | ✓ | | BH4 Sa1 | | ✓ | ✓ | ✓ | | -7 |
| 14/04/15 | | | | | ✓ | | BH4 Sa3 | | ✓ | ✓ | ✓ | | -8 |
| 15/04/15 | | | | | ✓ | | BH5 Sa1 | ✓ | ✓ | ✓ | ✓ | | -9 |

L1600418-COFC

SPECIAL INSTRUCTIONS/COMMENTS
TABLE 2 coarse grained
Residential

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)
Are any samples taken from a regulated DW System? Yes ☐ No ☐
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☐

SAMPLE CONDITION
FROZEN ☐
COLD ☐
COOLING INITIATED ☒
AMBIENT ☐
MEAN TEMP 10°C
OBSERVATIONS Yes ☐ No ☐
INIT PS

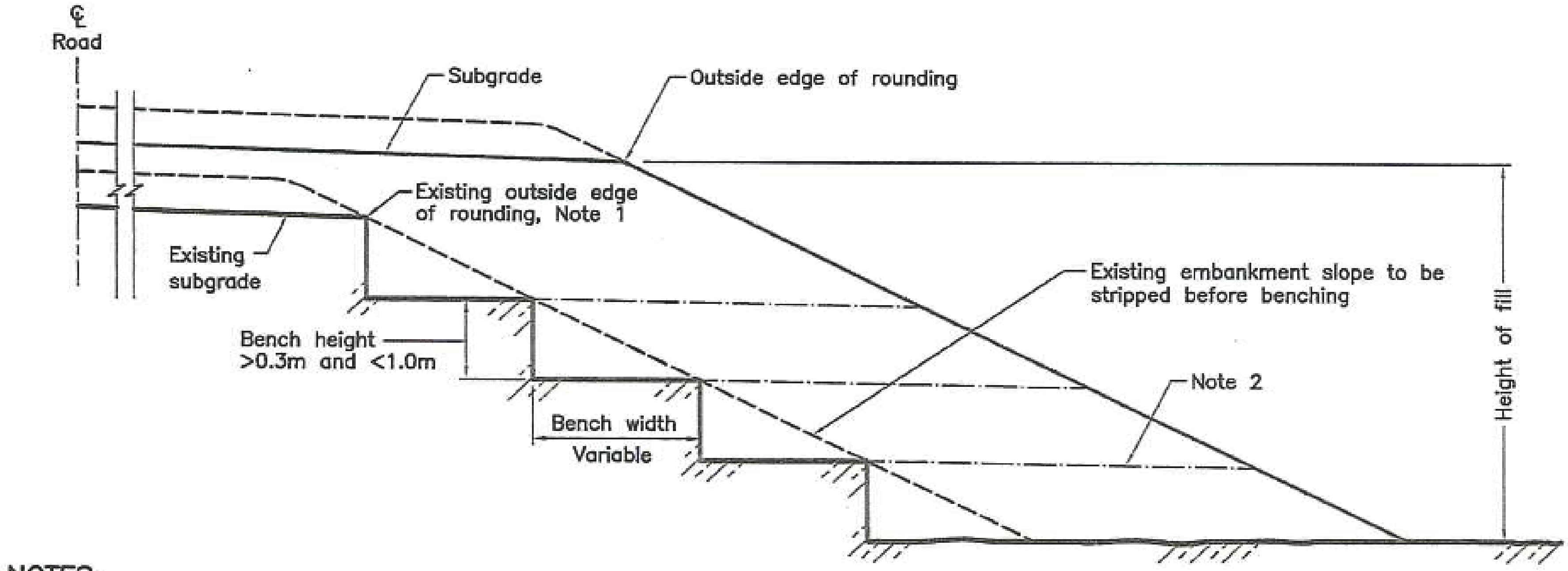
SAMPLED BY: Ed Van Puymbroeck
DATE & TIME: Apr 15, 2015
RECEIVED BY: R. Naly
DATE & TIME: Apr 15, 2015

RELINQUISHED BY:
DATE & TIME:
RECEIVED AT LAB BY: PStastny
DATE & TIME: 17 Apr-15 @

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

# Appendix 5 Benching of Earth Slopes

OPSD 208.010



NOTES:

1 When the subgrade is below the existing outside edge of rounding, benching shall be carried out below the point where the subgrade intersects the existing slope.

2 Benches are to be excavated one level at a time and the fill placed and compacted before the next bench is excavated.

A Benching is not required on existing slopes flatter than 3H:1V.

B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

# BENCHING OF EARTH SLOPES

Nov 2008 | Rev 2

OPSD 208.010

# Appendix C

# Laboratory Test Results

### Table 101

MTE

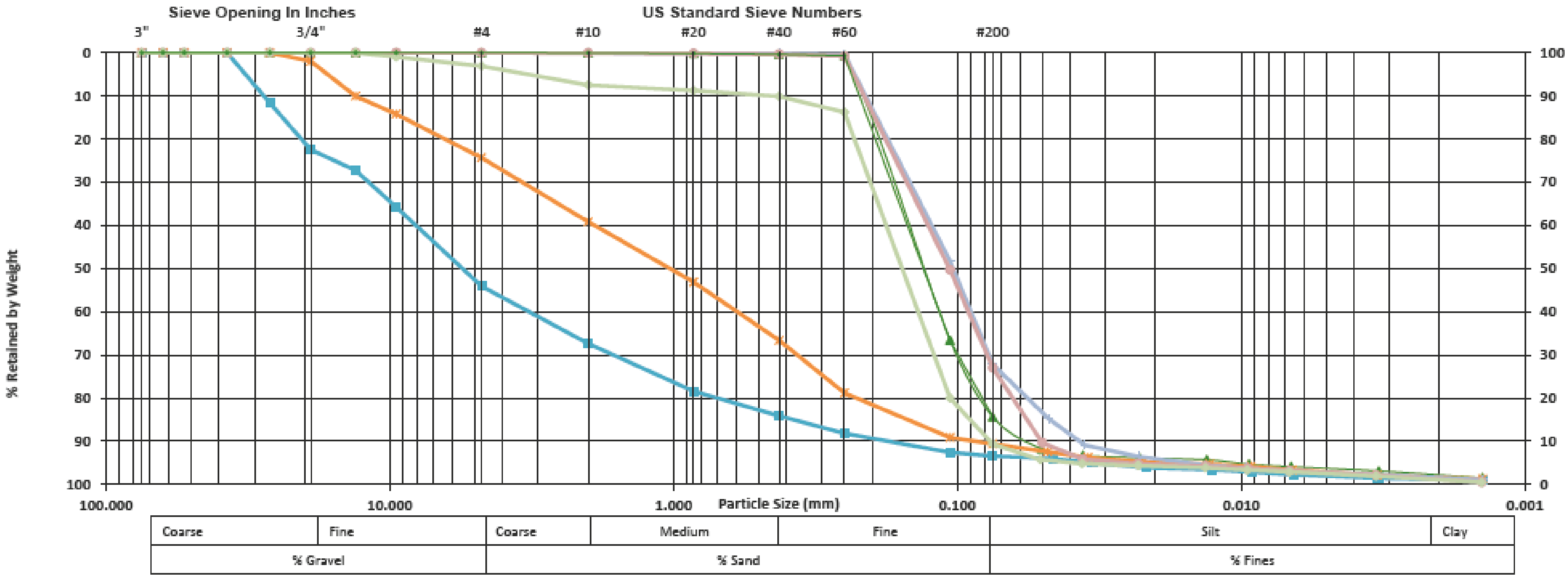
# Particle Size Distribution Analysis Test Results

**Project Name:** 10125 Oxbow Drive Additional Investigation
**Client:** 2270942 Ontario Ltd.
**Project Location:** 10125 Oxbow Drive, Middlesex Centre, ON

**Date Sampled:** Dec. 10-12, 2019
**Date Tested:** Jan. 7-10, 2020

**MTE File No.:** 43705-301
**Table No:** 101

## Unified Soil Classification



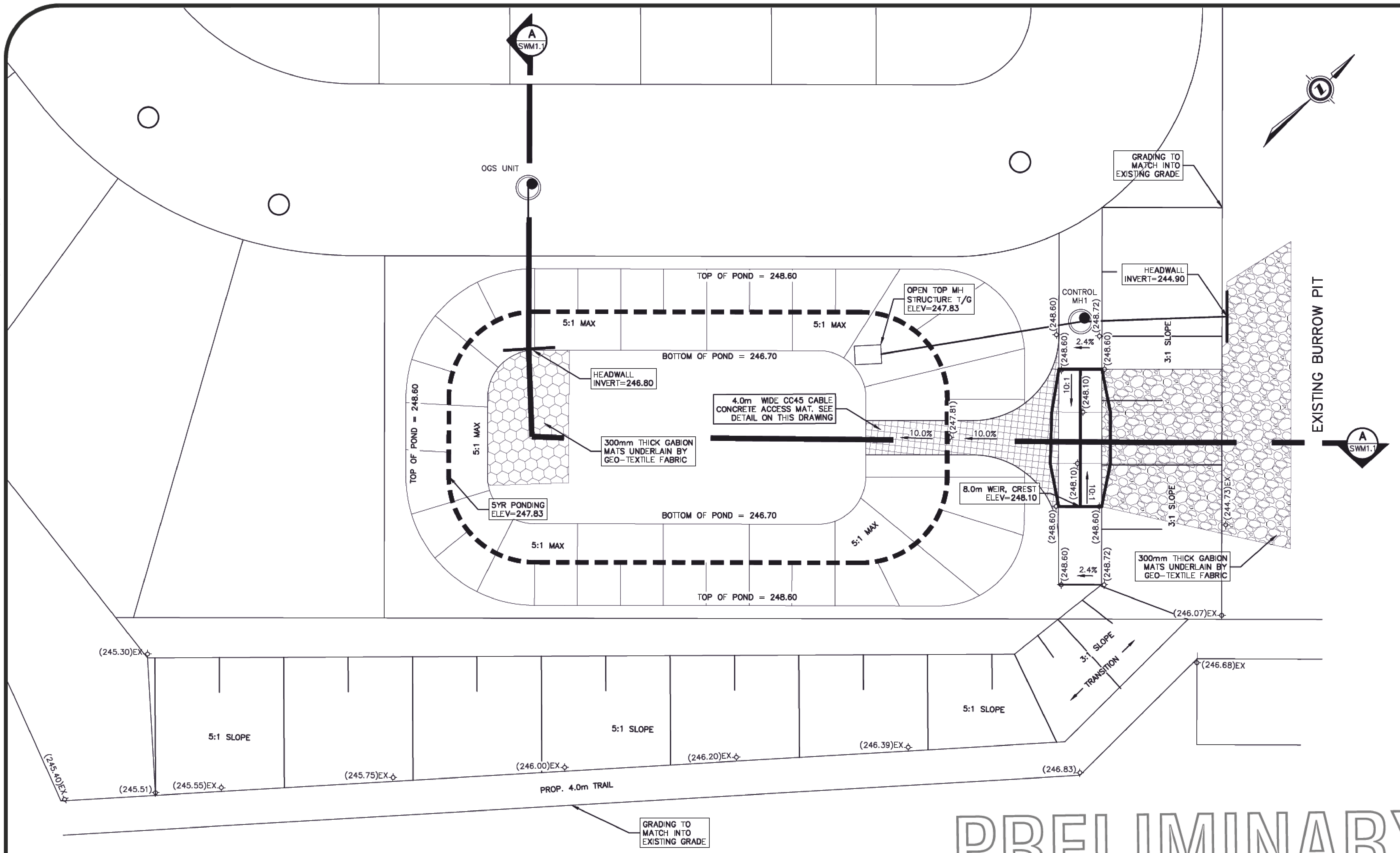
| Symbol | Borehole ID | Sample # | *Sample Depth* | Description |
|---|---|---|---|---|
| ▲ | MW101-19 | SS-12 | 10.7-11.3 mbgs | SAND, some Silt, trace Clay |
| ■ | MW103-19 | SS-10 | 7.6-8.2 mbgs | SAND and GRAVEL, trace Silt and Clay |
| ✱ | MW104-19 | SS-9 | 7.6-8.1 mbgs | Gravelly SAND, trace Silt and Clay |
| + | MW106-19 | SS-5 | 3.8-4.3 mbgs | Silty SAND, trace Clay |
| ● | MW107-19 | SS-5 | 3.8-4.4 mbgs | Silty SAND, trace Clay |
| ◆ | MW108-19 | SS-3 | 1.5-2.0 mbgs | SAND, trace Silt, Gravel and Clay |

CERTIFIED BY
CCIL
Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

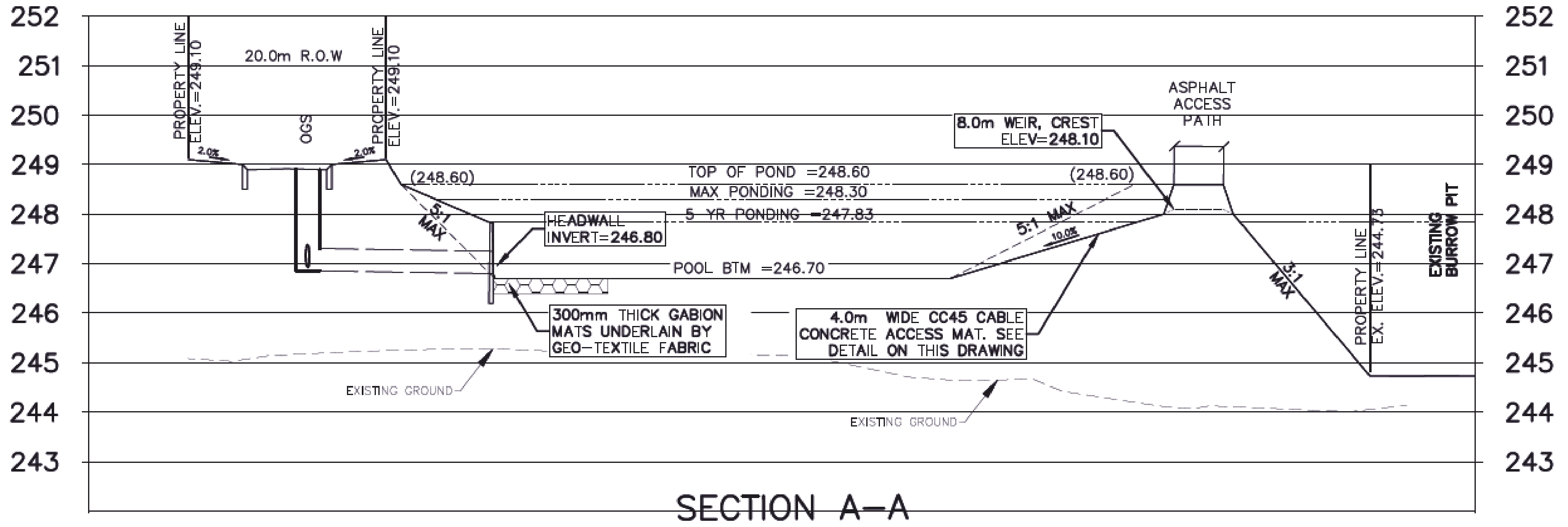
NOTES:

MTE FILE PATH: P:\P\43705\104\43705-104-SWM1.1

May 22, 2020 – 7:31:09 AM – Plotted By: Jorge Cornejo

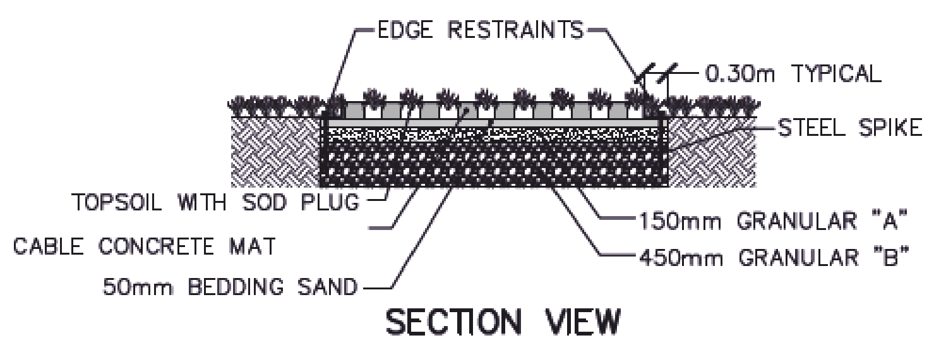


PRELIMINARY



## SECTION A–A
## SWM POND INLET & OUTLET WEIR

SCALE: HORIZ=1:500
VERT=1:100



SECTION VIEW

NOTES:
1. ALL GRANULARS TO BE COMPACTED TO 100% SPDD
2. TURFSTONE VOIDS TO BE FILLED WITH 19mm CLEAR STONE.

## CABLE CONCRETE MAT ACCESS DETAIL

N.T.S.

MUNICIPALITY OF MIDDLESEX CENTRE

KEY PLAN N.T.S.

GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

**NOTE TO CONTRACTOR :**

DO NOT SCALE DRAWINGS.

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED OR REUSED WITHOUT THE ENGINEER'S WRITTEN PERMISSION.

THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.

| No. | REVISION | BY | YYYY-MM-DD |
|---|---|---|---|
| 8. | | | |
| 7. | | | |
| 6. | | | |
| 5. | | | |
| 4. | | | |
| 3. | | | |
| 2. | | | |
| 1. | PRELIMINARY REVIEW | JJM | 2020-05-22 |

MTE
Engineers, Scientists, Surveyors
519-204-6510

OWNER
2270942 ONTARIO INC.

PROJECT
OXBOW DRIVE SUBDIVISION

DRAWING
SWM BLOCK PRELIMINARY

| | |
|---|---|
| Project Manager B. VEITCH | Project No. 43705-104 |
| Design By JJM | Checked By |
| Drawn By JAC | Checked By JJM |
| Surveyed By | Drawing No. |
| Date May.19/20 | SWM1.1 |
| Scale 1:300 | Sheet of |

# Stage 1-2 Archaeological Assessment
# 10125 Oxbow Drive, Komoka

Part of Lot 6 Concession 2, Geographic Township of Lobo, County of Middlesex

**Submitted to:**
GSP Group Inc.
72 Victoria Street South,
Kitchener, ON N2G 4Y9

and

Ontario's Ministry of Heritage, Sport, Tourism and Culture Industries

**Submitted by:**

Detritus
CONSULTING LTD.
archaeology · heritage

69 Claremont Avenue, Kitchener Ontario, N2M 2P5
Mobile/Office: 519-744-7018
e-mail: garth@golden.net www.detcon.net

Licensee: Mr. Garth Grimes
License Number: P017
PIF Number: P017-0825-2020
CP Number: 2020-089

**ORIGINAL REPORT**

July 9th, 2020

## Executive Summary

Detritus Consulting Ltd. ('Detritus') was retained by Mr. Kevin Muir of GSP Group Inc. ('the Proponent') to conduct a Stage 1-2 archaeological assessment of 10125 Oxbow Drive, Part of Lot 6, Concession 2, Geographic Township of Lobo in the County of Middlesex, Ontario (Figure 1). This assessment was undertaken prior to the proposed construction of a residential subdivision at the subject property.

This assessment was triggered by the Provincial Policy Statement ('PPS') that is informed by the *Planning Act* (Government of Ontario 1990a), which states that decisions affecting planning matters must be consistent with the policies outlined in the larger *Ontario Heritage Act* (Government of Ontario 1990b). According to Section 2.6.2 of the PPS, "development and site alteration shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved." To meet this condition, a Stage 1-2 assessment was conducted as part of the pre-approval phase of development archaeological consulting license P017 issued to Mr. Garth Grimes by the Ministry of Heritage, Sport, Tourism and Culture Industries ('MHSTCI') and adheres to the archaeological license report requirements under subsection 65 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and the MHSTCI's *Standards and Guidelines for Consultant Archaeologists* ('*Standards and Guidelines*'; Government of Ontario 2011).

The Study Area is an irregularly shaped lot situated southeast of Oxbow Drive in the community of Komoka. It measures 7.54 hectares in surface area and had been part of a gravel pit operation until as recently as 2009. At the time of assessment the Study Area was composed of an open manicured field of grass over a primarily sand and gravel surface layer with irregular topography caused by mounds of sand and gravel deposited in berms in various areas throughout the property as well as a large pond where the deepest part of the gravel pit once existed.

The Stage 1 background research indicated that the Study Area exhibited moderate to high potential for the identification and recovery of archaeological resources notwithstanding major disturbance to most of the surface through gravel pit operation.

A Stage 2 field assessment was recommended for the maintained grass component of the Study Area and was conducted on June 26, 2020. Evidence of disturbance was found in satellite photos and visually confirmed at the Study Area. Nevertheless, some judgemental test pitting was done to confirm disturbance. Additional test pitting was conducted in areas along the fringe of the gravel pit and small areas of undisturbed ground were found. Test pitting in these areas proceeded at 5m intervals. This investigation resulted in the identification and documentation of no archaeological resources; therefore, **no further archaeological assessment of the Study Area is recommended.**

*The Executive Summary highlights key points from the report only; for complete information and findings, the reader should examine the complete report.*

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## Project Personnel

| | |
|---|---|
| Project Manager: | Garth Grimes, P017 |
| Field Director: | Jon Cousins, R296 |
| Field Technician: | Eric Cousins |
| Report Preparation: | Garth Grimes, P017 |
| Mapping and GIS: | Garth Grimes, P017 |
| Licensee Review: | Walter McCall, P389 |

## Acknowledgments

Generous contributions by the following individuals made this report possible.

- Mr. Kevin Muir, GSP Group Inc.
- Ms. Heather Ingliss, Ingliss Family

# 1.0 Project Context

## 1.1 Development Context

Detritus Consulting Ltd. ('Detritus') was retained by Mr. Kevin Muir of GSP Group Inc. ('the Proponent') to conduct a Stage 1-2 archaeological 10125 Oxbow Drive, Part of Lot 6, Concession 2, Geographic Township of Lobo in the County of Middlesex, Ontario (Figure 1). This assessment was undertaken prior to the proposed construction of a residential subdivision at the subject property.

This assessment was triggered by the Provincial Policy Statement ('PPS') that is informed by the *Planning Act* (Government of Ontario 1990a), which states that decisions affecting planning matters must be consistent with the policies outlined in the larger *Ontario Heritage Act* (Government of Ontario 1990b). According to Section 2.6.2 of the PPS, "development and site alteration shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved." To meet this condition, a Stage 1-2 assessment was conducted as part of the pre-approval phase of development archaeological consulting license P462 issued to Mr. Garth Grimes by the Ministry of Heritage, Sport, Tourism and Culture Industries ('MHSTCI') and adheres to the archaeological license report requirements under subsection 65 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and the MHSTCI's *Standards and Guidelines for Consultant Archaeologists* ('*Standards and Guidelines*'; Government of Ontario 2011).

The purpose of a Stage 1 Background Study is to compile all available information about the known and potential archaeological heritage resources within the Study Area and to provide specific direction for the protection, management and/or recovery of these resources. In compliance with the *Standards and Guidelines* (Government of Ontario 2011), the objectives of the following Stage 1 assessment are as follows:

- To provide information about the Study Area's geography, history, previous archaeological fieldwork and current land conditions;
- to evaluate in detail, the Study Area's archaeological potential which will support recommendations for Stage 2 survey for all or parts of the property; and
- to recommend appropriate strategies for Stage 2 survey.

To meet these objectives Detritus archaeologists employed the following research strategies:

- A review of relevant archaeological, historic and environmental literature pertaining to the Study Area;
- a review of the land use history, including pertinent historic maps; and
- an examination of the Ontario Archaeological Sites Database ('ASDB') to determine the presence of known archaeological sites in and around the Study Area.

The purpose of a Stage 2 Property Assessment is to provide an overview of any archaeological resources within the Study Area, and to determine whether any of the resources might be archaeological sites with cultural heritage value or interest ('CHVI'), and to provide specific direction for the protection, management and/or recovery of these resources. In compliance with the *Standards and Guidelines* (Government of Ontario 2011), the objectives of the following Stage 2 assessment are as follows:

- To document all archaeological resources within the Study Area;
- to determine whether the Study Area contains archaeological resources requiring further assessment; and
- to recommend appropriate Stage 3 assessment strategies for archaeological sites identified.

The licensee received permission from the Proponent to enter the land and conduct all required archaeological fieldwork activities, including the recovery of artifacts.

## 1.2 Historical Context

### 1.2.1 Post-Contact Aboriginal Resources

Prior to the arrival of European settlers, the region was occupied by the Neutral or Attawandaron tribe. The earliest recorded visit to the region was undertaken by Étienne Brûlé, who requested permission of Samuel de Champlain to live among the Algonquin people and to learn their language and customs. The purpose of this endeavour was to establish good relations with the Aboriginal communities in advance of future military and colonial enterprises. In 1615, Brûlé joined twelve Huron warriors during their visit to the Andaste people, allies of the Huron, to ask their assistance in an expedition being planned by Champlain. Brûlé arrived two days late, however, and the Hurons were already defeated by the Iroquois (Heidenreich 1990).

Throughout the middle of the 17th century, the Iroquois sought to expand upon their territory and to monopolise the fur trade as well as the trade between the European markets and the tribes of the western Great Lakes region. A series of bloody conflicts followed known as the Beaver Wars, or the French and Iroquois Wars, contested between the Iroquois confederacy and the Algonkian speaking communities of the Great Lakes region. Many communities were destroyed including the Huron, Neutral, Susquehannock and Shawnee leaving the Iroquois as the dominant group in the region. By 1653 after repeated attacks, the Niagara Peninsula and most of Southern Ontario had been vacated (Heidenreich 1990).

The late 17th and early 18th centuries represent a watershed moment in the evolution of the post-contact Aboriginal occupation of Southern Ontario. It was at this time that various Iroquoian-speaking communities began migrating into southern Ontario from New York State, followed by the arrival of Algonkian-speaking groups from northern Ontario (Konrad 1981; Schmalz 1991). More specifically, this period marks the arrival of the Mississaugas into Southern Ontario and, in particular, the watersheds of the lower Great Lakes. The oral traditions of the Mississaugas, as recounted by Chief Robert Paudash and recorded in 1904, suggest that the Mississaugas defeated the Mohawk Nation, who retreated to their homeland south of Lake Ontario. Following this conflict, a peace treaty was negotiated between the two groups and, at the end of the 17th century, the Mississaugas' settled permanently in Southern Ontario, including within the Niagara Peninsula (Praxis Research Associates n.d.). Around this same time, members of the Three Fires Confederacy (Chippewa, Ottawa, and Potawatomi) began immigrating from Ohio and Michigan into southwestern Ontario (Feest and Feest 1978:778-779).

The Study Area first entered the record as a result of Treaty No. 3, which…

> *…was made with the Mississa[ug]a Indians 7th December, 1792, though purchased as early as 1784. This purchase in 1784 was to procure for that part of the Six Nation Indians coming into Canada a permanent abode. The area included in this Treaty is, Lincoln County excepting Niagara Township; Saltfleet, Binbrook, Barton, Glanford and Ancaster Townships, in Wentworth County; Brantford, Onondaga, Tusc[a]r[o]ra, Oakland and Burford Townships in Brant County; East and West Oxford, North and South Norwich, and Dereham Townships in Oxford County; North Dorchester Township in Middlesex County; South Dorchester, Malahide and Bayham Township in Elgin County; all Norfolk and Haldimand Counties; Pelham, Wainfleet, Thorold, Cumberland and Humberstone Townships in Welland County.*

Morris 1943:17-18

The size and nature of the pre-contact settlements and the subsequent spread and distribution of Aboriginal material culture in Southern Ontario began to shift with the establishment of European settlers. Lands in the Lower Grand River area were surrendered by the Six Nations to the British Government in 1832, at which point most Six Nations people moved into Tuscarora Township in Brant County and a narrow portion of Oneida Township (Page & Co. 1879:8; Tanner 1987:127; Weaver 1978:526). Despite the inevitable encroachment of European settlers on previously established Aboriginal territories, "written accounts of material life and livelihood, the correlation of historically recorded villages to their archaeological manifestations, and the similarities of those sites to more ancient sites have revealed an antiquity to documented cultural expressions that confirms a deep historical continuity to Iroquoian systems of ideology and thought” (Ferris 2009:114). As Ferris observes, despite the arrival of a competing culture, First Nations communities throughout Southern Ontario have left behind archaeologically significant resources that demonstrate continuity with their pre-contact predecessors, even if they have not been recorded extensively in historical Euro-Canadian documentation.

### 1.2.2 Euro-Canadian Resources

The Study Area is located in Lobo Township within the County of Middlesex, Ontario.

The history of the area began on July 24, 1788, when Sir Guy Carleton, the Governor-General of British North America, divided the Province of Québec into the administrative districts of Hesse, Nassau, Mecklenburg and Lunenburg (Archives of Ontario 2012-2015). Further change came in December 1791 when the former Province of Quebec was rearranged into Upper Canada and Lower Canada under the *Constitutional Act*. Colonel John Graves Simcoe was appointed as Lieutenant-Governor of Upper Canada (Coyne 1895) and he introduced several initiatives to populate the province including the establishment of shoreline communities with effective transportation links between them.

In July 1792, Simcoe divided Upper Canada into 19 counties stretching from Essex in the west to Glengarry in the east. Later that year, the four districts originally established in 1788 were renamed as the Western, Home, Midland and Eastern Districts. The current Study Area is situated in the historic Western District, which comprised lands obtained in the 'Between the Lakes Purchases’ of 1784 and 1792 (Archives of Ontario 2012-2015).

As population levels in Upper Canada increased, smaller and more manageable administrative bodies were needed resulting in the establishment of many new counties and townships. As part of this realignment, the boundaries of the Home and Western Districts were shifted and the London and Niagara Districts were established. Under this new territorial arrangement, the Study Area became part of the London District (Archives of Ontario 2012-2015).

Middlesex County was first settled in 1793 and initially comprised ten townships including the London Township. By 1842, the population of Middlesex County had reached over 31,000 inhabitants with approximately 7500 hectares. In just two more years that total would reach 52000 hectares. cleared for agriculture. and by 1844, the county’s agricultural lands exceeded 52,000 hectares (Smith 1846).

Lobo Township was named by Governor Maitland in honour of his service in the Peninsular campaign during the Napoleonic wars, lobo being Spanish for Wolf. The first patents in the township were granted in 1820 Scots making up the majority of the earliest immigrants. Jesse E. Middleton, The Province of Ontario: a History: 1615-1927, published 1927.

*The 1876 Illustrated Historical Atlas of Middlesex County*, Lobo Township Map shows Robert Robinson as the owner of Lot 8, Concession 2 containing the Study Area. Robinson’s homestead is depicted in the northeast corner of the lot, approximately 100m NNE of the Study Area. No features of interest are shown within the Study Area on this map.

Although significant and detailed landowner information is available on the current *Historical Atlas*, it should be recognized that historical county atlases were funded by subscriptions fees and were produced primarily to identify factories, offices, residences and landholdings of subscribers. Landowners who did not subscribe were not always listed on the maps (Caston 1997:100). Moreover, associated structures were not necessarily depicted or placed accurately (Gentilcore and Head 1984).

## 1.3 Archaeological Context

### 1.3.1 Property Description and Physical Setting

The Study Area is an irregularly shaped lot situated southeast of Oxbow Drive in the community of Komoka. It measures 7.54 hectares in surface area and had been part of a gravel pit operation until as recently as 2009. At the time of assessment the Study Area was composed of an open manicured field of grass over a primarily sand and gravel surface layer with irregular topography caused by mounds of sand and gravel deposited in berms in various areas throughout the property as well as a large pond where the deepest part of the gravel pit once existed. Some areas of long grass and weed were present along the northern margins of the Study Area. Disturbance is evident throughout including the remnants of gravel trucking paths and berms along some of the margins of the property intended to shield the gravel pit from view from the golf course to the southeast and Oxbow Drive to the northwest. Elevations range in the vicinity of 245m a.s.l. while the surrounding landscape averages about 5-10m higher.

The majority of the region surrounding the Study Area has been subject to European-style agricultural practices for over 100 years, having been settled by Euro-Canadian farmers by the mid-19th century. Much of the region today continues to be used for agricultural purposes.

The study area is situated within the Caradoc Sand Plan physiographic region, as defined by (Chapman and Putnam 1986). This region is described as:

> *In the neighbourhood of London there is a series of small plains which differ from the adjacent moraines and clay plains in that they are covered with sand or other light-textured, waterlaid deposits. Together they comprise about 300 square miles or 192,000 acres in which the soils are conducive to specialized agriculture. (Chapman and Putnam 1984:146)*

The region consists of a series of small, light-textured sandy plans that are waterlain deposits associated with former glacial spillways and deltas (Chapman and Putnam 1984). The soil is suitable for corn and soy beans in rotation with cereal grains as well as alfalfa and clover (Huffman and Dumanski 1986).

The closest source of potable water is a tributary of Twelve Mile Creek, located approximately 270 metres (m) to the northwest of the Study Area.

### 1.3.2 Pre-Contact Aboriginal Land Use

This portion of Southern Ontario has been demonstrated to have been occupied by people as far back as 11,000 years ago as the glaciers retreated. For the majority of this time, people were practicing hunter gatherer lifestyles with a gradual move towards more extensive farming practices. Table 1 provides a general outline of the cultural chronology of Thorold Township, based on Ellis and Ferris (1990).

**Table 1: Cultural Chronology for Lobo Township**

| Time Period | Cultural Period | Comments |
|---|---|---|
| 9500 – 7000 BC | Paleo Indian | first human occupation<br>hunters of caribou and other extinct Pleistocene game<br>nomadic, small band society |
| 7500 - 1000 BC | Archaic | ceremonial burials<br>increasing trade network<br>hunter gatherers |
| 1000 - 400 BC | Early Woodland | large and small camps<br>spring congregation/fall dispersal<br>introduction of pottery |
| 400 BC – AD 800 | Middle Woodland | kinship based political system<br>incipient horticulture<br>long distance trade network |
| AD 800 - 1300 | Early Iroquoian (Late Woodland) | limited agriculture<br>developing hamlets and villages |
| AD 1300 - 1400 | Middle Iroquoian (Late Woodland) | shift to agriculture complete<br>increasing political complexity<br>large palisaded villages |
| AD 1400 - 1650 | Late Iroquoian | regional warfare and<br>political/tribal alliances<br>destruction of Huron and Neutral |

### 1.3.3 Previous Identified Archaeological Work

In order to compile an inventory of known archaeological resources in the vicinity of the Study Area, Detritus consulted the ASDB. The ASDB, which is maintained by the MHSTCI (Government of Ontario n.d.), contains information concerning archaeological sites that have been registered according to the Borden system. Under the Borden system, Canada is divided into grid blocks based on latitude and longitude. A Borden Block is approximately 13 kilometres (km) east to west and approximately 18.5km north to south. Each Borden Block is referenced by a four-letter designator and sites within a block are numbered sequentially as they are found. The Study Area lies within block AfHi.

Information concerning specific site locations is protected by provincial policy and is not fully subject to the *Freedom of Information and Protection of Privacy Act* (Government of Ontario 1990c). 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 MHSTCI 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.

According to the ASDB, 22 sites have been registered within a 1km radius of the Study Area (Table 2). Of these 22 sites 21 are Pre-contact Aboriginal with those that have been assigned a date ranging from the Late Archaic to the late Woodland. One site has unknown attributes.

**Table 2: Registered Archaeological Sites within 1km of the Study Area**

| Borden Number | Site Name | Time Period | Affinity | Site Type |
|---|---|---|---|---|
| AfHi-338 | Komoka Station 1 | Pre-Contact, Woodland, Middle | Aboriginal | scatter |
| AfHi-301 | | Archaic, Late | Aboriginal | Other camp/campsite |
| AfHi-300 | | Archaic, Late | Aboriginal | findspot |
| AfHi-299 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-298 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-296 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-295 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-294 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-293 | | Pre-Contact | Aboriginal | Other camp/campsite |
| AfHi-292 | | Woodland, Late | Aboriginal | |
| AfHi-291 | | | | |
| AfHi-290 | | Woodland | Aboriginal | |
| AfHi-289 | | Woodland | Aboriginal | Unknown |
| AfHi-229 | Valleyview 8 | Pre-Contact | Aboriginal | scatter |
| AfHi-228 | Valleyview 7 | Archaic, Late | Aboriginal | Other camp/campsite |
| AfHi-227 | Valleyview 6 | Pre-Contact | Aboriginal | camp / campsite |
| AfHi-226 | Valleyview 5 | Pre-Contact | Aboriginal | scatter |
| AfHi-225 | Valleyview 4 | Woodland, Late | Aboriginal, Iroquoian | scatter |
| AfHi-224 | Valleyview 3 | Pre-Contact | Aboriginal | findspot |
| AfHi-223 | Valleyview 2 | Pre-Contact | Aboriginal | scatter |
| AfHi-222 | Valleyview 1 | Pre-Contact | Aboriginal | scatter |
| AfHi-181 | Renwick Village | Archaic, Late, Woodland, Middle | Aboriginal | Other camp/campsite, camp / campsite |

To the best of Detritus’ knowledge, no additional assessments have been conducted on adjacent properties, nor have sites been registered within 50m of the Study Area.

### 1.3.4 Archaeological Potential

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Detritus applied archaeological potential criteria commonly used by the MHSTCI (Government of Ontario 2011) to determine areas of archaeological potential within Study Area. These variables 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.

Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, when considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect sites locations and types to varying degrees. The MHSTCI (Government of Ontario 2011) categorizes water sources in the following manner:

- Primary water sources: lakes, rivers, streams, creeks;
- secondary water sources: intermittent streams and creeks, springs, marshes and swamps;
- past water sources, glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines of drained lakes or marshes; and
- accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

The closest source of potable water is the Oxbow River located 190m north of the Study Area.

Soil texture is also an important determinant of past settlement, usually in combination with other factors such as topography. The Study Area is situated within the Caradoc Sand Plain Physiographic Region. The soils within this region are suitable for pre-contact and post contact Aboriginal agricultural. Given the quality of the soil, the proximity of potable water, as well as the length of occupation of Lobo Township, prior to the arrival of Euro-Canadian settlers and considering the 21 Pre-contact Aboriginal sites present within 1km, and the Pre-contact and Post-contact Aboriginal archaeological potential of the Study Area is judged to be moderate to high.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; and properties listed on the municipal register or designated under the *Ontario Heritage Act* (Government of Ontario 1990b) or property that local histories or informants have identified with possible historical events.

The *Historical Atlas* (Page & Co. 1876) demonstrates the extent to which Lobo Township had been settled by 1876. Landowners are listed for every lot within the township, some of which had been subdivided into smaller parcels to accommodate an increasing population throughout the late 19th century. Structures and orchards are prevalent throughout the township, almost all of which front early roads and water bodies. The Study Area occupies the northwestern portion of Lot 8, Concession 3 which was owned by Robert Robinson as discussed earlier. The Robinson farmstead is depicted approximately 100m NNE of the Study Area. Considering this as well as the five Euro-Canadian and three multi-component sites registered within 1km of the Study Area, and the Euro-Canadian archaeological potential is judged to be moderate to high.

Finally, despite the factors mentioned above, extensive land disturbance can eradicate archaeological potential within a Study Area, as outlined in Section 1.3.2 of the *Standards and Guidelines* (Government of Ontario 2011). Aerial imagery from 2006-2018 was reviewed and indicate the Study Area was used as a gravel pit during this period. Extensive disturbance associated with this pit is visible with the only small marginal areas appearing to be possibly undisturbed. As per Section 2.1.8, Standard 1 of the *Standards and Guidelines* (Government of Ontario 2011), it is recommended that these areas be subject to a Stage 2 property inspection, conducted according to Section 1.2 of the *Standards and Guidelines* (Government of Ontario 2011), to confirm and document the disturbed areas.

# 2.0 Field Methods

The Stage 2 archaeological assessment of the Study Area was conducted on June 26, 2020 under archaeological consulting license P017 issued to Mr. Garth Grimes by the MHSTCI. The limits of the Study Area were visible by wire fencing and signage all along the property lines.

The weather during the assessment was mostly cloudy and 22˚C. Assessment conditions were excellent and at no time were the field, weather, or lighting conditions detrimental to the recovery of archaeological material. Photos 1 to 8 demonstrate the land conditions throughout the Study Area, including areas that met the requirements for a Stage 2 archaeological assessment, as per Section 7.8.6, Standards 1a, 1b, and 1c of the *Standards and Guidelines* (Government of Ontario 2011). Figure 4 provides an illustration of the Stage 2 assessment methods, as well as all photograph locations and directions.

Approximately 27% of the Study Area is composed of a large pond created by the flooding of the deepest portion of the gravel pit. Tis area is completely inundated and could not be test pit assessed but was photo documented in accordance with Section 2.1 of the *Standards and Guidelines* (Government of Ontario 2011; Photos 1 to 6).

Approximately 0.07% of the Study Area comprised maintained or long grass and weed along the northern margin of the Study Area, which was inaccessible for ploughing; this area was subject to a test pit survey at 5m intervals in accordance with Section 2.1.2 of the *Standards and Guidelines* (Government of Ontario 2011; Photos 1 to 6). Furthermore, the maintained grass was being bushhogged during the assessment, however, it did not affect the assessment. Test pits were excavated until test pits showed evidence of recent ground disturbance as per Standard 4 of this section. All test pits were at least 30 centimetres (cm) in diameter and were excavated 5cm into sterile subsoil. The soils were then examined for stratigraphy, cultural features, or evidence of fill. A single soil layer was observed. All soil from the test pits was screened through six-millimetre (mm) hardware cloth to facilitate the recovery of small artifacts and then used to backfill the pit. No further archaeological methods were employed since no artifacts were identified during the test pit survey.

The remaining 72.93% of the Study Area comprised the possible disturbance areas identified on past aerial imagery of the Study Area (see Section 1.3.4 above). Following a Stage 2 property inspection, conducted according to Section 2.1.8, Standards 1 and 2 of the *Standards and Guidelines* (Government of Ontario 2011), the surface of the property which is now composed of a mix of sand and gravel fill was documented and judgementally test pitted to physically confirm disturbance. This area was evaluated as having no potential based on the identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources, as per Section 2.1, Standard 2b of the *Standards and Guidelines* (Government of Ontario 2011). The previously disturbed area within the Study Area was mapped and photo documented in accordance with Section 2.1, Standards 5 and 6 and Section 7.8.1, Standard 1b and 1c of the *Standards and Guidelines* (Government of Ontario 2011).

# 3.0 Record of Finds

The Stage 2 archaeological assessment of the Study Area was conducted employing the methods described in Section 2.0 above. An inventory of the documentary record generated by fieldwork is provided in Table 3 below.

**Table 3: Inventory of Document Record**

| Document Type | Current Location of Document Type | Additional Comments |
|---|---|---|
| 1 Page of Field Notes | Detritus office | Stored digitally in project file |
| 1 Map Package provided by the Proponent | Detritus office | Stored digitally in project file |
| 1 Field Map | Detritus office | Stored digitally in project file |
| 64 Digital Photographs | Detritus office | Stored digitally in project file |

No material culture was encountered during the Stage 2 survey of the Study Area; therefore, no storage arrangements were necessary.

# 4.0 Analysis and Conclusions

Detritus Consulting Ltd. ('Detritus') was retained to conduct a Stage 1-2 archaeological assessment at 10125 Oxbow Drive, Part of Lot 6, Concession 2, Geographic Township of Lobo in the County of Middlesex, Ontario (Figure 1). This assessment was undertaken prior to the proposed construction of a residential subdivision at the subject property.

The Study Area is an irregularly shaped lot situated southeast of Oxbow Drive in the community of Komoka. It measures 7.54 hectares in surface area and had been part of a gravel pit operation until as recently as 2009. At the time of assessment the Study Area was composed mostly of an open manicured field of grass over a primarily sand and gravel surface layer with irregular topography caused by mounds of sand and gravel deposited in berms in various areas throughout the property as well as a large pond where the deepest part of the gravel pit once existed.

The Stage 1 background research indicated that the Study Area exhibited moderate to high potential for the identification and recovery of archaeological resources notwithstanding major disturbance to most of the surface through gravel pit operation.

A Stage 2 field assessment was recommended for the maintained grass component of the Study Area and was conducted on June 26, 2020. Evidence of disturbance was found in satellite photos and visually confirmed at the Study Area. Nevertheless, some judgemental test pitting was done to confirm disturbance. Additional test pitting was conducted in areas along the fringe of the gravel pit and small areas of undisturbed ground were found. Test pitting in these areas proceeded at 5m intervals. This investigation resulted in the identification and documentation of no archaeological resources; therefore, **no further archaeological assessment of the Study Area is recommended.**

# 5.0 Recommendations

The Stage 2 assessment of the Study Area resulted in the identification and documentation of no archaeological resources; therefore, **no further archaeological assessment of the Study Area is recommended.**

# 6.0 Advice on Compliance with Legislation

This report is submitted to the Minister of Heritage, Sport, Tourism and Culture Industries 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 Heritage, Sport, Tourism and Culture Industries, 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 archaeological 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 Ministry of Consumer Services.

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## 8.0 Maps

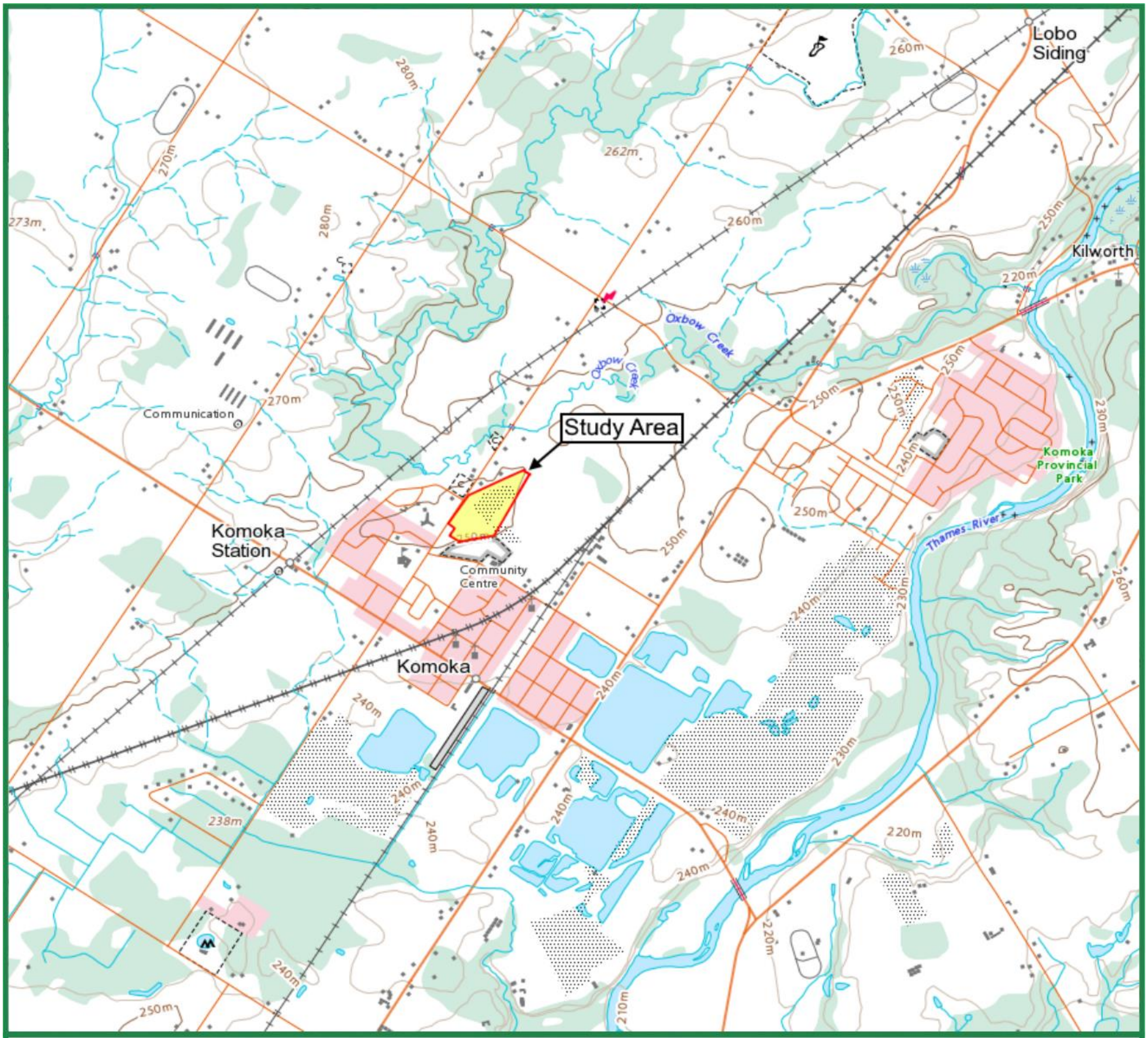


Figure 1: Study Area

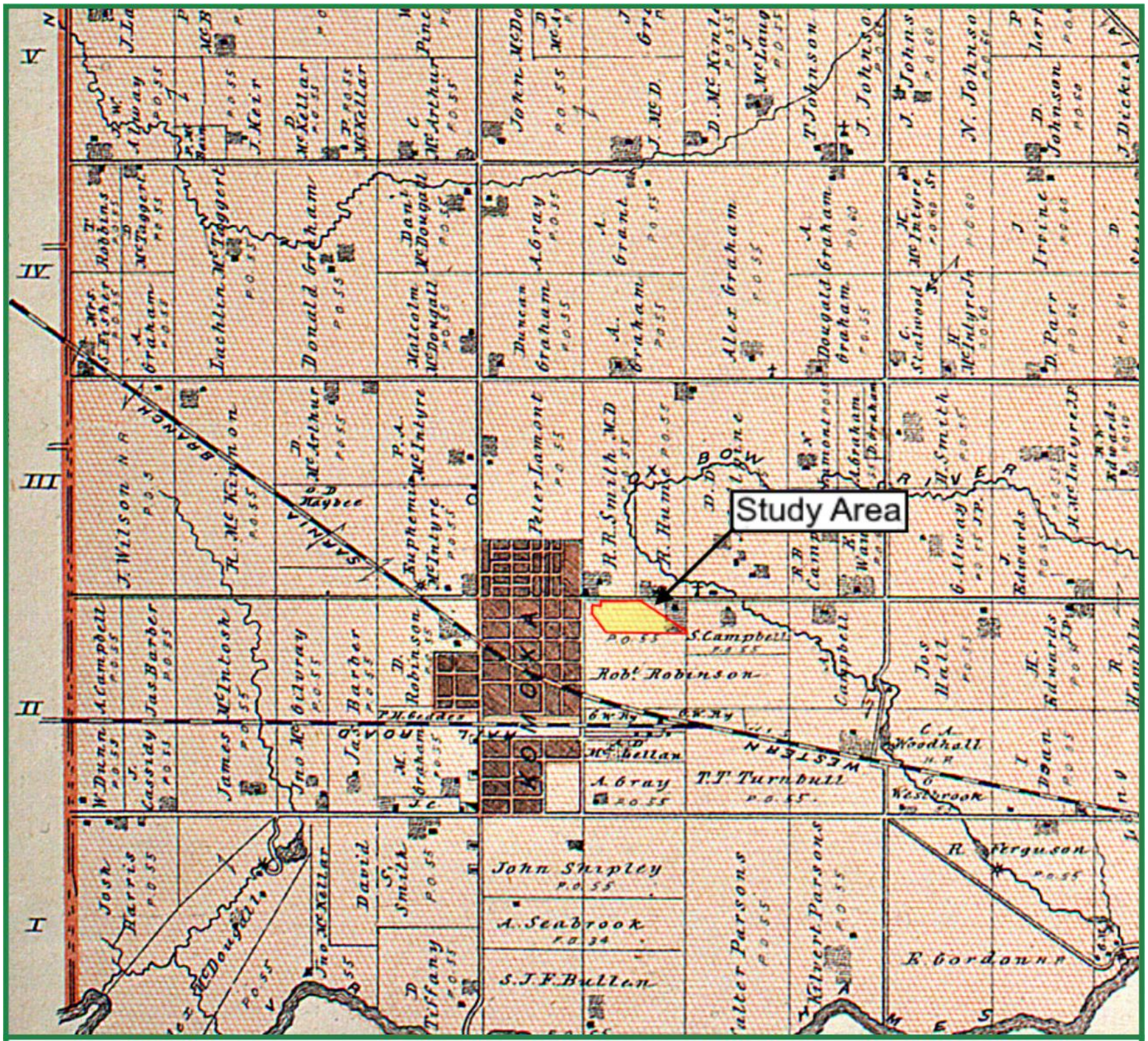


Figure 2. Part of the 1877 Illustrated Historical Atlas of Middlesex County, Lobo Township Map

Figure 3: Satellite Image of Gravel Pit Operation (May 2006)

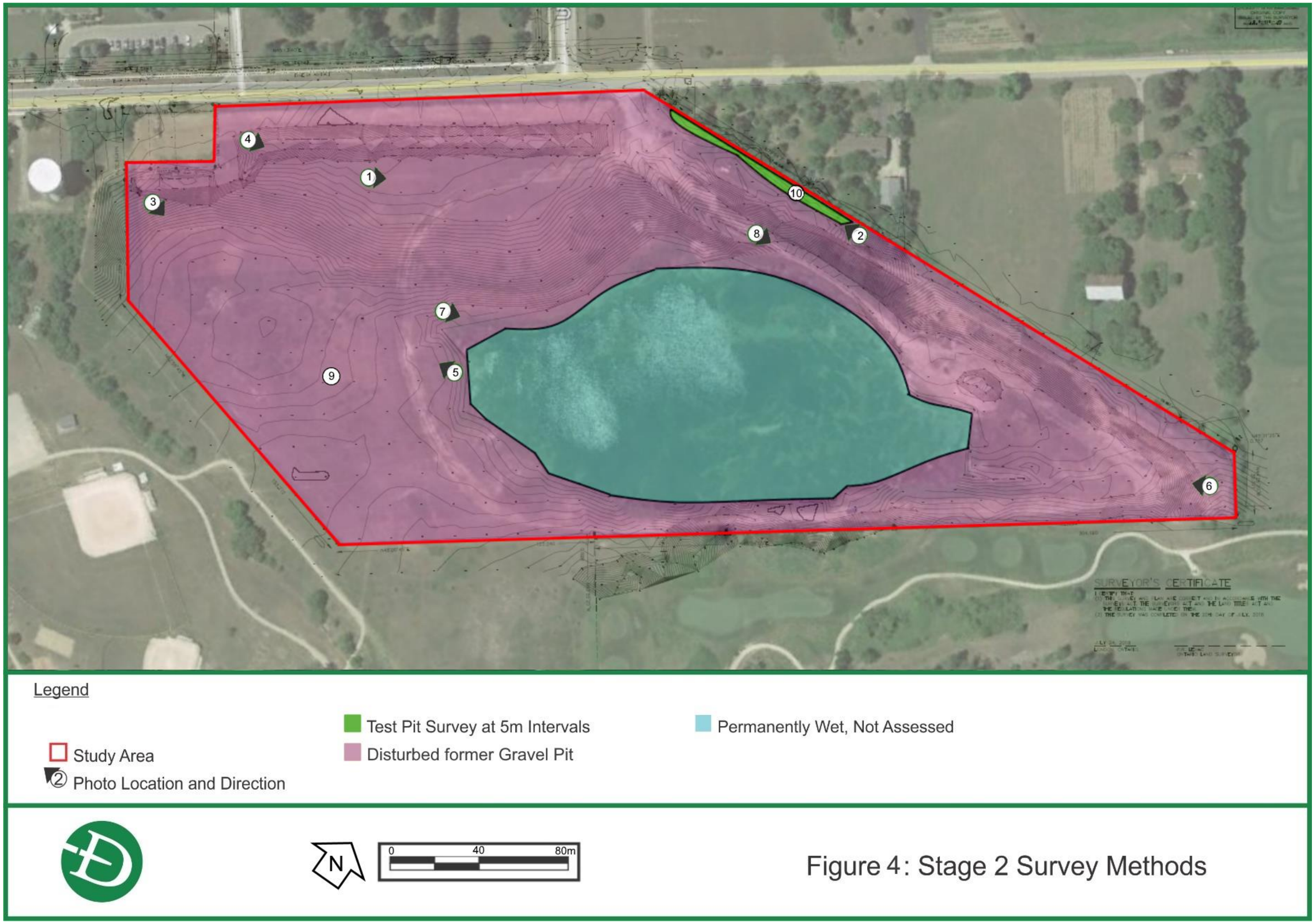
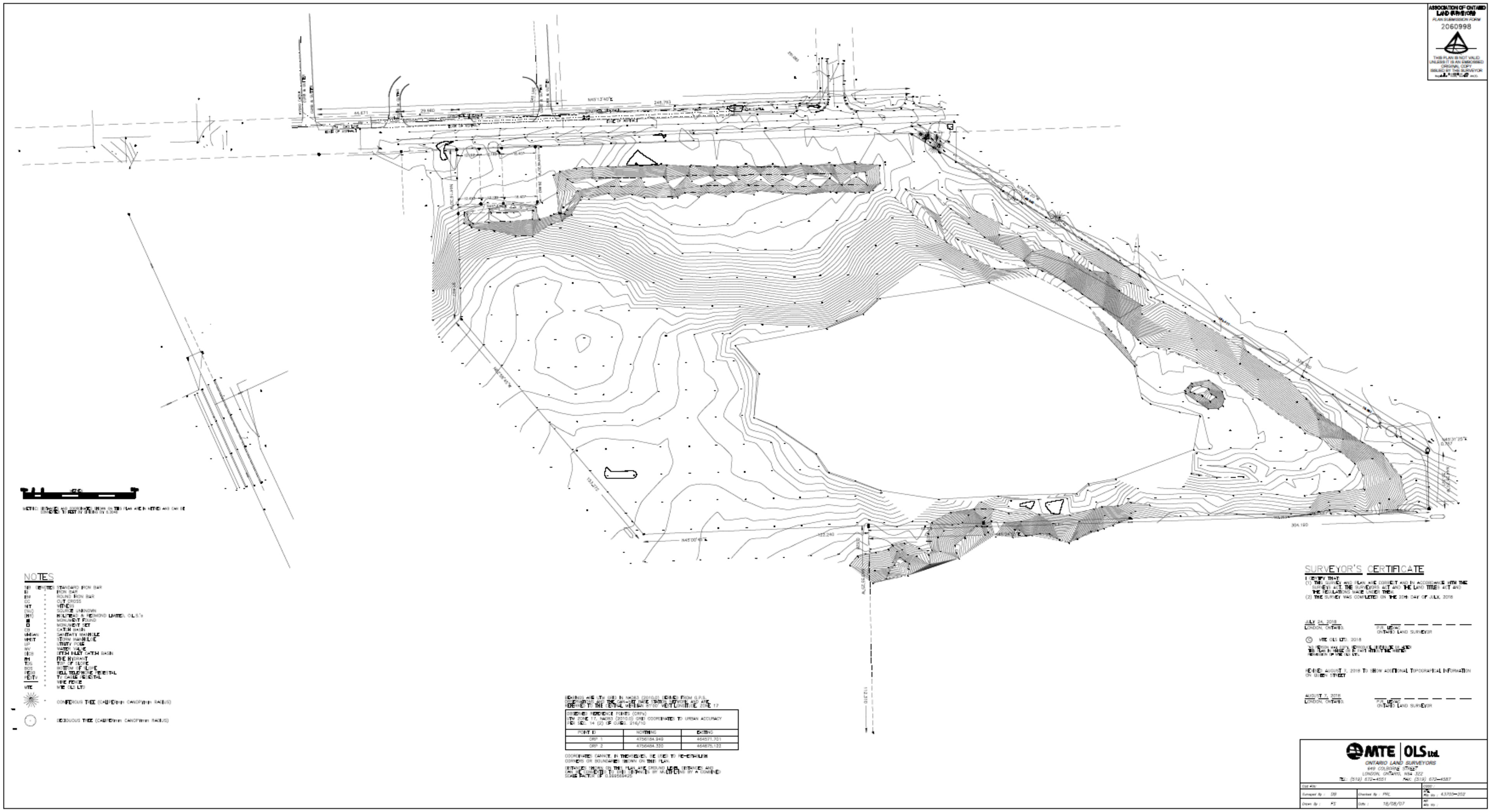


Figure 4: Stage 2 Survey Methods

**Figure 5: Development Map**



METRIC: DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

NOTES

SIB DENOTES STANDARD IRON BAR
IB " IRON BAR
RIB " ROUND IRON BAR
CC " CUT CROSS
WIT " WITNESS
(SU) " SOURCE UNKNOWN
(HR) " HOLSTEAD & REDMOND LIMITED, O.L.S.'s
■ " MONUMENT FOUND
□ " MONUMENT SET
CB " CATCH BASIN
MHSAN " SANITARY MANHOLE
MHST " STORM MANHOLE
UP " UTILITY POLE
WV " WATER VALVE
DICB " DITCH INLET CATCH BASIN
FH " FIRE HYDRANT
TOS " TOP OF SLOPE
BOS " BOTTOM OF SLOPE
PEDB " BELL TELEPHONE PEDESTAL
PEDTV " TV CABLE PEDESTAL
" WIRE FENCE
MTE " MTE OLS LTD
" CONIFEROUS TREE (CALIPERmm CANOPYmm RADIUS)
○ " DECIDUOUS TREE (CALIPERmm CANOPYmm RADIUS)

BEARINGS ARE UTM GRID IN NAD83 (2010.0) DERIVED FROM G.P.S. OBSERVATIONS AND THE CAN-NET BASE STATION NETWORK AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17

OBSERVED REFERENCE POINTS (ORPs)
UTM ZONE 17, NAD83 (2010.0) GRID COORDINATES TO URBAN ACCURACY PER SEC. 14 (2) OF O.REG. 216/10

| POINT ID | NORTHING | EASTING |
|---|---|---|
| ORP 1 | 4756184.949 | 464571.701 |
| ORP 2 | 4756484.320 | 464675.122 |

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

DISTANCES SHOWN ON THIS PLAN ARE GROUND LEVEL DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY A COMBINED SCALE FACTOR OF 0.999569425

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
(1) THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
(2) THE SURVEY WAS COMPLETED ON THE 20th DAY OF JULY, 2018

JULY 24, 2018
LONDON, ONTARIO.

P.R. LEVAC
ONTARIO LAND SURVEYOR

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REVISED AUGUST 7, 2018 TO SHOW ADDITIONAL TOPOGRAPHICAL INFORMATION ON QUEEN STREET

AUGUST 7, 2018
LONDON, ONTARIO.

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| Surveyed By: DB | Checked By: PRL | MTE File No.: 43705-202 |
| Drawn By: FS | Date: 18/08/07 | HR File No.: |

# 9.0 Images

## 9.1 Photos

**Photo 1: Maintained Grass Test Pit Surveyed judgementally; Disturbed sand, facing north-northeast**

**Photo 2: Maintained Grass Test Pit Surveyed at 5m intervals; facinf southwest**

**Photo 3: Maintained Grass Test Pit Surveyed judgementally; Disturbed sand, facing east**

**Photo 4: Maintained Grass Test Pit Surveyed judgementally; Disturbed sand, facing northeast**

**Photo 5: Maintained Grass Test Pit Surveyed judgementally; Disturbed sand, facing southwest**

**Photo 6: Gravel and sand artificial berms with flooded pit in distance, disturbed sand surface in foreground (facing northeast**

**Photo 7: Flooded gravel pit pond, disturbed surface in foreground, facing northeast**

**Photo 8: Disturbed Sand and Gravel Surface, Facing east**

**Photo 9: Disturbed test pit**

**Photo 10: Undisturbed test pit**