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FUNCTIONAL SERVICING REPORT

720 Erbsville Road
Waterloo, Ontario



Prepared for:

Sunvest DEVELOPMENT CORP.

January 21, 2025

JPE-1027

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1 Introduction

JPE Engineering (JPE) was retained to undertake a functional grading and servicing study for the proposed development at 720 Erbsville Road, Waterloo, Ontario (henceforth the "Site").

For the purposes of description in this report, Erbsville Road is assumed to run north-south. The total property area is approx. 9.3 ha with a proposed development area of 3.1 ha (the "Site"). The remaining 6.2 ha will remain as existing. The Site is bounded by Erbsville Road to the west, environmental lands (Laurel Creek) to the north and east, and an agricultural field to the south. Refer to **Plate 1** for an aerial photo of Property and the Site.

The Site currently comprises one residential/agricultural property with a residential home situated on the northwestern corner of the Site.



PLATE 1: Location Plan

It is proposed that the existing Site development will be demolished, and a mix of townhouses and stacked townhouses constructed with auxiliary driveways, pedestrian paths, amenity areas and two SWM ponds. The total development would contain approximately 170 residential units. The proposed Site Plan is included in **Appendix A**.

The site planning and design at the time of writing is in a preliminary stage, and is striving toward an Official Plan Amendment (OPA) and re-zoning for the Site. Therefore, it is premature to undertake detailed engineering at this early stage of the project's life. Accordingly, the purpose of this report is to:

- Demonstrate that the site is developable as proposed from a site municipal engineering perspective;
- Identify the general design criteria and constraints; and,
- Propose a functional design of the site grading and servicing in order to obtain preliminary acceptance on the design direction to guide the future detailed design that will follow acceptance of the functional design.
- Generally support the Planning applications (OPA and zoning);

Once the OPA and rezoning is completed, the development concept will be in a more final state and at that time final detailed engineering will be undertaken to support Site Plan Approval, Building Permits and construction.

2 Existing Conditions

The following sections describe the existing conditions of the Site at the time of writing based on field reconnaissance, topographical survey, and review of existing available information.

2.1 General

The Site's development area currently contains a single detached home (located in the north corner of the property) and agricultural field. The remainder of the subject property is environmental lands and is not proposed for development and will remain in is current condition (i.e., Laurel Creek, vegetation, wetland, etc.).

The Site has frontage and existing access onto Erbsville Road (a regional road) along the Site's western flankage. Erbsville Road is currently a two-lane road with a rural cross section (i.e., gravel shoulders, roadside ditches, and no curb or sidewalk).

Refer to **Appendix B drawing FE-1** for the Site's existing conditions.

2.2 Existing Topography and Drainage

The Site generally slopes from high elevations along the western limits (high elevation = ~355.5m) to the east (low elevation = ~347.5m) with an elevation differential of approx. 8m. There is a somewhat undefined divided running east-west through the central portions of the Site. Existing stormwater drainage follows the Site's topography as sheet flow (no stormwater infrastructure exists on the Site).

Refer to **Appendix B** for the Site's existing conditions (shown on **drawing FE-1** and **FE-3**).

2.3 Existing Subsurface Conditions

A geotechnical investigation was undertaken and documented in the report entitled:

Geotechnical Investigation
Proposed Townhouse Development
672 and 720 Erbsville Road
Waterloo, Ontario

Prepared by: CVD Engineering
Date: March 27, 2024

While the reader should reference the Geotechnical Report for full details of the investigation's findings and recommendations, it is concluded that there does not appear to be any significant subsurface conditions that preclude development of the Site. That said, during final design and construction, the following should be confirmed:

- The basement floor elevation should be minimum 0.6m above high water table; and,
- During earth grading, servicing, road construction, and building construction, the founding soils should be ensured to be competent by a Geotechnical Engineer.

Refer to **Appendix F** for the Geotechnical Investigation report.

2.4 Existing Municipal Servicing

From review of existing information and field reconnaissance, there is adjacent municipal servicing on Erbsville Road. The existing municipal infrastructure is described as follows, and shown on the existing engineering plans in **Appendix E**.

a) Stormwater

No storm servicing exists on the subject Site. On Erbsville Road, to the west of the Site, stormwater is conveyed from a highpoint near Regal Place via roadside ditches and driveway culverts to the north and south.

b) Sanitary

Sanitary infrastructure (300mm diameter pipe) exists on Erbsville Road from the intersection of Regal Place southerly along the flankage of the Site. The sewer was constructed in circa 2013 (MECP Application No. 0441-9AQJ8S).

The 300mm diameter sewer runs southerly along Erbsville Road at a slope of 0.35%. The subject Site was tributary to this sewer's design as shown on the sewer's design Sanitary Catchment Area drawing (refer to **Appendix E**).

c) Potable Water & Fire Protection

A 300mm diameter watermain exists on the eastern side of Erbsville Road from just north of the Regal Place intersection and runs southerly along the flankage of the Site.

Two fire hydrants exist on the eastern boulevard of Erbsville Road: one on the north side of the Regal Place intersection, and another near the southern property limit of the Site.

At the time of writing, the existing 300mm diameter watermain adjacent to the Site is supplied only from the south (i.e., it is serviced from only one direction and is not looped). However, it is understood that the City of Waterloo and Region of Waterloo have dual ownership watermains planned for the area along Erbsville Road, Conservation Drive, and Beaver Creek Road in order to service the Beaver Creek

Meadows District Plan area. This proposed watermain work will loop the subject Erbsville Road watermain. This proposed new watermain installation is currently budgeted for 2024/2025.

d) Utilities (Hydro, communication and Gas)

From field observation, Hydro and tele-communication exist on a pole line on the western side of Erbsville Road along the entire flankage of the Site. Similarly, natural gas also exists within the Erbsville Road right-of-way.

3 Proposed Development

The Site's existing building, hardscape and appurtenances will be demolished in their entirety and removed from site.

Given the form of the development proposed (i.e., 169 residential units, driveways, parking, hardscape, etc.), and the required Site grading, all existing Site vegetation and topsoil will be removed.

The following sections describe the municipal functional engineering of the Site.

3.1 Proposed Site Access and Parking

The Site is proposed to have two driveway entrances off Erbsville Road (refer to the Site Plan in **Appendix A**). Internal to the Site, driveways and pathways with provide vehicular and active transportation. The internal driveways will be designed to accommodate garbage truck, snow plough, and emergency vehicle ingress and egress. Onsite parking to service the Site will be at surface with no underground parking proposed.

In addition, an access route will be provided along the southern boundary of the Site from Erbsville Road to the proposed SWM Pond in the southeast corner of the Site.

3.2 Proposed Area Grading and Drainage

The grading of the Site will respect various Site constraints, including:

- Erbsville Road: It is understood that Erbsville Road will potentially be urbanized and widened to 4 lanes in the not-too-distant future (the Region of Waterloo will be undertaking a Class EA to study this). Thus, assuming a 4-lane urban cross section, the right-of-way limit will be approx. 0.25m above the centreline of the road.

  The proposed Site grading will thus assume ground elevations along its western boundary (i.e., Erbsville Road's ROW) to be 0.25m above the existing road centreline such that the future Erbsville Road urbanization can match into the then existing Site property line elevations.

- Environmental: The north and eastern limits of the development border environmental areas and environmental work has established buffers to these areas. Generally Site grading will match into the existing elevations of the buffers and the buffers will remain as existing. There are however a few limited exceptions given development constraints, including:

  - The SWM pond outlet pipe will cross the buffer and discharge to Laurel Creek; and,
  - Some limited lengths of the proposed infiltration swale along the eastern side of the development will be located in the outer fringes of the buffer.

  The supporting Environmental Study prepared by NRSI discusses these exceptions.

- Floodplain: A regulatory floodplain of Laurel Creek has been established and is shown on the Functional Engineering Plans. The floodplain elevations are based on GRCA modelling (Laurel Creek HEC-RAS model) and the Floodplain cross sections have been shown on the Site grading plan (**Appendix B, Drawing FE-1**).

  The proposed developed will remain outside the Regulatory Floodplain with no grading proposed within the floodplain.

The proposed grading of the Site will generally sheet flow stormwater internally onto the Site's proposed roads/driveways and/or swales. A storm sewer system with catchbasins to collect stormwater up to the minor storm event (5-year storm) will convey stormwater to the proposed SWM Pond in the southeastern corner of the Site. Stormwater flows in excess of the sewer capacity (i.e., storms events greater than the minor storm) will be conveyed overland as sheet flow via the driveways, swales or other surface routes to the SWM Pond.

While stormwater runoff from the majority of the Site will be directed to the Site's SWM Pond, the one significant exception is the rear portion (approx. 50%) of the development along the eastern side of the development (i.e., Blocks 8 to 14). This area is low and will not be able to be directed to the proposed SWM pond due to elevation constraints. It is proposed instead to convey this storm drainage via sheet flow to a proposed "Infiltration Swale" located along the eastern flankage of the Site (refer to **Appendix B, Drawing FE-1**).

The following general grading design criteria is proposed:

- Slopes on vehicular and pedestrian areas will be between 0.5% to 6% (1% to 4% preferred);
- Slopes on landscaped areas will be between 2% to 10% (2% to 5% preferred). Where significant transitions in elevation are required, a maximum slope of 33%, or retaining walls will be used (slopes preferred over retaining walls if space permits);
- Where needed, the Site's grading will be designed to limit the surface ponding depth over catchbasins to a maximum depth of 0.3m before overland spill occurs; and,
- Grading and building design will strive for basement finished floor elevations to be a minimum of 0.6m above the high groundwater table.

Appendix B's drawing FE-1 shows the functional grading, ground slopes as percentages, and the general overland drainage directions proposed for the Site.

3.3 Proposed Stormwater Management

The development of the Site with buildings, driveways, parking, hardscape, etc., will increase the impervious cover compared to existing conditions. This increased impervious cover, and generally the grading of the land with positive slopes that eliminates depression storage, will increase stormwater flows and tend to degrade stormwater quality compared to existing conditions.

To control and treat stormwater, one stormwater management (SWM) pond is proposed to be located in the southeastern corner of the Site. The SWM pond will provide quantity control, reducing post-development peak stormwater flows to pre-development flow rates. The Pond's outlet will comprise a pipe discharging directly into Laurel Creek and will convey controlled flow up to the 100 year storm. Storms exceeding the 100 year event will spill from the Pond via a weir into the environmental lands eventually discharging to Laurel Creek.

Given the relatively small area of the Site (well less then 5 ha), a constructed wetland is not proposed for quality control. Instead, stormwater quality treatment will be achieved utilizing Oil Grit Separators (OGSs) located at the Pond's outlet downstream of the quantity control.

Finally, it is required that post-development site stormwater infiltration should attempt to match pre-development recharge rates if feasible. Accordingly, active infiltration measures will be implemented in the form of infiltration swales, roof-water infiltration galleries, etc.

For further details of the Site's drainage, stormwater controls, and water balance, refer to the separate report entitled "720 Erbsville Road, Waterloo, ON – Stormwater Management Report", prepared by Water's Edge Ltd. (circa September 2024).

Finally, it is understood that a future development at 672 Erbsville Road (located to the immediate south of the subject Site) may share SWM facilities with 720 Erbsville Road. Accordingly, the proposed SWM pond on 720 Erbsville Road has been positioned and designed such that it can be readily expanded southward to increase storage volume to service 672 Erbsville Road.

3.4 Proposed Sanitary Servicing

The Site is located within the City of Waterloo's municipal sanitary servicing area. It is proposed to extend a sanitary sewer lateral from the existing sanitary manhole at the Regal Place intersection into the Site and along the Site's internal road network with laterals extended to each residential unit (refer to **Appendix B, drawing FE-2)**. All sewer works will be designed to municipal and/or OBC standards.

The proposed development will comprise 170 residential units. The municipal sanitary design criteria pertinent to the Site is:

- Population estimate (per the Region or Waterloo's 2020 Water and Wastewater Monitoring Report, Section 2.4):
  - 2.44 persons per townhouse unit;
  - 1.77 persons per stacked townhouse unit.

- Residential flows:
  - Average design flow = 275 L/person/day;
  - Peak factoring = Harmon formula.

- Groundwater infiltration allowance = 0.25 L/s/ha.

Utilizing the population estimate, the design criteria, and the infiltration allowance based on the entire Site area, the following design flows are estimated (refer to **Appendix C** for calculations):

- Average flow: 1.69 L/s
- Peak flow: 5.00 L/s

It is anticipated that given the Site's small sewage flow (5.00 L/s) relative to the capacity of Erbsville Road's 300mm diameter trunk sanitary sewer (572 L/s), and given the Erbsville Road sanitary sewer was designed with the Site as a tributary catchment, that capacity is not an issue for the Site's development. However, it is understood that the City of Waterloo has a sanitary network model of the City's sanitary system and that the proposed Site flows will be added to this model to ensure no downstream capacity constraints exist.

3.5 Proposed Water Supply, Demand & Distribution

The Site is located within the City of Waterloo's municipal water servicing area. A 300mm municipal watermain exists at the intersection of Erbsville Road and Regal Place adjacent to the Site. A hydrant flow test was conducted on October 21, 2021 to determine existing supply and pressures (refer to **Appendix D**).

While it is understood that the proposed looping of area's watermain infrastructure (described earlier in this report) will only better the water supply to the subject site, for the purposes of the analysis in this FSR, it will be assumed the Site will be supplied from the existing infrastructure (a worst-case scenario).

For Site servicing, it is proposed to connect a 200mm water service to the existing 300mm diameter watermain at the intersection of Erbsville Road and Regal Place. A network of 150mm diameter watermain would be installed within the Site's internal road network to provide potable water as well as fire protection via on-site private fire hydrants. Refer to **Appendix B, drawing FE-2** for the proposed water servicing.

The following municipal criteria has been used to calculate the domestic water demands and fire flow requirements (per DGSSMS):

- Population density:
  - 2.44 persons per townhouse unit;
  - 1.77 persons per stacked townhouse unit.
- Water supply demand:
  - Residential: 225 L/person/day with peaking factors per DGSSMS;
  - Fire: per OBC 2012 - A3.2.5.7.
- Minimum Pressure:
  - Non-fire scenario: 40 psi (276 kPa);
  - Fire Scenario: minimum 20 psi (138 kPa).
- Maximum Pressure: 100psi (689kPa).

Three worst-case scenarios were developed to calculate water demands on which modelling could be undertaken to determine if sufficient supply exists. Modelling was performed using Excel spreadsheets and the EPANET 2.2 software. The scenarios are described as follows with the results summarized in **Table 1** (refer to **Appendix D** for the data and modelling):

1. **Residential Only Flows:**
   - Average day: the demand by the population without a peaking factor;
   - Minimum hour: the demand by the population with a peaking factor of 0.4;
   - Maximum day: the demand by the population with a peaking factor of 2.75;
   - Peak Hour: the demand by the population with a peaking factor of 4.13.
2. **Fire at worst case Townhouse Block + Maximum day:**
   - Per OBC plus Maximum day residential demand.
3. **Fire at worst case Stacked Townhouse Block + Maximum day:**
   - Per OBC plus Maximum day residential demand.

As demonstrated in **Table 1**, the existing municipal water supply on Erbsville Road is adequate to service the development's demand under all scenarios. As noted previously, it is expected that once the Erbsville watermain is looped as part of the Beaver Creek Meadows District Plan, water supply will only improve from the modelled existing conditions.

During final design, the proposed water system and connections to the municipal watermain will be designed to municipal, OBC, and MECP standards, including required water metering.

Table 1 – Water Demand Modelling Results

SCENARIO (worst case pressure node)	TOTAL DEMAND Lps	RESIDUAL PRESSURE	
		psi	kPa
A. Residential Only Flows:			
Criteria (min/max)	*n/a*	*40 / 100*	*276 / 689*
- No flow (J-2)	0.00	75	515
- Average day	0.89	-	-
- Minimum hour	2.46	-	-
- Maximum day	0.36	-	-
- Peak Hour (J-6)	3.69	75	514
B. Fire at TH Block + Max. day			
Criteria (min/max)	*n/a*	*20 / 100*	*138 / 689*
- @ node J-6	92.45	52.5	362
C. Fire at Stacked TH Block + Max. day			
Criteria (min/max)	*n/a*	*20 / 100*	*138 / 689*
- @ node J-3	107.45	37.5	258

'-' = not modelled

4 Proposed Erosion and Sediment Control

During construction, erosion and sediment control measures will be implemented to ensure sediment is prevented from migrating off the Site. These controls are expected to comprise of silt fence, mud-mats at construction accesses to Erbsville Road, temporary ditches/swales, straw bale/rock check dams, temporary sediment ponds, and other measures as required.

The required erosion controls will be designed during the final design and approval stages of the project.

5 Utilities

The various utilities (i.e. Hydro, gas, telecommunications, etc.) all have existing facilities adjacent to the Site. Servicing of the development by the various utilities will be provided by extension of these facilities into the Site. During the design stages of the project each utility will identify their specific requirements through the standard application circulation, design, and review process.

6 Summary

This Functional Servicing Report describes the proposed site grading and municipal servicing design for the proposed development at 720 Erbsville Road, Waterloo, Ontario. The report demonstrates that the proposed development is feasible and can be designed and constructed in accordance with municipal and provincial standards.

The following summarizes the functional site engineering, and provides recommendations for the final design of the Site:

Grading and Drainage:

a) The functional site grading demonstrates that appropriate gradients for all vehicular and pedestrian areas can be achieved, and that stormwater can be conveyed to appropriate stormwater outlets.

b) During final design, erosion and sediment controls will be designed and proposed to be implemented during construction to control site stormwater runoff and ensure external areas are not adversely impacted.

Stormwater Management:

c) SWM quantity control will be achieved via one proposed SWM pond located in the southeastern corner of the Site. The pond will have outlet controls to ensure peak discharge flows from the design storm events are equal to or less than municipal criteria. The outlet will be piped to discharge directly to Laurel Creek. An emergency overflow weir is incorporated into the pond's design.

   Note, the SWM Pond has been positioned and designed such that it can be readily expanded to increase storage volume to service 672 Erbsville Road.

d) For those areas that cannot be routed to the SWM pond (i.e., the eastern residential rear yards adjacent to the environmental buffer area), an infiltration swale will be utilized to capture and infiltrate the required stormwater flows.

e) SWM quality control will be achieved with an oil grit separator (OGS) located downgradient of the SWM pond's quantity control structure.

f) Infiltration of roof water is proposed throughout the Site to provide groundwater recharge.

Sanitary:

g) Internal sanitary sewers will collect sewage from the residential development and convey it to the existing Erbsville Road 300mm diameter trunk sanitary sewer.

h) The subject development was a proposed sub-catchment to the existing Erbsville Road sanitary sewer. However, as is typical practice, the City of Waterloo should add the proposed development's sanitary flows to their sanitary model (if not already done) and confirm downgradient sewer capacity is not an issue.

Water:

i) The existing Erbsville Road watermain infrastructure was found to have sufficient capacity to service the proposed development. Once the Erbsville watermain is looped under the municipality's Beaver Creek Meadows District Plan proposed water works project, supply will only improve.

j) A proposed 200mm diameter service will connect to the existing 300mm diameter municipal watermain on Erbsville Road to provide potable water and fire protection for the Site.

k) A looped 150mm diameter watermain system will be installed within the Site's internal road network to distribute water via service laterals to each residential unit.

l) Proposed private hydrants within the development, and existing hydrants external to the Site on Erbsville Road will provide fire protection for the Site.

Utilities:

m) Existing utilities (i.e., hydro, gas and communication) exist on Erbsville Road adjacent to the Site.

n) During the final planning and design of the Site, the various Utilities will be coordinated to provide service to the Site.

Based on the functional engineering review described herein, we conclude the proposed Site can be developed and serviced from a municipal/civil engineering perspective in accordance with municipal and agency criteria.

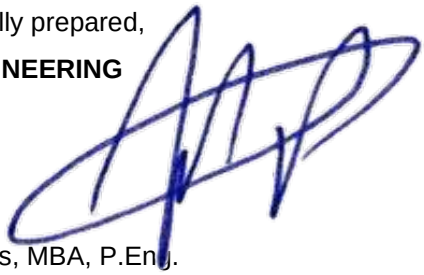
We recommend that the City of Waterloo, Region of Waterloo, and other agencies confirm the proposed criteria and review/confirm that the functional design approach outlined herein meets their requirements, and that they subsequently provide their "approval in principle". This will support the Planning applications, and provide guidance to the Site's detailed final design during the Site Plan Approval process.

We trust this study and its findings support the OPA and re-zoning applications for the Site. Should there be any questions, or if further information is required, please do not hesitate to contact the undersigned.

* * * * * * * * * * * * * * *

Respectfully prepared,

JPE ENGINEERING



John Perks, MBA, P.Eng.
Senior Engineer, President

APPENDIX A:

Site Plan

Concept Plan

City of Waterloo
Region of Waterloo

Subject Lands: + 33,002 m² / 3.30 ha

Residential Zone Area: 30,438m² / 3.04ha

Proposed Units:
Townhouses: 58
Stacked Townhouses: 112
Total Proposed Units: 170

Parking Required:
Townhouse: 78 (1.33 per unit)
Stacked Townhouse: 124 (1.1 per unit)
Total Parking Required: 202

Parking Provided:
Townhouse: 78 (1.33 per unit)
Stacked Town: 153 (1.3 per unit)
Total Parking Provided: 231 (1.35/unit)

Additional Lands: + 4,975m² / 0.49 ha

Notes:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.
2. PROPERTY BOUNDARY APPROXIMATE, TO BE VERIFIED BY SURVEY.
3. CONTOURS (1m) & ENVIRONMENTAL CONSTRAINTS BASED ON ERBSVILLE EA STUDY (SEPTEMBER, 2018) AND NRSI EIS SURVEYS (2023)
7. FOR CONCEPTUAL PURPOSES ONLY.

DATE: February 10, 2025
FILE: 0977D
SCALE: 1:1,500
DRAWN: GC

north

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APPENDIX B:

Functional Engineering Drawings

- FE-1: Functional Grading Plan
- FE-2: Functional Servicing Plan
- FE-3: Pre-Development Storm Catchment Area Plan
- FE-4: Post-Development Storm Catchment Area Plan

720 ERBSVILLE ROAD
Waterloo, ON



LIST OF DRAWINGS:

FE-1: Functional Grading Plan

FE-2: Functional Servicing Plan

FE-3: Functional Pre-Development Storm

FE-4: Functional Post-Development Storm

FUNCTIONAL DESIGN - ISSUED FOR REVIEW

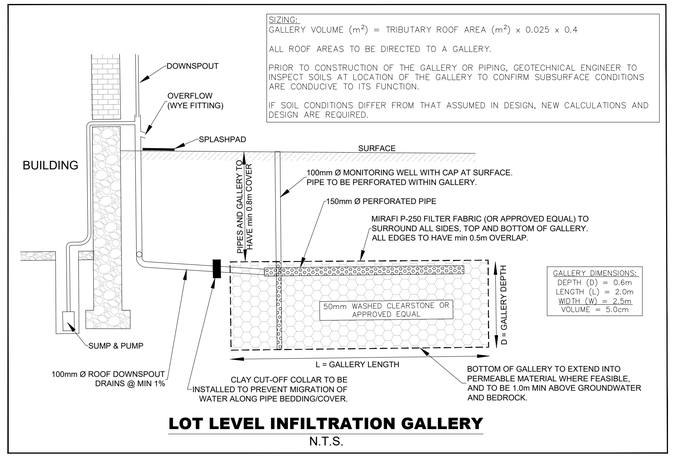
January 21, 2025

Sunvest DEVELOPMENT CORP.

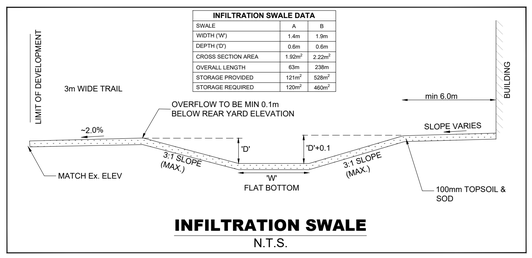
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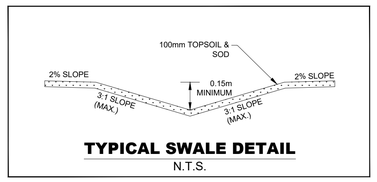




LOT LEVEL INFILTRATION GALLERY
N.T.S.



INFILTRATION SWALE
N.T.S.



TYPICAL SWALE DETAIL
N.T.S.

FUNCTIONAL DESIGN NOTES:

A. GENERAL:

1. THE FUNCTIONAL ENGINEERING PLANS ARE NOT FOR CONSTRUCTION. THE SOLE PURPOSE OF THESE PLANS IS TO DEMONSTRATE THE GRADING AND MUNICIPAL SERVICING DESIGN INTENT. ONCE APPROVAL IN PRINCIPLE HAS BEEN OBTAINED FROM THE APPROVAL AUTHORITIES, A DETAILED DESIGN WILL BE COMPLETED.
2. NOTES INCLUDED ON ANY ONE ENGINEERING PLANS SHALL PERTAIN TO ALL ENGINEERING PLANS IN THE DRAWING SET.
3. THE ENGINEERING PLANS SHALL NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE PERMISSION OF JPE ENGINEERING.
4. THE ENGINEERING PLANS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER PROJECT PLANS AND DOCUMENTS, INCLUDING BUT NOT LIMITED TO LEGAL SURVEY, EXISTING CONDITION, GRADING, SERVICING, DETAILS, STORMWATER MANAGEMENT, ARCHITECTURAL, LANDSCAPE, ETC.
5. THE POSITION OF UNDERGROUND AND ABOVEGROUND UTILITIES/PLANT, STRUCTURES AND EXISTING TOPOGRAPHICAL FEATURES IS NOT NECESSARILY SHOWN, AND WHERE SHOWN, THE ACCURACY OF THE LOCATION AND/OR ELEVATION IS NOT GUARANTEED.

B. GENERAL DESIGN CRITERIA:

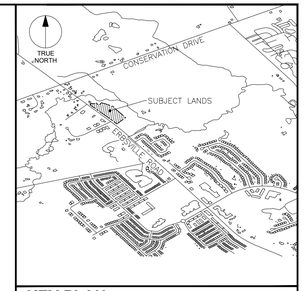
1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH OPSD, OPSS, OBC, AND LOCAL MUNICIPAL STANDARDS, WHICHEVER IS MORE STRINGENT AS DETERMINED BY THE MUNICIPALITY AND ENGINEER.
2. SPECIFIC REFERENCES MADE TO STANDARDS ON THE ENGINEERING DRAWINGS ARE FOR CONVENIENCE ONLY AND SHALL NOT EXCLUDE OTHER STANDARDS FROM APPLYING TO THE WORK.
3. THE MINIMUM AND MAXIMUM SLOPES SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED:

	MINIMUM	MAXIMUM
a. CONCRETE GUTTER:	0.5%	8.0%
b. HARDSCAPE:	0.7%	5.0%
c. SOFTSCAPE:	2.0%	33.0%
d. VEGETATED SWALES:	2.0%	33.0%
e. AMENITY AREAS:	2.0%	5.0%

4. ALL AREAS SHALL BE MADE TO HAVE POSITIVE DRAINAGE AND BE DIRECTED TO APPROPRIATE OUTLETS TO ENSURE NO SURFACE PONDING OF STORM WATER OCCURS.
5. ELEVATIONS ALONG CURB LINES, SIDEWALKS, ETC., REFERENCE BOTTOM OF CURB, SIDEWALK, ETC., UNLESS OTHERWISE INDICATED.

LEGEND

321.09 / Ex. Dwelling, etc.	ALL ITALIC TEXT IS EXISTING
321.09 i	ALL NON-ITALIC TEXT IS PROPOSED
	SANITARY
	EX. SANITARY
	WATERMAIN
	EX. WATERMAIN
	STORM
	EX. STORM
	EX. SAN. MANHOLE
	CURB STOP / VALVE
HYD	HYDRANT
	FITTING / BEND
M	PROP WATER METER
S	PROP SUMP PUMP OUTLET
	PROP. RETAINING WALL
	EXISTING CONTOUR
	PROPOSED SWALE
Ex.321.16	MATCH EXISTING GRADE
321.09	PROPOSED GRADE
S321.09	PROPOSED SWALE GRADE
4.3%	PROPOSED ± SLOPE GRADE



KEY PLAN N.T.S.

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REV.#	BY:	DESCRIPTION:	DATE
1	JPE	2nd SUBMISSION (NORTH SWM POND REMOVED)	2025.02.25

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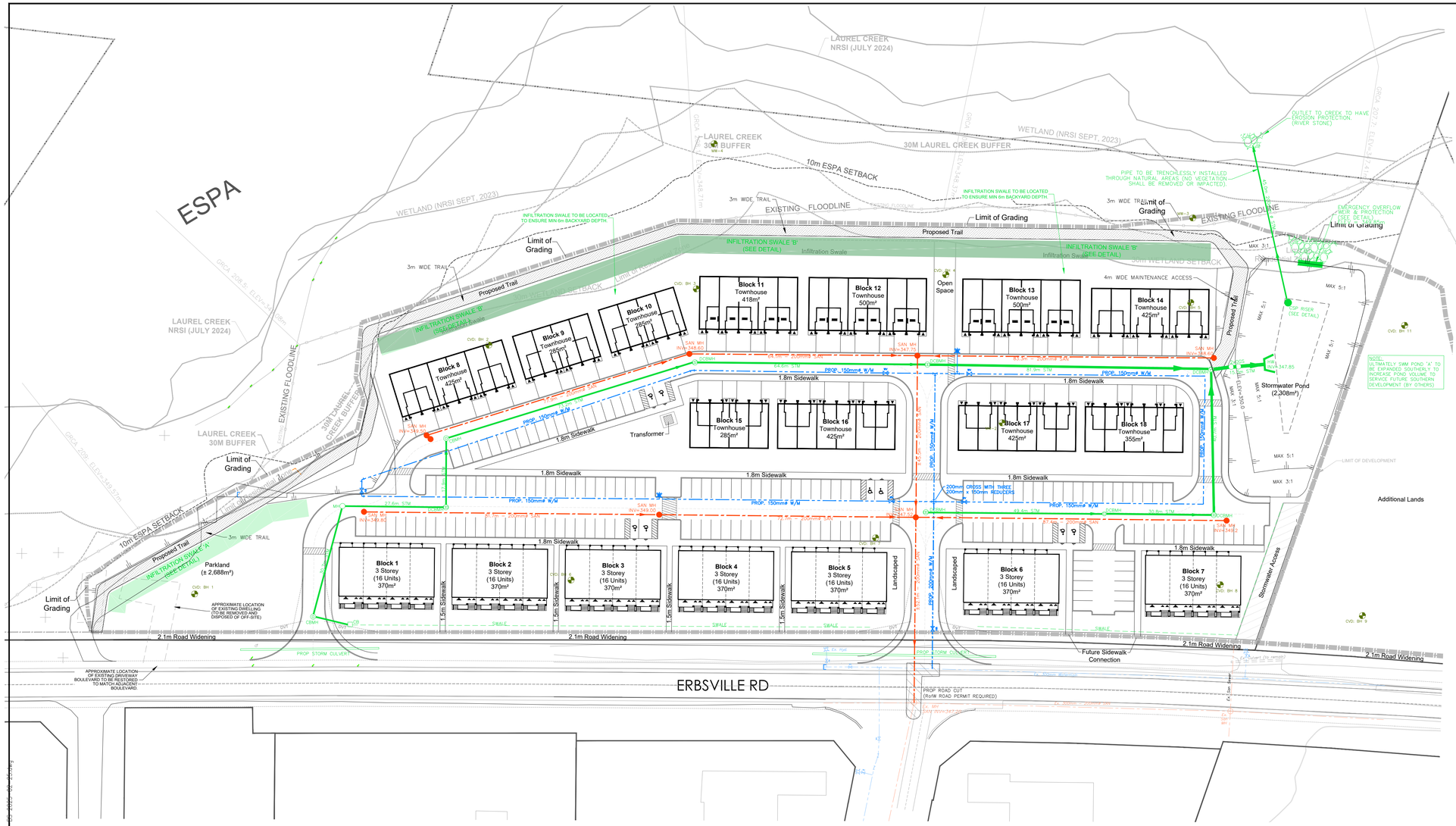
720 ERBSVILLE ROAD, WATERLOO, ON

Drawing Title:

FUNCTIONAL GRADING PLAN

Scale: 1:600	**Date:** 2025-01-21
Drawn By: MES/JP	**Checked By:** JP
Project #: JPE-1027	**Dwg #:** FE - 1
	Rev #: 1

File Name: JPE-1027-60 2025-02-25.dwg Last Saved: February 25, 2025 Plotted: February 25, 2025 5:17:25 PM


ESPA
LAUREL CREEK NRSI (JULY 2024)
WETLAND (NRSI SEPT, 2023)
30M LAUREL CREEK BUFFER
10m ESPA SETBACK
EXISTING FLOODLINE
3m WIDE TRAIL
Proposed Trail
Limit of Grading
INFILTRATION SWALE 'B' (SEE DETAIL)
INFILTRATION SWALE 'A' (SEE DETAIL)
INFILTRATION SWALE TO BE LOCATED TO ENSURE MIN 6m BACKYARD DEPTH.
Infiltration Swale
30M WETLAND SETBACK
4m WIDE MAINTENANCE ACCESS
Open Space
Parkland (± 2,688m²)
Block 1 3 Storey (16 Units) 370m²
Block 2 3 Storey (16 Units) 370m²
Block 3 3 Storey (16 Units) 370m²
Block 4 3 Storey (16 Units) 370m²
Block 5 3 Storey (16 Units) 370m²
Block 6 3 Storey (16 Units) 370m²
Block 7 3 Storey (16 Units) 370m²
Block 8 Townhouse 425m²
Block 9 Townhouse 285m²
Block 10 Townhouse 285m²
Block 11 Townhouse 418m²
Block 12 Townhouse 500m²
Block 13 Townhouse 500m²
Block 14 Townhouse 425m²
Block 15 Townhouse 285m²
Block 16 Townhouse 425m²
Block 17 Townhouse 425m²
Block 18 Townhouse 355m²
Transformer
Stormwater Pond (2,308m³)
OUTLET TO CREEK TO HAVE EROSION PROTECTION. (RIVER STONE)
PIPE TO BE TRENCHLESSLY INSTALLED THROUGH NATURAL AREAS (NO VEGETATION SHALL BE REMOVED OR IMPACTED).
EMERGENCY OVERFLOW WEIR & PROTECTION (SEE DETAIL)
RISER (SEE DETAIL)
NOTE: ULTIMATELY SWM POND 'A' TO BE EXPANDED SOUTHERLY TO INCREASE POND VOLUME TO SERVICE FUTURE SOUTHERN DEVELOPMENT (BY OTHERS)
LIMIT OF DEVELOPMENT
Additional Lands
Stormwater Access
Future Sidewalk Connection
2.1m Road Widening
1.8m Sidewalk
1.5m Sidewalk
Landscaped
SWALE
PROP. 150mmø W/M
PROP. 200mmø S/M
PROP. 250mmø S/M
PROP. 300mmø S/M
200mm CROSS WITH THREE 200mm x 150mm REDUCERS
PROP. STORM CULVERT
APPROXIMATE LOCATION OF EXISTING DWELLING (TO BE REMOVED AND DISPOSED OF OFF-SITE)
APPROXIMATE LOCATION OF EXISTING DRIVEWAY BOULEVARD TO BE RESTORED TO MATCH ADJACENT BOULEVARD
ERBSVILLE RD
PROP ROAD CUT (RoW ROAD PERMIT REQUIRED)
GRCA 209.5 ELEV=349.37m
GRCA 209.5 ELEV=349.53m
GRCA 207.2 ELEV=348.91m
GRCA 207.2 ELEV=348.91m
SAN. MH INV=348.60
SAN. MH INV=347.75
SAN. MH INV=349.00
SAN. MH INV=349.80
SAN. MH INV=347.85
SAN. MH INV=344.62
SAN. MH INV=349.50
CBMH
CB
CVD: BH 1
CVD: BH 2
CVD: BH 3
CVD: BH 4
CVD: BH 5
CVD: BH 6
CVD: BH 7
CVD: BH 8
CVD: BH 9
CVD: BH 11
MH-1
MH-2
MH-3
MH-4
MAX 5:1
MAX 3:1
5% MAX.
MIN. ELEV=350.0
PROP. 1.5m Ø CSP
PROP. 1.8m Ø CSP
PROP. 2.0m Ø CSP
PROP. 2.4m Ø CSP
PROP. 200mmø SAN
PROP. 250mmø SAN
PROP. 300mmø SAN
PROP. 375mmø SAN
PROP. 450mmø SAN
PROP. 525mmø SAN
PROP. 600mmø SAN
PROP. 750mmø SAN
PROP. 900mmø SAN
Ex. 1.5m Ø CSP
Ex. 2.4m Ø CSP
Ex. 300mm SAN
Ex. 375mm SAN
Ex. 450mm SAN
Ex. 525mm SAN
Ex. 600mm SAN
Ex. 750mm SAN
Ex. 900mm SAN
Ex. MH
Ex. CBMH
Ex. CB
Ex. Hydro Pole
Ex. Hydro Pole w/ Transformer
Ex. Guy Wire
Ex. Overhead Hydro
Ex. Underground Hydro
Ex. Underground Bell
Ex. Underground Gas
Ex. Underground Fibre
Ex. Underground Cable TV
Ex. Underground Telephone

PROJECT NORTH

TRUE NORTH

ESPA

LAUREL CREEK NRSI (JULY 2024)

LAUREL CREEK 30M BUFFER

30M LAUREL CREEK BUFFER

WETLAND (NRSI SEPT. 2023)

10m ESPA SETBACK

EXISTING FLOODLINE

30m WETLAND SETBACK

CVD: BH 1

CVD: BH 2

CVD: BH 3

CVD: BH 4

CVD: BH 5

CVD: BH 6

CVD: BH 7

CVD: BH 8

CVD: BH 9

CVD: BH 11

1 / 20 / 0.57ha

1 / 20 / 0.71ha

1 / 20 / 0.21ha

1 / 20 / 0.70ha

1 / 20 / 0.96ha

ERBSVILLE RD

Ex. 300mm CSP

Ex. 1200mm CSP

Ex. MH

Ex. 300mm CONC

Ex. 1200mm CSP

Ex. MH

Ex. 1200mm CSP

Ex. MH

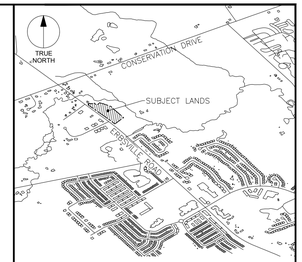
LEGEND

CATCHMENT AREA NUMBER — 20 / 70 / 0.24ha — RUNOFF CO-EFFICIENT

AREA IN HECTARES

Ex. MAJOR OVERLAND FLOW DIRECTION

PROPOSED CATCHMENT AREA BOUNDARY



KEY PLAN N.T.S.

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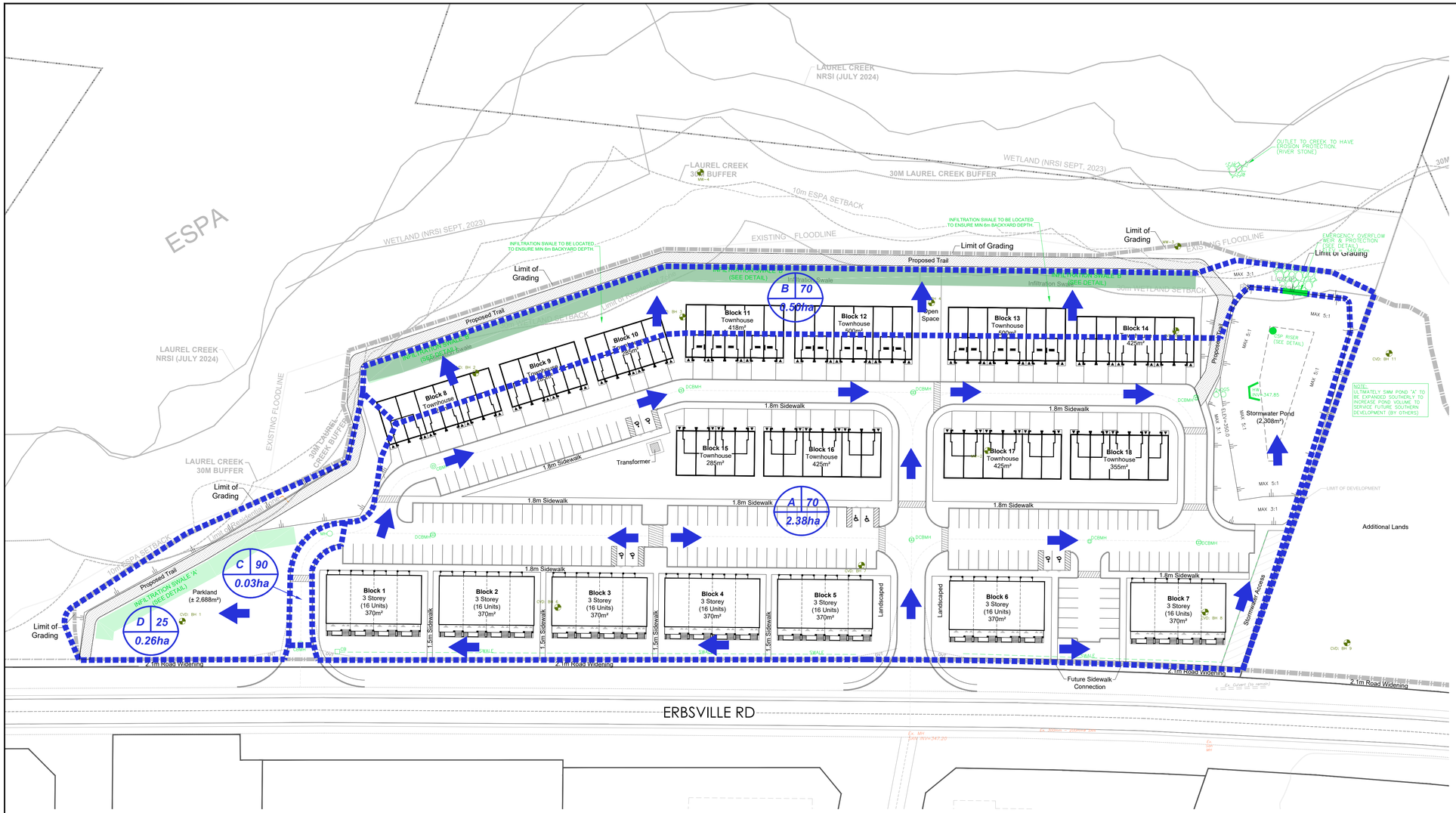
Drawing Title:

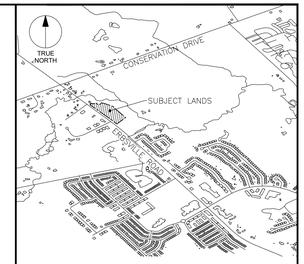
FUNCTIONAL PRE-DEVELOPMENT STORM CATCHMENT PLAN

Scale: 1:600	**Date:** 2025-01-21
Drawn By: MES	**Checked By:** JP

Project #:	Dwg #:	Rev #:
JPE-1027	FE - 3	1

File Name: JPE-1027-BS-2025-02-25.dwg Last Saved: February 25, 2025 Plotted: February 25, 2025 5:17:39 PM





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REV.#	BY:	DESCRIPTION:	DATE
1	JPE	2nd SUBMISSION (NORTH SWM POND REMOVED)	2025.02.25

LEGEND

CATCHMENT AREA NUMBER — 20 | 70 — RUNOFF CO-EFFICIENT
AREA IN HECTARES — 0.24ha
MAJOR OVERLAND FLOW DIRECTION
PROPOSED CATCHMENT AREA BOUNDARY

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Project:

720 ERBSVILLE ROAD, WATERLOO, ON

Drawing Title:

FUNCTIONAL POST-DEVELOPMENT STORM CATCHMENT PLAN

Scale:	1:600	Date:	2025-01-21
Drawn By:	MES/JP	Checked By:	JP
Project #:	JPE-1027	Dwg #:	FE - 4
Rev #:	1		

File Name: JPE-1027-BS 2025-02-25.dwg Last Saved: February 25, 2025 Plotted: February 25, 2025 5:17:43 PM

Appendix C:

Sanitary Calculations

September 17, 2024

720 ERBSVILLE ROAD, Waterloo ON
Sanitary Flow Calculation

TYPE	DENSITY (ppu)	# Units	Population
Single Dwelling	3.25	0	0
TownHouses	2.44	58	142
Aprt - 1 bed	1.40	0	0
Aprt - 2 bed	2.10	0	0
Aprt - 3 bed	3.10	0	0
Aprt - 4 bed	3.50	0	0
Stacks	1.77	112	199
TOTAL	**n/a**	**170**	**341**

Residential Flow:

Site Population	341	persons
Existing Population	0	persons
Total Population	341	persons
Flow per person	275	L/person/day
Peaking factor	4.05	per harmon: $1+ (14/(4+(P/1000)^{0.5}))$
Average flow	93775	L/day
Average flow	1.09	L/s
Peak flow	4.40	L/s

Commercial Flow:

Commercial area	0	ha
Existing Commerica	0	ha
Total Population	0	ha
Flow rate	0.5	L/s/ha
Peaking factor	2.5	
Average flow	0.00	L/s
Peak flow	0	L/s

Infiltration Flow

Total Area	0.35	ha
Infiltration rate	0.25	L/s/ha
Infiltration allowance	0.60	L/s

TOTAL

Average flow	**1.69**	**L/s**
Peak flow	**5.00**	**L/s**

Appendix D:

Water Supply & Demand

- Design Calculations
- EPANET 2.2 modelling output

720 ERBSVILLE ROAD
Waterloo, Ontario

AVAILABE WATER SUPPLY

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

HYDRANT FLOW TEST RESULTS
(per Hydrant Flow Test by C&H, Oct 5, 2021)

Static Pressure	74	psi	
One Port			
Residual Pressure	62	psi	
Flow	69.8	L/s	1107 usGAL/m
Two Ports			
Residual Pressure	50	psi	
Flow	107.6	L/s	1705 usGAL/m

CALCULATED AVAILABLE FLOW AT TEST HYDRANT @ 20psi
https://www.joiff.com/members/documents/hydrant_testing.pdf

$Q2 = Q1 (S - R2)^{0.54} / (S - R1)^{0.54}$

where: Q = flow rate in litres per seconds
S = static pressure in psi
R = residual pressure in psi

Q1	1705.5	usGal / m	107.6	lps
S			74.0	psi
R1			50.0	psi
R2			20.0	psi
Q2 =			**166.7**	**lps**
			2642.59302	usGal / m

720 ERBSVILLE ROAD
Waterloo, Ontario

DOMESTIC WATER DEMAND

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

Proposed Residential Apartment	Population Density[1]		Units	Equivalent Population (persons)	Water Demand[1] @ 225 L/p/day (L/day)
Single Dwelling	3.25	PPU	0.00	0.00	0
TownHouses	2.44	PPU	58.00	142.00	31,950
Stacks	1.77	PPU	112.00	199.00	44,775
Aprt - 1 bed	1.40	PPU	0.00	0.00	0
Aprt - 2 bed	2.10	PPU	0.00	0.00	0
Aprt - 3 bed	3.10	PPU	0.00	0.00	0
Aprt - 4 bed	3.50	PPU	0.00	0.00	0
		Total	**170**	**341**	**76,725**

	Peaking Factor[2]	Flow
Average day (L/s)	1.00	0.89
Maximum day (L/s)	2.75	2.44
Minimum hour (L/s)	0.40	0.36
Peak hour (L/s)	4.13	3.67

NOTES:

1 Region's Water and Wastewater Monitoring Report, Region of Waterloo (June 2020)
2 MOE's "Design Guidelines for Drinking Water Systems (2008) - Table 3-1

720 ERBSVILLE ROAD
Waterloo, Ontario

FIRE FLOW REVIEW
per OBC 2012 - A3.2.5.7

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

Building Classification: C 3-storey Traditional Townhouse Building (6 Unit)

Building details:

Building materials	Wood frame with metal/brick siding.		
Number of Storeys	2		plus basement
Avg Floor area (1 level)	425	m2	
Avg building height	9	m	(incl basement, excludes roof)
Thus, Building volume =	3825	m3	(floor area x height)
Firewall separation ?	No		
Sprinklered ?	No		
Stand Pipes ?	No		

Minimum supply of water (per OBC) = Q = K • V • S_{tot}

where: Q = minimum water supply required (L)
K = coefficient (Table 1 of 3.2.5.7 Table 1)
V = total building volume in cubic metres
S_{tot} = total of spatial coefficient (Stot = 1.0 + [S_{side1} + S_{side2} + S_{side3} + ... etc.)]

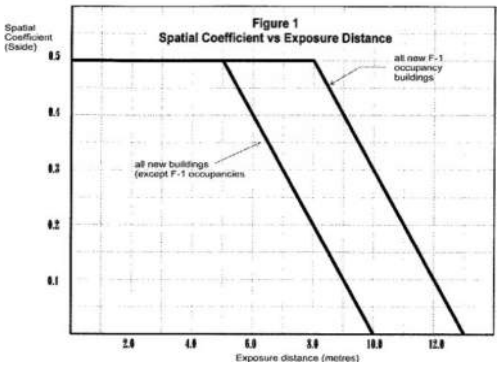
K = 23

Table 1
Water Supply Coefficient - K

Type of Construction	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

V = 3825 m3

		separation:	
S_N =	0.5	3	m
S_E =	0.0	>10	m
S_S =	0.5	3	m
S_W =	0.0	>10	m
constant	1.0		
S_{tot} =	2.0	(max = 2)	



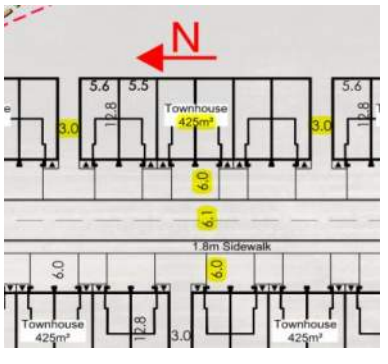


Table 2

Part 3 Buildings under the Building Code	Required Minimum Water Supply Flow Rate, L/min
One-storey building with building area not exceeding 600 m²	1 800
All other buildings	2 700 (if Q ≤ 108 000 L)(1) 3 600 (if Q > 108 000 L and ≤ 135 000 L)(1) 4 500 (if Q > 135 000 L and ≤ 162 000 L)(1) 5 400 (if Q > 162 000 L and ≤ 190 000 L)(1) 6 300 (if Q > 190 000 L and ≤ 270 000 L)(1) 9 000 (if Q > 270 000 L)(1)

Thus, by formula, Q = 175,950 m3

Thus min supply rate = 5400 L/min
= 90 L/s

Plus Maximum Day 2.44 L/s

REQUIRED MIN SUPPLY 92.44 L/s (at 20 PSI)

Notes :
1. The analysis of this sheet is per OBC2012 - Appendix A (Volume 2), Section A3.2.5.7.
2. Per OBC 6.3, the absolute minimum fire flow required for residential development is 45 L/s at 20 psi.

720 ERBSVILLE ROAD
Waterloo, Ontario

FIRE FLOW REVIEW
per OBC 2012 - A3.2.5.7

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

Building Classification: C 3-storey Stacked Townhouse Building (16 Unit)

Building details:

Building materials	Wood frame with metal/brick siding.		
Number of Storeys	3		plus basement
Avg Floor area (1 level)	370	m2	
Avg building height	12	m	(incl basement)
Thus, Building volume =	4440	m3	(floor area x height)
Firewall separation ?	No		
Sprinklered ?	No		
Stand Pipes ?	No		

Minimum supply of water (per OBC) = Q = K • V • S_{tot}

where: Q = minimum water supply required (L)
K = coefficient (Table 1 of 3.2.5.7 Table 1)
V = total building volume in cubic metres
S_{tot} = total of spatial coefficient (Stot = 1.0 + [S_{side1} + S_{side2} + S_{side3} + ... etc.)]

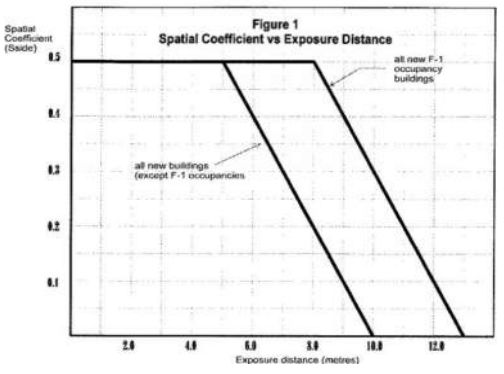
K = 23

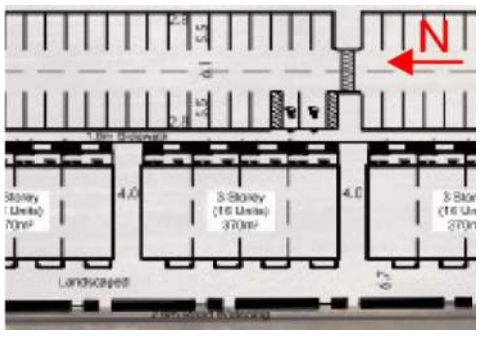
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Water Supply Coefficient - K

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Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

V = 4440 m3

		separation:	
S_N =	0.5	3	m
S_E =	0.0	>10	m
S_S =	0.5	3	m
S_W =	0.0	>10	m
constant	1.0		
S_{tot} =	2.0	(max = 2)	





Thus, by formula, Q = 204,240 m3

Thus min supply rate = 6300 L/min
= 105 L/s

Plus Maximum Day 2.44 L/s

Table 2

Part 3 Buildings under the Building Code	Required Minimum Water Supply Flow Rate, L/min
One-storey building with building area not exceeding 600 m²	1 800
All other buildings	2 700 (if Q ≤ 108 000 L)(1) 3 600 (if Q > 108 000 L and ≤ 135 000 L)(1) 4 500 (if Q > 135 000 L and ≤ 162 000 L)(1) 5 400 (if Q > 162 000 L and ≤ 190 000 L)(1) 6 300 (if Q > 190 000 L and ≤ 270 000 L)(1) 9 000 (if Q > 270 000 L)(1)

REQUIRED MIN SUPPLY 107.44 L/s (at 20 PSI)

Notes :
1. The analysis of this sheet is per OBC2012 - Appendix A (Volume 2), Section A3.2.5.7.
2. Per OBC 6.3, the absolute minimum fire flow required for residential development is 45 L/s at 20 psi.

720 ERBSVILLE ROAD
Waterloo, Ontario

SUMMARY OF EPANET INPUT & RESULTS

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

SCENARIO 'A1': No Demand
Fire Demand = 0 LPS

NODE	# UNITS		Pop.	Demand (LPS)	PRESSURE		
	TH	Stacks		(LPS)	m	PSI	kPa
J1			0	0.00	52.00	73.9	510
J2			0	0.00	52.50	74.7	515
J3			0	0.00	52.80	75.1	518
J4			0	0.00	53.70	76.4	526
J5			0	0.00	54.20	77.1	531
J6			0	0.00	54.80	77.9	537
J7			0	0.00	53.40	75.9	524
TOTAL	**0**	**0**	**0**	**0.00**			

720 ERBSVILLE ROAD
Waterloo, Ontario

SUMMARY OF EPANET INPUT & RESULTS

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

SCENARIO 'A2': Peak Hour
Fire Demand = 0 LPS

NODE	# UNITS		Pop.	Demand (LPS)	PRESSURE		
	TH	Stacks		(LPS)	m	PSI	kPa
J1			0	0.00	51.97	73.9	510
J2			0	0.00	52.46	74.6	514
J3	14	80	176	1.89	52.76	75.0	517
J4	21		52	0.56	53.66	76.3	526
J5			0	0.00	54.16	77.0	531
J6	23		57	0.61	54.76	77.9	537
J7		32	57	0.61	53.36	75.9	523
TOTAL	**58**	**112**	**342**	**3.68**			

720 ERBSVILLE ROAD
Waterloo, Ontario

SUMMARY OF EPANET INPUT & RESULTS

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

SCENARIO 'B': Townhouse Fire @ Node J6
Fire Demand = 90 LPS

NODE	# UNITS		Pop.	Demand (LPS)	PRESSURE		
	TH	Stacks		(LPS)	m	PSI	kPa
J1			0	0.00	39.33	55.9	386
J2			0	0.00	38.45	54.7	377
J3	14	80	176	1.26	38.23	54.4	375
J4	21		52	0.37	38.82	55.2	381
J5			0	0.00	39.16	55.7	384
J6	23		57	90.41	36.92	52.5	362
J7		32	57	0.41	36.82	52.4	361
TOTAL	**58**	**112**	**342**	**92.45**			

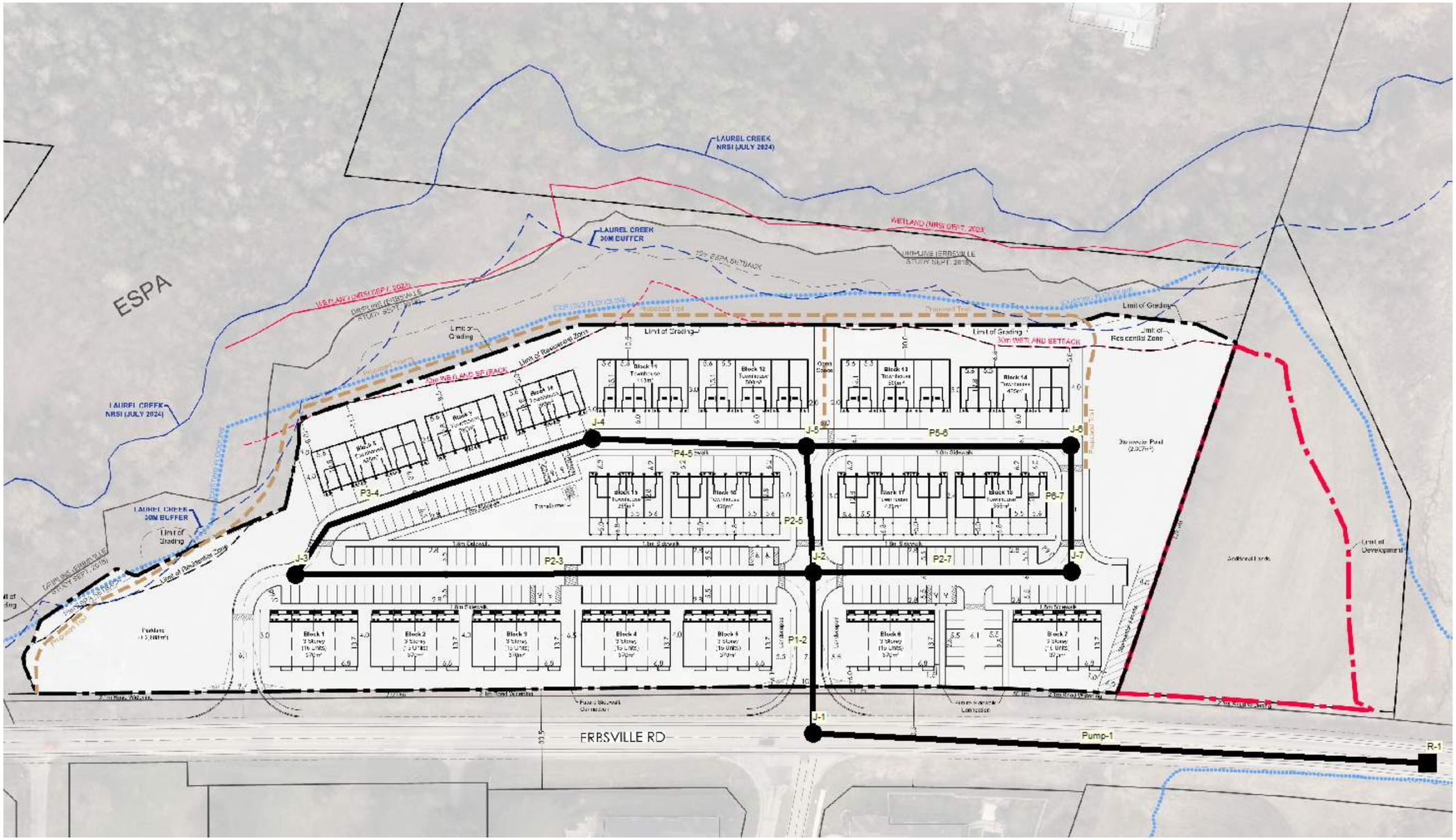
720 ERBSVILLE ROAD
Waterloo, Ontario

SUMMARY OF EPANET INPUT & RESULTS

File No: JPE1027
Date: Sept 17, 2024
Sheet By: JP

SCENARIO 'C': Stacked Townhouse Fire @ Node J3
Fire Demand = 105 LPS

NODE	# UNITS		Pop.	Demand (LPS)	PRESSURE		
	TH	Stacks		(LPS)	m	PSI	kPa
J1			0	0.00	35.24	50.1	345
J2			0	0.00	33.92	48.2	333
J3	14	80	176	106.26	26.35	37.5	258
J4	21		52	0.37	31.58	44.9	310
J5			0	0.00	34.67	49.3	340
J6	23		57	0.41	35.63	50.7	349
J7		32	57	0.41	34.42	48.9	337
TOTAL	**58**	**112**	**342**	**107.45**			



SCALE:

NTS

scale is approx. when plotted on 11x17 paper

KEY PLAN:



#	REVISION	BY	DATE
1	First Submission	JRP	2023-09-18
2	Second Submission	JRP	2024-09-17

BASE MAPPING SOURCES:
- MHBC Site Plan (2023-08-10)

JPE ENGINEERING
info@jpe-engineering.ca
519-577-2238
www.jpe-engineering.ca

720 ERBSVILLE ROAD
Waterloo, ON

EPANET WATER NETWORK PLAN

SHEET 1 of 1

DWG JPE-1027 FE-W1

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.2                                  *
*************************************************************************
```

Input File: JPE1026 - 720 Erbsville - Water Model - Scenario A1-nodemand 2024-09-17.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
P1-2	J-1	J-2	45	200	
P2-7	J-2	J-7	80	150	
P6-7	J-7	J-6	42	150	
P5-6	J-6	J-5	80	150	
P2-5	J-5	J-2	47	150	
P2-3	J-2	J-3	156	150	
P4-5	J-4	J-5	65	150	
P3-4	J-3	J-4	110	150	
Pump-1	R-1	J-1	#N/A	#N/A	Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
Pump-1	100.00	75.00	0.03	0.00	0.00	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J-1	0.00	405.60	52.00	0.00	
J-2	0.00	405.60	52.50	0.00	
J-3	0.00	405.60	52.80	0.00	
J-4	0.00	405.60	53.70	0.00	
J-5	0.00	405.60	54.20	0.00	
J-6	0.00	405.60	54.80	0.00	
J-7	0.00	405.60	53.40	0.00	
R-1	0.00	353.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P1-2	0.00	0.00	0.00	Open	
P2-7	0.00	0.00	0.00	Open	
P6-7	0.00	0.00	0.00	Open	
P5-6	0.00	0.00	0.00	Open	
P2-5	0.00	0.00	0.00	Open	
P2-3	0.00	0.00	0.00	Open	
P4-5	0.00	0.00	0.00	Open	
P3-4	0.00	0.00	0.00	Open	
Pump-1	0.00	0.00	-52.00	Open	Pump

```
  ************************************************************************
  *                            E P A N E T                               *
  *                     Hydraulic and Water Quality                      *
  *                     Analysis for Pipe Networks                       *
  *                          Version 2.2                                 *
  ************************************************************************
```

Input File: JPE1026 - 720 Erbsville - Water Model - Scenario A2-peak 2024-09-17.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
P1-2	J-1	J-2	45	200	
P2-7	J-2	J-7	80	150	
P6-7	J-7	J-6	42	150	
P5-6	J-6	J-5	80	150	
P2-5	J-5	J-2	47	150	
P2-3	J-2	J-3	156	150	
P4-5	J-4	J-5	65	150	
P3-4	J-3	J-4	110	150	
Pump-1	R-1	J-1	#N/A	#N/A	Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
Pump-1	100.00	75.00	0.19	2.49	2.49	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J-1	0.00	405.57	51.97	0.00	
J-2	0.00	405.56	52.46	0.00	
J-3	1.89	405.56	52.76	0.00	
J-4	0.56	405.56	53.66	0.00	
J-5	0.00	405.56	54.16	0.00	
J-6	0.61	405.56	54.76	0.00	
J-7	0.61	405.56	53.36	0.00	
R-1	-3.67	353.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P1-2	3.67	0.12	0.08	Open	
P2-7	1.03	0.06	0.03	Open	
P6-7	0.42	0.02	0.01	Open	
P5-6	-0.19	0.01	0.00	Open	
P2-5	-1.41	0.08	0.05	Open	
P2-3	1.24	0.07	0.04	Open	
P4-5	-1.21	0.07	0.04	Open	
P3-4	-0.65	0.04	0.01	Open	
Pump-1	3.67	0.00	-51.97	Open	Pump

```
  ************************************************************************
  *                            E P A N E T                               *
  *                     Hydraulic and Water Quality                      *
  *                     Analysis for Pipe Networks                       *
  *                          Version 2.2                                 *
  ************************************************************************
```

Input File: JPE1026 - 720 Erbsville - Water Model - Scenario B 2024-09-17.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
P1-2	J-1	J-2	45	200	
P2-7	J-2	J-7	80	150	
P6-7	J-7	J-6	42	150	
P5-6	J-6	J-5	80	150	
P2-5	J-5	J-2	47	150	
P2-3	J-2	J-3	156	150	
P4-5	J-4	J-5	65	150	
P3-4	J-3	J-4	110	150	
Pump-1	R-1	J-1	#N/A	#N/A	Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
Pump-1	100.00	75.00	0.14	47.52	47.52	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J-1	0.00	392.93	39.33	0.00	
J-2	0.00	391.55	38.45	0.00	
J-3	1.26	391.03	38.23	0.00	
J-4	0.37	390.72	38.82	0.00	
J-5	0.00	390.56	39.16	0.00	
J-6	90.41	387.72	36.92	0.00	
J-7	0.41	389.02	36.82	0.00	
R-1	-92.45	353.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P1-2	92.45	2.94	30.72	Open	
P2-7	43.99	2.49	31.52	Open	
P6-7	43.58	2.47	30.98	Open	
P5-6	-46.83	2.65	35.40	Open	
P2-5	-35.40	2.00	21.08	Open	
P2-3	13.06	0.74	3.33	Open	
P4-5	11.43	0.65	2.60	Open	
P3-4	11.80	0.67	2.76	Open	
Pump-1	92.45	0.00	-39.33	Open	Pump

```
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.2                                  *
*************************************************************************
```

Input File: JPE1026 - 720 Erbsville - Water Model - Scenario C 2024-09-17.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm	
P1-2	J-1	J-2	45	200	
P2-7	J-2	J-7	80	150	
P6-7	J-7	J-6	42	150	
P5-6	J-6	J-5	80	150	
P2-5	J-5	J-2	47	150	
P2-3	J-2	J-3	156	150	
P4-5	J-4	J-5	65	150	
P3-4	J-3	J-4	110	150	
Pump-1	R-1	J-1	#N/A	#N/A	Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m3	Avg. Kw	Peak Kw	Cost /day
Pump-1	100.00	75.00	0.13	49.49	49.49	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
J-1	0.00	388.84	35.24	0.00	
J-2	0.00	387.02	33.92	0.00	
J-3	106.26	379.15	26.35	0.00	
J-4	0.37	383.48	31.58	0.00	
J-5	0.00	386.07	34.67	0.00	
J-6	0.41	386.43	35.63	0.00	
J-7	0.41	386.62	34.42	0.00	
R-1	-107.45	353.60	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status	
P1-2	107.45	3.42	40.59	Open	
P2-7	16.15	0.91	4.93	Open	
P6-7	15.74	0.89	4.70	Open	
P5-6	15.33	0.87	4.48	Open	
P2-5	-34.60	1.96	20.21	Open	
P2-3	56.69	3.21	50.43	Open	
P4-5	-49.94	2.83	39.87	Open	
P3-4	-49.57	2.80	39.33	Open	
Pump-1	107.45	0.00	-35.24	Open	Pump

Hydrant Flow Test : 720 ERBSVILLE RD, Waterloo, Ontario WO 42328

Static Hydrant: ERBSVILLE RD, Waterloo, Ontario.
Flowing Hydrant: ERBSVILLE RD & REGAL PL , Waterloo, Ontario.

Static Pressure	74 PSI
Residual Pressure (1)	62 PSI
Residual Pressure (2)	50 PSI
Residual Pressure (3)	

Co efficient value	0.9

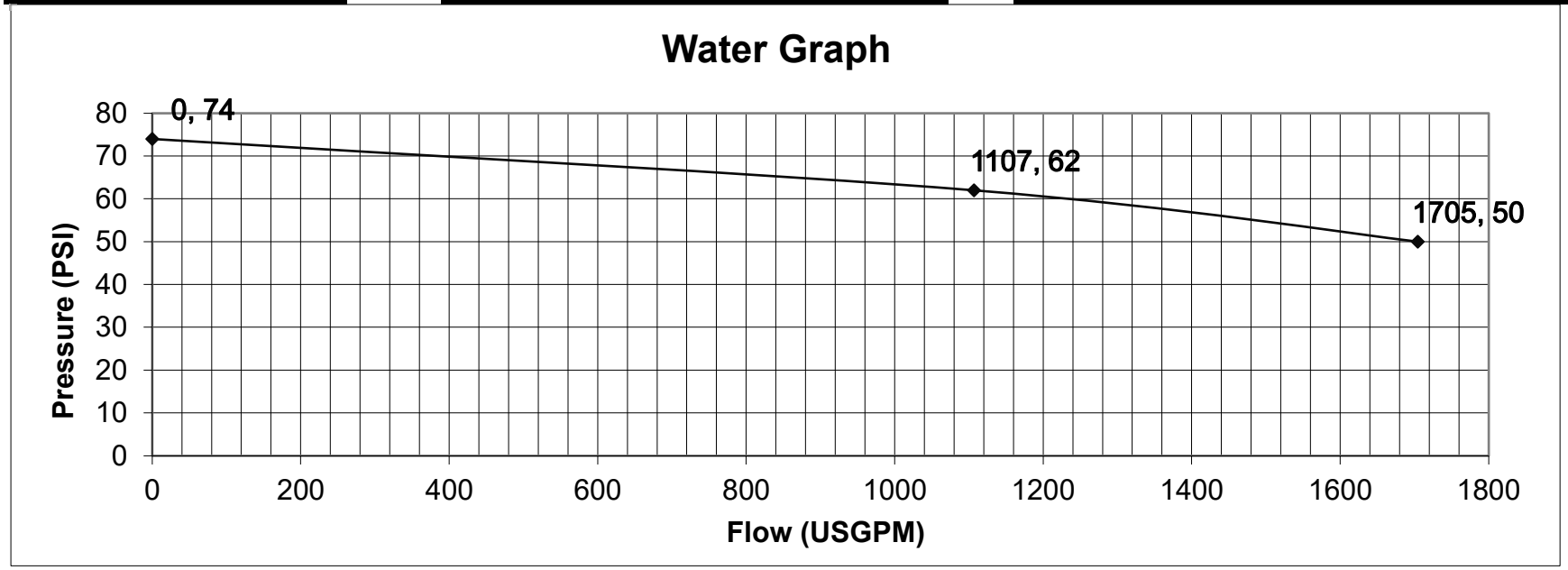
Pitot Reading (1)	43.5 PSI
Outlet Size (1)	2.5 inches
Pitot Reading (2)	25.8 PSI
	25.8 PSI
Outlet Size (2)	2.5 inches
Pitot Reading (3)	
Outlet Size (3)	
Flow 1 Calculated	
	1107 USGPM
Flow 2 Calculated	
	1705 USGPM
Flow 3 Calculated	
	0.00

# of Outlets Flowed (1)	1
# of Outlets Flowed (2)	2
# of Outlets Flowed (3)	0

Graph Data:

Pressure Values (y-axis)	Flow Values (x-axis)
74	0
62	1107
50	1705

Time of Test :	10:00 AM
05-Oct-21	
Performed by:	SRM & Tye



Appendix E:

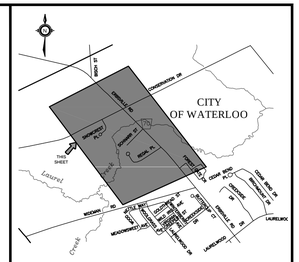
Existing Engineering Drawings

- Erbsville Road – Sanitary Catchment Areas
- Erbsville Road – Plan & Profile drawing



LEGEND

- DRAINAGE AREA NUMBER
- AREA (HA)
- POPULATION DENSITY (ppu=POPULATION PER UNIT; pph=POPULATION PER HECTARE)
- POPULATION
- SANITARY DRAINAGE AREA BOUNDARY
- MHS# – PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SEWER



KEY MAP - N.T.S.

DISCLAIMER

THE BUILDINGS/TREES/DRIVEWAYS/ENTRANCES/UTILITIES ON THIS DRAWING ARE APPROXIMATE. THIS DRAWING WAS MADE FOR DISCUSSION PURPOSES ONLY. THE ABOVE NOTED MUST BE CONFIRMED BY A FIELD VISIT. IBI GROUP ASSUMES NO RESPONSIBILITY FOR ANY INACCURATE INFORMATION OR DAMAGES BY USE OF THIS DRAWING.

NOTES

1. THIS PLAN TO BE READ IN CONJUNCTION WITH CITY OF WATERLOO STANDARD DRAWINGS AND OPSD'S.
2. THE CONTRACTOR SHALL NOTIFY THE CITY AND THE ENGINEER 72 HOURS PRIOR TO COMMENCING ANY LAND DISTURBING ACTIVITY.
3. THE CONTRACTOR SHALL REPAIR ANY SILTATION OR EROSION DAMAGE TO ADJOINING LANDS AND DRAINAGE WAYS RESULTING FROM LAND DEVELOPMENT OR DISTURBING ACTIVITIES.
4. THE CONTRACTOR SHALL INSPECT THE EROSION CONTROL MEASURES AFTER EACH RAIN OF 1cm OR MORE AND AT LEAST ONCE EACH WEEK AND UNDERTAKE NEEDED REPAIRS.
5. THE CONTRACTOR SHALL ENSURE THAT DURING SITE ACTIVITY A COPY OF THE EROSION CONTROL PLAN IS ON SITE.
6. ALL SILT FENCING TO BE INSTALLED PRIOR TO ANY AREA GRADING, EXCAVATING OR DEMOLITION COMMENCING.
7. EROSION CONTROL FENCING TO BE INSTALLED AROUND THE BASE OF ALL STOCKPILES.
8. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES. CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES AS REQUIRED BY CITY OR ENGINEER.
9. CONTRACTOR RESPONSIBLE TO CLEAN MUNICIPAL ROADWAY OF ALL SEDIMENTS FROM VEHICULAR TRACKING AT THE END OF EACH WEEK.

NOTE

A MINIMUM OF 56 SQ.M. OF USABLE REAR YARD AREA HAVING A MAXIMUM SLOPE OF 4% IS TO BE INCORPORATED INTO THE INDIVIDUAL DESIGN OF EACH LOT. THE MINIMUM USEABLE REAR YARD AREA BEHIND THE BACK OF THE HOUSE SHALL ALSO BE 6.0 M IN DEPTH.

SURVEY INFO:
TOPOGRAPHIC SURVEY BY IBI GROUP DATED SEPT. 2009.

BENCHMARK - ELEVATION.
CONCRETE MONUMENT No. 030-03-006. REGISTERED PLAN 58M-376. SOUTH SIDE OF WIDEMAN ROAD AT NORTHEAST CORNER OF LOT 22, REGISTERED PLAN 58M-376.

#	DATE	BY	DESCRIPTION
			REVISIONS
5	AUG.9/13	PCK	FINAL SUBMISSION/CONSTRUCTION
4	JUL.9/13	PCK	ISSUED FOR TENDER
3	JUN.26/13	PCK	FINAL SUBMISSION
2	MAR.28/13	PCK	THIRD SUBMISSION

APPROVALS

LICENSED PROFESSIONAL ENGINEER
AUG 9, 2013
J. R. R. PERKS
PROVINCE OF ONTARIO

APPROVED DATE

IBI GROUP
379 QUEEN STREET SOUTH
KITCHENER, ONTARIO
N2G 1W6
(519) 745-9455
www.ibigroup.com

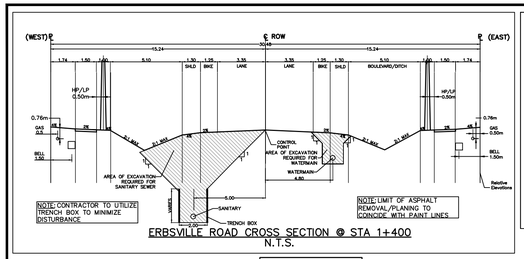
CITY OF WATERLOO
REGION OF WATERLOO

SUNVEST
REGAL PLACE
PART OF LOT 6, REGISTERED PLAN 575, PART OF LOT 45, GERMAN COMPANY TRACT

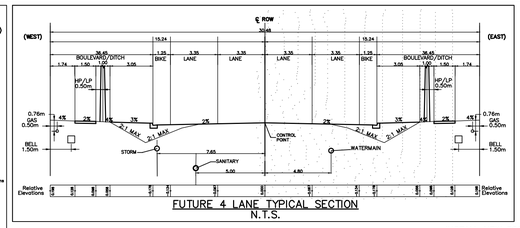
SANITARY CATCHMENT AREAS

DESIGNED BY:	PCK	SCALE:	1:2500 1:250
DRAWN BY:	PCK	DRAFT PLAN #:	N/A
CHECKED BY:	JRP	FILE NUMBER:	28249
DATE:	2011.07.19	SHEET NUMBER:	2

FILE: J:\28249_Regal\Plan\S.9 Drawings\00civil\current\28249E.dwg LAYOUT: SAN DRAIN (EXT)
LAST SAVED BY: Patrick.cloutier , Wednesday, August 07, 2013 3:10:44 PM PLOTTED BY: Patrick Cloutier Wednesday, August 07, 2013 3:16:19 PM



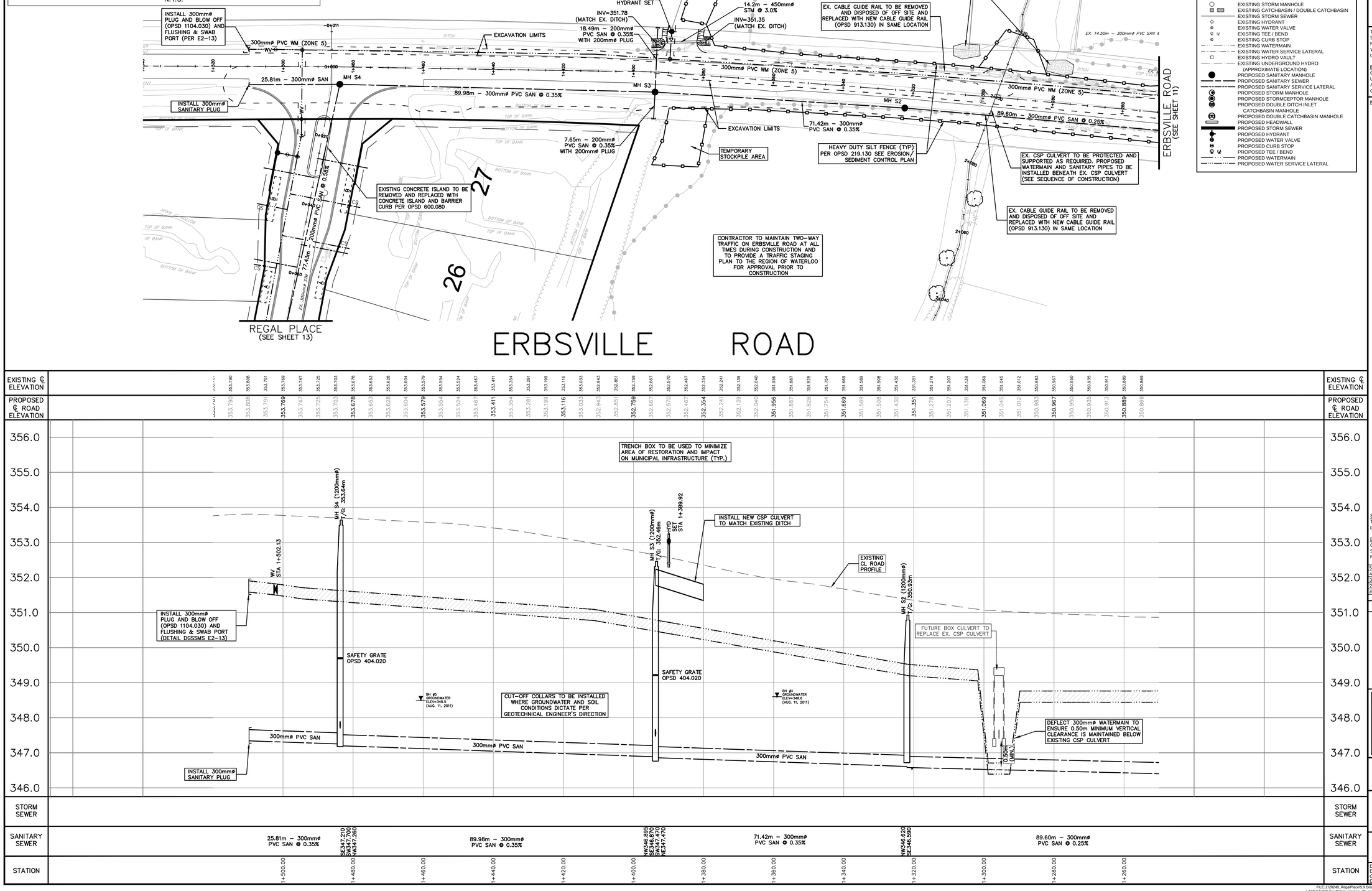
ERBSVILLE ROAD CROSS SECTION @ STA 1+400
N.T.S.

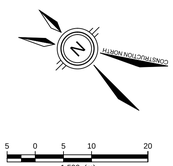


FUTURE 4 LANE TYPICAL SECTION
N.T.S.

SEQUENCE OF CONSTRUCTION:

1. CONTRACTOR TO USE TRENCH BOX TO INSTALL SANITARY SEWER AND WATERMAIN DURING APPROACH TO EXISTING CULVERT AT WIDEMAN CREEK. AS CONTRACTOR APPROACHES CREEK FROM SOUTHERLY DIRECTION, CONTRACTOR SHOULD ALSO USE TRENCH BOX TO EXCAVATE AND EXPOSE EXISTING CULVERT SOUTH AND NORTH OF WIDEMAN CREEK.
2. AS EXISTING CULVERT IS EXPOSED, CONTRACTOR TO BRACE EXISTING CULVERT APPROPRIATELY TO REDUCE CHANCE OF CULVERT FAILURE DURING CONSTRUCTION.
3. GEOTECHNICAL ENGINEER TO BE ON SITE AND PROVIDE DIRECTION FOR DEWATERING PROCEDURES AS REQUIRED WHILE EXISTING CULVERT IS EXPOSED.
4. CONTRACTOR TO HAND EXCAVATE UNDER EXISTING CULVERT AND INSTALL WATERMAIN AND SANITARY PIPES UNDER CULVERT MAINTAINING CLEARANCE AS SHOWN ON PROFILE.
5. CONTRACTOR TO BACKFILL EXCAVATION AROUND EXISTING CULVERT PER OPSD 802.010.
6. RE-HABILITATE AND RE-STABILISE ALL DISTURBED AREAS AS STATED IN TENDER DOCUMENTS.

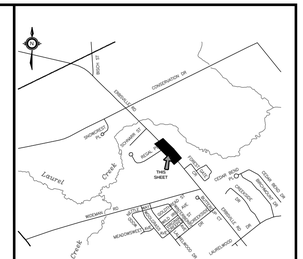




LEGEND

- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN / DOUBLE CATCHBASIN
- EXISTING STORM SEWER
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING TEE / BEND
- EXISTING CURB STOP
- EXISTING WATERMAIN
- EXISTING WATER SERVICE LATERAL
- EXISTING HYDRO VAULT
- EXISTING UNDERGROUND HYDRO (APPROXIMATE LOCATION)
- PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY SERVICE LATERAL
- PROPOSED STORM MANHOLE
- PROPOSED STORMCEPTOR MANHOLE
- PROPOSED DOUBLE DITCH INLET CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN MANHOLE
- PROPOSED HEADWALL
- PROPOSED STORM SEWER
- PROPOSED HYDRANT
- PROPOSED WATER VALVE
- PROPOSED CURB STOP
- PROPOSED TEE / BEND
- PROPOSED WATERMAIN
- PROPOSED WATER SERVICE LATERAL

KEY MAP - N.T.S.



THE POSITION OF THE POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.

BEFORE STARTING WORK, THE CONTRACTOR SHALL CONFIRM THE POSITION AND EXACT LOCATION OF ALL SUCH UTILITIES, AND SHALL ASSUME ALL RESPONSIBILITY FOR ANY DAMAGE TO THEM MADE DURING THE COURSE OF THE CONTRACT WORK.

NOTES

1. ALL WORK TO BE DONE IN ACCORDANCE WITH THE CITY OF WATERLOO STANDARDS, REGION OF WATERLOO'S SSMS DOCUMENTATION AND/ORTHE OPSD/OPSS STANDARDS.
2. SANITARY SEWER TO BE PVC PIPE SDR 35.
3. SANITARY SEWER MANHOLES ARE TO BE AS PER OPSD 701.010 (1200) AND TO BE BACKFILLED WITH GRANULAR 'B'.
4. SANITARY SERVICE LATERALS ARE TO BE 100mmø PVC SDR 28. SERVICE LATERALS DEEPER THAN 4.0m SHALL INCORPORATE A RISER SUCH THAT THE SERVICE LATERAL AT PROPERTY LINE IS NOT DEEPER THAN 3.5m OR SHALLOWER THAN 2.85m.
5. LOCATION OF EXISTING WATERMAIN SERVICES ARE TO BE CONFIRMED PRIOR TO COMMENCING ANY CONNECTION/REPLACEMENT WORK.
6. SINGLE CATCHBASIN LEADS SHALL BE 300mmø PVC SDR 35 WITH A MINIMUM SLOPE OF 1.0%. (UNLESS OTHERWISE DIRECTED BY ENGINEER.)
7. DOUBLE CATCHBASIN LEADS SHALL BE 300mmø PVC SDR 35 WITH A MINIMUM SLOPE OF 1.0%. (UNLESS OTHERWISE DIRECTED BY ENGINEER.)
8. WATERMAIN IS TO BE CLASS 150 PVC PIPE WITH MINIMUM COVER OF 2.0m. CONTRACTOR MUST ENSURE A MINIMUM OF 2.5m CLEAR HORIZONTAL AND 0.5m CLEAR VERTICAL SEPARATION FROM WATERMAIN TO ALL SEWERS AT ALL TIMES. CLEAR SEPARATION MEASURED FROM OUTSIDE OF PIPE WALL TO OUTSIDE OF PIPE WALL IS MAINTAINED DURING INSTALLATION.
9. THE EXISTING WATERMAIN SHALL BE FLUSHED, SWABBED, CLEANED, DISINFECTED, AND BACTERIOLOGICAL SAMPLES TAKEN, ALL IN ACCORDANCE WITH CITY OF WATERLOO STANDARDS UNTIL THE WATERMAIN IS PASSED AND ACCEPTED BY THE CITY.
10. WATER SERVICE LATERALS ARE TO BE 25mmø POLYETHYLENE PIPE AND AS PER R.O.W. SSMS E2-05 WITH SERVICE BOXES SET ON PROPERTY LINE.
11. (AB) EXISTING WATER SERVICE LATERALS SHALL BE DISCONNECTED AT MAIN AND ABANDONED. TOP SECTION OF CURB STOP TO BE REMOVED AND DISPOSED OF OFF SITE UNLESS NOTED OTHERWISE.
12. ALL HYDRANTS SHALL CONFORM TO AWWA C502 AND OPEN COUNTER-CLOCKWISE.
13. HYDRANTS FOR WATERMAINS LESS THAN 300mm
    - 1-100mm NOZZLE WITH STORTZ CONNECTION
    - 2-65mm NOZZLES - 150mm MECHANICAL JOINT INLET
14. HYDRANTS FOR WATERMAINS 300mm AND LARGER
    - 1-100mm NOZZLE WITH STORTZ CONNECTION
    - 2-65mm NOZZLES - 150mm MECHANICAL JOINT INLET
15. TRANSITION PROPOSED BACK OF CURB TO MATCH EXISTING BACK OF CURB. TRANSITION SHALL BE DONE OVER 5.0m LENGTH.
16. GRADING SHALL BE TO R.O.W. UNLESS OTHERWISE NOTED.
17. TRENCH BOX INSTALLATION REQUIRED WHERE INDICATED OR OTHERWISE DIRECTED BY ENGINEER.
18. PAVEMENT STRUCTURE.
    REGAL PLACE
    - 40mm HL3 SURFACE ASPHALT
    - 2-45mm HL8 BINDER ASPHALT
    - 150mm GRANULAR 'A'
    - 450mm GRANULAR 'B'
    ERBSVILLE ROAD
    - 40mm HL3 SURFACE ASPHALT
    - 2-45mm HL8 BINDER ASPHALT
    - 150mm GRANULAR 'A'
    - 450mm GRANULAR 'B'
19. REFER TO SURFACE WORKS DRAWINGS FOR PAVEMENT ELEVATIONS.
20. TEMPORARY SUPPORT OF EXISTING UTILITY POLES MUST BE APPROVED BY WATERLOO NORTH HYDRO. ALL ASSOCIATED COSTS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
21. GAS VALVES, MAIN, SERVICES TO BE ADJUSTED BY OTHERS. CONTRACTOR TO COORDINATE WITH UNION GAS (TYP.)

SURVEY INFO:
TOPOGRAPHIC SURVEY COMPLETED BY IBI GROUP INC. DATED SEPT. 2009.

BENCHMARK - ELEVATION: 351.844m
CONCRETE MONUMENT No. 030-03-006, REGISTERED PLAN 58M-376. SOUTH SIDE OF WIDEMAN ROAD AT THE NORTHEAST CORNER OF LOT 22, REGISTERED PLAN 58M-376.

#	DATE	BY	DESCRIPTION
5	AUG.9/13	PCK	FINAL SUBMISSION/CONSTRUCTION
4	JUL.9/13	PCK	ISSUED FOR TENDER
3	JUN.26/13	PCK	FINAL SUBMISSION
2	MAR.28/13	PCK	THIRD SUBMISSION

REVISIONS

APPROVALS

LICENSED PROFESSIONAL ENGINEER
AUG. 9, 2013
J. R. R. PERKS
PROVINCE OF ONTARIO

IBI GROUP
379 QUEEN STREET SOUTH
KITCHENER, ONTARIO
N2G 1W6
(519) 745-9455
www.ibigroup.com

CITY OF WATERLOO
REGION OF WATERLOO

SUNVEST
REGAL PLACE
PART OF LOT 6, REGISTERED PLAN 575
PART OF LOT 45, GERMAN COMPANY TRACT

ERBSVILLE ROAD
PLAN AND PROFILE 3
STA.1+250 TO 1+520

DESIGNED BY:	PCK	SCALE HORIZ:	1:500
DRAWN BY:	PCK	SCALE VERT:	1:50
CHECKED BY:	JRP	FILE NUMBER:	28249
DATE:	JUL.19/13	SHEET NUMBER:	12

FILE: J:\28249_RegalPlace\5.9 Drawings\05civil\layouts\28249-PP-ERBSVILLE_ROAD - PPS.dwg LAYOUT: ERBSVILLE 1+250 TO 1+520
LAST SAVED BY: Patrick.cloutier , Thursday, August 08, 2013 3:03:42 PM PLOTTED BY: Patrick Cloutier Thursday, August 08, 2013 3:09:41 PM

Appendix F:

Geotechnical Investigation

CHUNG & VANDER DOELEN
ENGINEERING LTD.

GEOTECHNICAL INVESTIGATION
PROPOSED TOWNHOUSE DEVELOPMENT
672 and 720 Erbsville Road
Waterloo, Ontario

SUBMITTED TO:
Sunvest Group of Companies
901 Victoria Street North
Kitchener, Ontario
N2B 3C3

ATTENTION:
Mr. Peter de Groot

FILE NO /1526**/** March 27, 2024

CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

March 27, 2024
File No.: 1526

Sunvest Group of Companies
901 Victoria Street North
Kitchener, Ontario
N2B 3C3

Attention: Mr. Peter de Groot

RE: Geotechnical Investigation
Proposed Townhouse Development
672 and 720 Erbsville Road, Waterloo, Ontario

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation Report carried out at the above-referenced Site. Soil samples will be retained for a period of three (3) months and will thereafter be disposed of unless we are otherwise instructed.

If you have any questions or clarifications are required, please contact the undersigned at your convenience.

We thank you for giving us this opportunity to be of service to you.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Eric Y. Chung, M.Eng., P.Eng.
Principal Engineer

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1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by Sunvest Group of Companies to conduct a geotechnical investigation for a proposed townhouse development to be located at 672 and 720 Erbsville Road in Waterloo, Ontario.

It is proposed to construct 187 units of townhouses at 720 Erbsville Road. The design of 672 Erbsville Road was not available at time of this reporting, but it is understood that townhouses are being contemplated at the site. Paved driveway and parking are provided throughout the property. A SWM facility is proposed at the north end of the property. The finished floor elevations of the townhouses were not available at the time of reporting.

The purpose of this investigation has been to determine the subsurface conditions and relevant soil properties at the subject site in order to provide geotechnical recommendation for the design and construction of site grading operation, municipal site servicing, roadway extensions, and residential foundations. Infiltration rates of the various soil deposits encountered during the investigation will also be provided for SWM design purposes.

2.0 FIELD WORK

Eleven (11) boreholes were advanced to depths of 5.2 m below existing grades on November 23 and 24, 2023 in order to investigate the subsurface conditions at the site. The borehole locations are illustrated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions.

The boreholes were advanced using a track-mounted drilling rig, supplied, and operated by a specialist contractor. The drill rig was equipped with continuous flight solid and hollow stem augers and standard soil sampling equipment. Standard penetration tests (SPTs) in accordance with ASTM Specification D1586, were carried out at frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or “N”-values.

The undrained shear strength of the cohesive soil deposit was determined on slightly disturbed SPT samples using a field pocket penetrometer. The compactness condition or consistency of the soil strata has been inferred from the various test results. Dynamic Cone Penetration testing (DCPT) was conducted at Borehole 10 to confirm the compactness condition of the fine granular deposits.

In addition, two (2) monitoring wells were installed at Boreholes 9 and 11 to determine the depth/elevation of the groundwater table at 672 Erbsville Road.

Ground surface elevations at the borehole locations were surveyed by CVD and were referenced to a temporary benchmark (TBM) described below:

TBM: Top of manhole in center of roadway at intersection of Erbsville Road and Regal Place, as shown in Drawing No. 1

Elevation: 353.73 m (Geodetic)

3.0 LABORATORY TESTING

Soil samples obtained from the in-situ tests were examined in the field and subsequently brought to our laboratory for visual and tactile examination to confirm field classification. Moisture content determination of all retrieved samples occurred.

In addition, four (4) grain size distribution analyses were performed on the major soil deposits to confirm field classification and to provide information on soil hydraulic conductivity.

Four (4) soil samples were submitted to AGAT Laboratories of Mississauga, Ontario for analysis of Metals and Inorganics, Petroleum Hydrocarbons (PHCs) F1 to F4, and Benzene, Toluene, Ethylbenzene and Xylene (BTEX). The chemical testing was conducted to assess the environmental quality of excess soils which will be removed off-site or re-used during construction.

4.0 EXISTING SITE CONDITIONS

The majority of the site currently exists as undeveloped farmland. A two-storey residential dwelling currently occupies the northwest corner of the property at 720 Erbsville Road. The remainder of the site is densely tree covered. The site is bound to the south by residential subdivisions and farmland, and to the north and east by Laurel Creek and to the west by Erbsville Road.

The site at 720 Erbsville Road is gently rolling land with approximately 5± m grade differential across the site. The site at 672 Erbsville Road has a gentle decline in grade in a southeastern direction, towards Laurel Creek. Ground surface elevations at the borehole locations ranged between 347.73 and 354.05 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered at the boreholes are presented on the Borehole Log Sheets, Enclosures 1 to 11. The following notes are intended to amplify and comment on the subsurface data obtained. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions

between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

5.1 Topsoil and Granular Fill

Topsoil was encountered at ground surface at Boreholes 2 to 11 with measured thicknesses between 150 and 350 mm. The thickness of topsoil could vary between and beyond the borehole locations.

Granular fill was encountered at ground surface of Borehole 1 with a measured thickness of 50 mm.

5.2 Fill

Fill was encountered at ground surface of Boreholes 1, 2, and 7 and extended to depths between 0.7 and 2.2 m below existing grades. The fill varied in percentages of sand and silt ranging from sand with trace silt to sandy silt. The fill at Borehole 1 contained trace gravel, organics, and rootlets. Brick fragments were observed within the fill to a depth of 0.9 m below existing grade at Borehole 1. The fill at Borehole 7 contained trace organics below 1.5 m depth.

The SPT "N"-values measured within the fill ranged from 3 to 10 blows per 300 mm of penetration, indicating a variable very loose to compact compactness condition. Natural moisture contents were measured between 5 and 18%, indicating a moist moisture condition. Elevated moisture contents are likely due to the presence of organics.

5.3 Upper Clayey Silt

Clayey silt was encountered underlying the topsoil at Boreholes 8, 9, 10 and 11 and the fill at Borehole 2 and extended to depths between 0.7 and 4.1 m below existing grades.

The deposit contained trace sand. Occasional sand lenses were observed within the deposit at Boreholes 2 and 8, and occasional silt seams/layers at Boreholes 8 and 11. The deposit at Borehole 10 contained frequent silt sandy silt seams.

Results of one (1) grain size distribution analyses of the clayey silt from Borehole 9 are shown graphically on Enclosure 15.

The SPT "N"-values measured within the cohesive deposits ranged from 7 to 19 per 300 mm of penetration. The undrained shear strengths obtained on the retrieved samples ranged from 120 to over 250 kPa. Based on the above test results, the deposit is considered to have a firm to very stiff consistency. Natural moisture contents were measured between 10 and 32%, and the plasticity was generally observed to range from at plastic limit to wetter than the plastic limit.

5.4 Fine Granular Deposits

Fine granular deposits were encountered underlying the fill at Boreholes 1 and 7, the topsoil at Boreholes 3, 4, 5, and 6 and the clayey silt at Boreholes 2, 8, 9, 10, and 11, and extended to a depth of 1.8 m at Borehole 9. Boreholes 1 to 8, 10, and 11 were terminated within the deposit at depths of 5.2 m below existing grades.

The fine granular deposits comprised varying amounts of sands and silts in the range of sand with trace silt to silt with trace sand. Traces of organics were observed within the deposit at Borehole 3 to a depth of 0.6 m. Traces of gravel were observed within the sand deposit at Borehole 9, and occasional gravelly seams at Boreholes 3 and 4. Traces of clay and occasional sandy seams were observed within the silt deposit at Borehole 8.

Results of three (3) grain size distribution analyses of the fine granular deposits from Boreholes 1, 4, and 6 are shown graphically on Enclosures 12 to 14.

The SPT “N”-values measured within the deposits ranged from 2 to 24 blows per 300 mm of penetration, indicating a variable very loose to compact compactness condition. Natural moisture contents were measured between 3 and 25%, indicating a damp to saturated moisture condition.

5.5 Lower Clayey Silt

Locally at Borehole 9, a lower clayey silt deposit was encountered. Borehole 9 was terminated within the deposit at a depth of 5.2 m below existing grade. The deposit contained trace sand, occasional sand seams, and occasional silt seams.

The SPT “N”-values measured within the lower clayey silt deposit ranged from 6 to 13 blows per 300 mm of penetration. The undrained shear strengths obtained on the retrieved samples ranged from 84 to 180 kPa. Based on the above test results, the deposit is considered to have a firm to stiff consistency. Natural moisture contents were measured between 16 and 25%, and the plasticity was generally observed to be at the plastic limit.

5.6 Soil Chemistry

Four (4) soil samples were submitted to AGAT Laboratories of Mississauga, Ontario for analysis of Metals and Inorganics, Petroleum Hydrocarbons (PHCs) F1 to F4, and Benzene, Toluene, Ethylbenzene and Xylene (BTEX). The chemical testing was conducted to assess the environmental quality of excess soils which will be removed off-site or re-used during construction.

The following table presents the location, depth, description, and parameters for each soil sample collected and submitted.

Sample I.D.	Sample Depth	Sample Description	Parameters Analyzed
BH 2 – SA 2	0.76 to 1.37 mbeg	Clayey Silt (Native)	Metals, Inorganics, PHCs (F1-F4), BTEX
BH 5 – SA 2	0.76 to 1.37 mbeg	Silty Sand to Sand and Silt (Native)	Metals, Inorganics, PHCs (F1-F4), BTEX
BH 7 – SA 1	0.35 to 0.61 mbeg	Sand and Silt (Fill)	Metals, Inorganics, PHCs (F1-F4), BTEX
BH 9 – SA 1	0.20 to 0.61 mbeg	Clayey Silt (Fill)	Metals, Inorganics, PHCs (F1-F4), BTEX

Notes: 1. mbeg: meters below existing grade

The results and laboratory certificates of chemical analysis provided by AGAT Laboratories of Mississauga, Ontario are enclosed in Appendix “B”. A comparison of the soil chemistry results to the applicable regulatory standard is included in Appendix “C”.

5.7 Groundwater

Groundwater conditions were monitored during sampling and upon removal of the drilling augers at all borehole locations. Boreholes 1 to 6 and 10 remained open upon withdrawal of drilling augers with groundwater measured at depths between 1.2 and 4.0 m below existing grades. Boreholes 7 and 8 remained open and dry upon withdrawal of drilling augers.

In addition, four (4) monitoring wells were installed at 720 Erbsville Road in 2006 and monitored by Naylor Engineering Associates Ltd. and Stantec from 2006 to 2022. The groundwater elevations were measured at depths between 0.4± and 7.8± m below existing grades, corresponding to elevations between 346.8± and 349.9± m.

Two (2) monitoring wells were installed at Boreholes 9 and 11 to determine the groundwater level/elevation at 672 Erbsville Road. The following table provides the water level readings taken on December 14, 2023.

Borehole No.	Existing Ground Elevation (m)	Water Level Below Existing Ground Surface (m)	Water Level Elevation (m)
9	350.12	1.66	348.46
11	348.84	0.90	347.94

Based on the measured/observed groundwater levels in the monitoring wells, moisture contents, and the conditions in the boreholes upon withdrawal of the drilling augers during sampling, the groundwater table at 672 Erbsville Road is considered to be located at depths between 0.9± and 1.7± m below existing grades, corresponding to elevations between 346.5± and 348.5± m. The groundwater table at 720 Erbsville Road is considered to be located at depths between 0.4± and 7.8± m below existing grades, corresponding to elevations between 346.8± and 349.9± m.

It is noted that the groundwater table will fluctuate in response to major weather events. Seasonal fluctuations of the groundwater table are to be expected.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is proposed to construct 187 units of townhouses at 720 Erbsville Road. The design of 672 Erbsville Road was not available at time of this reporting, but it is understood that townhouses are being contemplated at the site. Paved driveway and parking are provided throughout the property. A SWM facility is proposed at the north end of the property. The finished floor elevations of the townhouses were not available at the time of reporting.

In general, loose to compact fill materials varying in percentages of sand and silt were encountered underneath the surficial topsoil and/or granular fill at Boreholes 1, 2, and 7 and extended to depth between 0.7 and 2.2 m below existing grades. Native firm to very stiff cohesive deposits and very loose to compact fine granular deposits were encountered underlain the above-described soils to depths of 5.2 m, the maximum depth of exploration.

The groundwater table at 672 Erbsville Road is considered to be located at depths between 0.9± and 1.7± m below existing grades, corresponding to elevations between 346.5± and 348.5± m. The groundwater table at 720 Erbsville Road is considered to be located at depths between 0.4± and 7.8± m below existing grades, corresponding to elevations between 346.8± and 349.9± m.

6.2 Basement Construction

The finalized site plan and building/townhouse block deigns were not available at the time of reporting, however, it is anticipated that basements are expected to be incorporated in the designs.

The groundwater table at 672 Erbsville Road is considered to be located at depths between 0.9± and 1.7± m below existing grades, corresponding to elevations between 346.5± and 348.5± m. The groundwater table at 720 Erbsville Road is considered to be located at depths between 0.4± and 7.8± m below existing grades, corresponding to elevations between 346.8± and 349.9± m.

Due to the high permeability of the native fine granular deposits in the areas of Boreholes 1 to 7, the basement floor level must be established at least 0.6 m higher than the high groundwater table. It is further recommended that the extent of the saturated granular material can be determined by test pits.

In the areas of Borehole 8 to 11 where the very low-permeability clayey silt deposit would typically create only very modest seepage towards basements, groundwater can be easily and appropriately managed using conventional basement/foundation drainage systems (i.e., conventional weeping tile and sump pump drainage systems). Positive exterior grade adjacent to the basement will direct surface water away from the building preventing surface water infiltration.

6.3 Site Grading and Engineered Fill Construction

The finished floor elevation and finished site grading plan were not available at the time of reporting, however, based upon the topography of the site, regrading is anticipated. It is recommended to construct engineered fill in areas to be raised and to remedy existing poor bearing-support soils in order to suitably support the future roadway, infrastructure servicing, and building structures. Engineered fill is considered a suitable and feasible option to remedy existing non-suitable soil conditions and will allow for construction of foundations at more desirable elevations.

Based on the results of the boreholes, fill materials and very loose to loose native soil conditions were encountered at all eleven (11) boreholes and extended to depths between 0.7± and 2.3± m below existing grades. Fill materials and very loose to loose fine granular deposits will need to be excavated and replaced with engineered fill.

The onsite fine granular soils cut from the higher areas can be reused for engineered fill construction to support building foundations and floor slabs. Any shortfall of material can be made up with imported OPSS Granular B Type I or similar gradation soil. The natural moisture content of approved soil used to construct engineered fill should be within 3% below its optimum moisture content to achieve the specified degree of compaction. Judicious addition of water can be expected in order to achieve suitable compaction, especially if the work is carried out during dry periods.

It is recommended that any off-site borrow source materials be tested prior to importing, in order to ensure that the environmental quality of the fill meets all environmental approval criteria and to ensure that the natural moisture content of the fill is suitable for compaction.

The cohesive soils located in the areas of Boreholes 8 to 11 are considered frost susceptible. Constructing engineered fill, backfilling footings, foundation walls and service trenches using the onsite soils during wet or sub-zero periods of the year is not advisable unless strict procedures are followed and monitored on a full-time basis by the geotechnical engineer. Backfilling local excavations (such as foundation walls, footings, and trenches inside the building) should be performed using onsite granular soils or imported OPSS Granular B Type I.

The cohesive soils are susceptible to softening and deformation when exposed to excessive moisture and construction traffic. As a result, it is imperative that the grading/filling operations are planned and maintained to direct surface water run-off to low points and then be positively drained by suitable means. During periods of wet weather, construction traffic should be directed along the designated construction routes so as not to disturb and rut the exposed subgrade soil. Temporary construction roads consisting of clear crushed material (such as crushed stone or recycled concrete) may be required during poor weather conditions such as wet Spring or Fall.

It is recommended that site grading and engineered fill be constructed during the summer and early fall months when drier warmer weather conditions typically exist as the onsite finer grained and cohesive soils are sensitive to moisture and will become difficult to handle and compact to the specified degree of compaction when wet.

Engineered fill should be constructed in accordance with the following procedures in order to support building foundations and floor slabs:

1. All fill, any deleterious materials and very loose to loose/firm native soils are to be excavated/removed to expose the underlying competent native subgrade soil within the building areas. The inorganic fine granular material should be separately stockpiled and reused for engineered fill construction;

2. The exposed inorganic earth subgrade is to be thoroughly recompacted by large heavy compaction equipment (10 tonne recommended) and inspected by qualified geotechnical personnel. Any loose or soft areas identified should be excavated to the level of competent soil;

3. If a wet/saturated subgrade condition is encountered, the initial lift to raise the grade will require coarse pit run sand and gravel, 450 to 600 mm thick and be statically rolled in order to stabilize and "bridge" the prepared subgrade;

4. The required grades can then be achieved by placing approved on-site soils (or imported OPSS Granular B Type I) in maximum 300 mm thick loose lifts and compacting to a minimum of 100% Standard Proctor maximum dry density (SPMDD) to the underside of the proposed footings. Compaction in the out-door pavement areas and for the support of floor slabs should be at least 95% SPMDD. The moisture content of all fill materials should be within 3% below their optimum moisture contents to achieve the specified degrees of compaction;

5. Engineered fill used to support future building foundations and floor slabs must be placed such that the fill pad extends horizontally outwards from all footings at least the same distance as how thick the engineered fill pad will exist between the underside of future footings and the approved native earth subgrade; and

6. All fill placement and compaction operations must be supervised on a full-time basis by qualified geotechnical personnel to approve fill material and ensure the specified degrees of compaction have been achieved.

Footings cast on approved engineered fill can be designed using a Geotechnical Reaction of 100 kPa at SLS and a Factored Geotechnical Resistance of 150 kPa at ULS.

Vibration could be generated from various construction equipment during construction, such as compactors and rollers which could be harmful to surrounding structures and buildings. Peak particle velocity (PPV) of ground motion is widely accepted as the best descriptor of potential for vibration damage to structures. The safe vibration limit can be set to 8 to 25 mm/s PPV, depending on the sensitivity of surrounding structures to vibration.

Vibration monitoring can be carried out to measure the PPV of ground motion from vibration generated from typical compaction equipment at the beginning of the project in the potentially critical areas. This will set criteria and establish the type of equipment to be used for this project.

6.4 Footing Foundations

Conventional strip and spread footing foundations can be used to support the proposed townhouses. Footings cast on competent native fine granular deposits, cohesive deposits, or engineered fill (constructed in accordance with the procedures provided in Section 6.3) can be designed using a Geotechnical Reaction of 100 kPa at SLS and a Factored Geotechnical Resistance at of 150 ULS.

These soil bearing pressures can be achieved provided that the founding subgrade is undisturbed during construction. The majority of the settlements will take place during construction and the first loading cycle of the building. The maximum total and differential settlements of footings designed to the above recommended soil bearing pressure are expected to be less than 25 and 20 mm, respectively, and these are considered tolerable for the structure being contemplated.

The following table summarizes the highest founding level and elevation for the footing at each borehole location:

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	350.75	2.15	348.60
2	349.16	0.86	348.30
3	349.17	0.77	348.40
4	349.54	0.74	348.80
5	349.10	0.70	348.40
6	351.94	1.44	350.50
7	354.05	2.25	351.80
8	351.85	0.75	351.10
9	350.12	0.72	349.40
10	347.73	0.73	347.00
11	348.84	0.74	348.10

In addition, the footings should be founded below any existing fill materials on competent native undisturbed soils. Spacing between adjacent footing steps should not be steeper than 10H to 7V.

It is recommended that a lean concrete mat be placed over approved footing subgrade in wet or saturated areas to prevent further disturbance to the bearing soils resulting from construction activities.

Exterior footings and footings in unheated portions of the building should be provided with a soil cover of not less than 1.2 m or equivalent synthetic thermal insulation for adequate frost protection. The founding subgrade soils must be protected from frost penetration during winter construction.

It is recommended that the footing excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper subgrade preparation.

6.5 Site Servicing

It is anticipated that the site will be serviced with municipal services and pipe invert depths are assumed to be in the order of 1.5± to 3.0± m below finished grades.

6.5.1 Excavation Conditions

Trenching can be carried out using conventional open cut procedures. The excavations will generally intersect very loose to compact fill, very loose to compact fine granular deposits, and/or firm to stiff clayey silt which will generally provide suitable subgrade support to sewer and watermain serving. Any loose/soft, unstable and/or organic soils encountered at the pipe invert should be sub-excavated and replaced with well compacted Granular "A" which should be placed in 150 mm thick layers and compacted to at least 95% Standard Proctor Maximum Dry Density (SPMDD). The support of pipes in these areas can also be achieved with non-shrinkable fill if poor soil is encountered at the subgrade level and fully removed.

Above the groundwater table, excavations in the Type 3 Soils are expected to remain stable during the construction period provided that side slopes are cut to 1H : 1V from the bottom of the excavation. Where seepage or perched groundwater is encountered, side slopes should be cut to more stable angles of 3H : 1V. The side slopes should be suitably protected from erosion processes.

6.5.2 Pipe Bedding

As noted in Section 6.5.1, any unsuitable soils exposed at the pipe subgrade should be sub-excavated and replaced with imported Granular "A", placed in thin layers, and compacted to at least 95% SPMDD, or can be removed and supported on non-shrinkable fill.

The bedding requirements for the services should be in accordance with Ontario Provincial Standard Drawings OPSD - 802 for flexible and rigid pipes. The bedding shall be a Class "B" and consist of at least 150 mm thick Granular "A" compacted to at least 95% SPMDD. Granular "A" should be used to backfill around the pipe to at least 150 mm above the top of the pipe.

Particular attention should be given to ensure material placed beneath the haunches of the pipe is adequately compacted. Recycled asphalt will not be allowed to be used in Granular “A” bedding material.

6.5.3 Trench Backfill

Excavated inorganic materials are considered suitable for reuse as trench backfill. If necessary, potential mixing of drier and wetter excavated soils in proper ratios can be done to produce a suitable mixture near the material's optimum moisture content in order to achieve the required compaction specification. Conversely, judicious addition of water may be required if the soils are significantly drier than their optimum moisture content in order to facilitate suitable compaction.

The backfill should be placed in thin layers, 300 mm thick or less dependant on the demonstrated success of compaction based on in-situ density test results. Other types of materials such as organic soils, overly wet soils, boulders, and frozen materials (if work is carried out in the winter months) should not be used for backfilling. All trench backfill should be compacted to at least 95% SPMDD.

Backfilling operations should follow closely after excavation so that only a minimal length of trench slope is exposed at any one time so as to minimize potential problems. This will potentially minimize over-wetting of the subgrade material. Particular attention should be given to make sure frozen material is not used as backfill should construction extend into the winter season.

It has been our experience that excavated cohesive soils should be broken into smaller pieces (less than 150 mm diameter) before returning into the trench as backfill. This will eliminate "wedging" problems and reduce long term settlement. Particular attention must be made to backfilling the laterals where the trenches are narrow and against the manholes and catch-basins. Thinner lifts and additional compaction must be applied.

Frequent inspection by experienced geotechnical personnel should be carried out to examine and approve backfill material, to carefully inspect placement, and to verify that the specified degree of compaction has been obtained by in situ density testing.

6.5.4 Groundwater Control

The groundwater table will likely be encountered during the installation of site servicing and construction works. It should be noted that the groundwater table can be expected to fluctuate seasonally and with major weather events.

CVD recommends that test pits be dug during the tendering stage of the project, so that the potential contractors can examine the groundwater and soil conditions and arrive at suitable methods of excavation, groundwater control and backfilling based on their experience.

Where the exposed base subgrade and sidewall soils of the excavation comprises saturated granular deposits, it is recommended that groundwater be lowered and controlled to at least 0.6 m below the base of excavations to create and maintain a stable subgrade condition to facilitate pipe laying and backfilling operations, and to ensure cut slope stability.

In general, groundwater is expected to be controllable by pumping from several filtered sump pits (possibly together with intercept ditching) if the water table at the time of construction is located within

0.6 m above the required excavation level. If the water table at the time of construction is located higher than 0.6 m above the required excavation level, it is expected that pre-lowering of the groundwater table will be required prior to excavation. This may require the use of well points.

Pumping over 50,000 Litres/day is considered to be a "water taking" by the Ministry of Environment, Conservation and Parks (MECP) and is subject to the ministry's "Permit To Take Water (PTTW)" requirements. In March 2016, the Ministry provided an exemption from the permitting requirements for "construction-only" water takings that do not exceed 400,000 Litres/day. For these modest "construction-only" water takings, the water taking must still be "registered" on the MECP "Environmental Activity and Sector Registry (EASR)", but nevertheless a quicker and less formal process is now available to allow pumping to proceed.

In addition, the ministry has clarified that surface water from rainfall is not included in the water quantity and there is no time limitation for these regulated water takings, although a qualified person (QP) must still evaluate the water taking for all the same environmental impact issues and then indicate this through the online registration procedure. For all other water takings and construction water takings exceeding 400,000 Litres/day, a PTTW is still required along with a 90-day review process.

Based on the preliminary hydrological assessment, the construction water takings are not expected to exceed 400,000 Litres/day, hence only an application for EASR should be required.

6.6 Pavement Design and Construction

The earth subgrade soil is generally expected to consist of fine granular soils and/or cohesive soils. The following flexible pavement structure is recommended for the local residential roadway based on the results of the gradational analyses, assumed CBR values, groundwater table, frost susceptibility of subgrade soils and anticipated traffic volume.

Component	Light Duty Pavement (mm)	Heavy Duty Pavement (mm)
Asphaltic Concrete HL3 Asphaltic Concrete HL8	40 40	40 50
Granular "A" Base	150	150
Granular "B" Sub-base	300	400

The pavement design considers that pavement construction will be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base may be required.

The subgrade should be prepared in accordance with the recommendations provided in Section 6.3 and Section 6.5.3 prior to placement of the granular base layers.

The base and sub-base materials should be produced in accordance with the current OPSS specifications and placed and uniformly compacted to at least 100% SPMDD. The asphaltic concrete should be placed and compacted in accordance with OPSS Form 310 and to at least 92% of the Marshall Density (MRD). Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

It should be noted that even well-compacted trench backfill could settle for a period of time after construction. In this regard, the surface course of the asphaltic concrete should be placed at least one (1) year after trench backfill is completed so as to allow any minor settlements to occur within the trench backfill. The incomplete pavement structure may not be capable of supporting construction traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to paving with the base course and/or the surface course asphaltic concrete.

The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff away from buildings, sidewalks, and other similar pertinent structures. The roadway subgrade should be free of depressions and should have a 2% slope from the crown to the edge of the pavement.

Longitudinal sub-drains with positive drainage outlets are recommended to be installed at the subgrade level along the periphery and in low areas of the pavement construction to enhance the performance of the pavement. Systematic drainage of the granular base materials will promote the longevity of the pavement structure.

6.7 Earthquake Considerations

In accordance with The Ontario Building Code 2012 (OBC), the proposed structures should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8. Based on the anticipated condition of the engineered fill materials and the underlying soil condition encountered at the boreholes and our local experience with the upper 30 m of soil deposit underlying the site, the site can be classified as a **Site Class C** as per OBC Table 4.1.8.4.A (Page B4-24).

6.8 Floor Slab Construction

The floor slab for the proposed townhouses can be constructed as conventional slab-on-grade on the native fine granular deposit, cohesive deposit, or engineered fill. At the time of floor slab construction, the exposed subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer. Any soft and/or unstable areas detected should be replaced with imported granular fill which should be compacted to at least 95% SPMDD.

Following the proof-rolling of the subgrade, it is recommended that a minimum 150 mm thick layer of OPSS Granular “A” be placed and compacted to at least 100% SPMDD beneath the concrete floor slabs to provide uniform support.

A modulus of subgrade reaction (k_s) of 30 MN/m^3 may be used for the design of the floor slabs with a clayey silt subgrade, and 40 MN/m^3 for a fine granular subgrade.

The floor slabs should be separated structurally from the columns and foundation walls. Sawcut control joints should be provided at regular spacing (less than 30 times the concrete slab thickness) and to depths between one-third and one-quarter of the slab thickness.

Care should be taken to ensure that the backfill against foundation walls, interior piers/columns and concrete pits are placed in thin layers and each layer compacted to at least 95% SPMDD. These types of confined areas should be backfilled with imported granular soils such as OPSS Granular B Type I.

Moisture migration from the underlying soils through the concrete slab-on-grade will take place via "capillary action" and "diffusion" (due to vapour pressure differential). Although the Granular "A" layer will provide a capillary break, the low permeance of the concrete slab and floor coverings will result in 100% humidity under the concrete slab and, consequently, the moisture in the concrete will increase over time. The potential effect of the soil moisture should be considered in selecting the floor coverings. A vapour retarder material (such as a 15-mil poly, ASTM E-1745) can be placed to reduce soil moisture migration. Reference is made to ACI 302.

6.9 Lateral Earth Pressure

Basement walls and retaining walls should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used for these calculations. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$P = K (\gamma H + q)$

where:

P =	lateral earth pressure	kPa
K =	earth pressure coefficient, 0.5 for non-yielding foundation wall	
γ =	unit weight of granular backfill	21 kN/m^3
H =	unbalanced height of wall	m
q =	surcharge load at ground surface	kPa

The soils encountered in the areas of Boreholes 8 to 11 are not considered to be free-draining materials. A drainage core layer should be installed against basement walls in accordance with OBC requirements. The basement walls should be damp-proofed.

A perimeter drainage system is required to ensure hydrostatic pressure does not build up in the backfill against the foundation wall. The perimeter weeping tile system is to be installed at the base of the footing to direct the collected waters to sump pump installations or the storm sewer.

6.10 Infiltration Rates of Onsite Soils

It is understood that a stormwater management feature is to be considered at the site. It is noted that infiltration features should have the base located at least 1.0 m above the groundwater table and that a minimum infiltration rate of 15 mm/hr is required. The infiltration should also be located at least 5 m from the basement/footing drains.

Based on the results of grain size analyses and our experience, the hydraulic conductivity and infiltration rate of the native inorganic soil types encountered at the boreholes are estimated and provided in the following table and may be used for storm water management purposes:

Material	Hydraulic Conductivity (K) (cm/sec)	Infiltration Rate (mm/hr)
Fine Granular Deposits (Enclosures 12 to 14)	1×10^{-3} to 1×10^{-2}	30 to 100
Clayey Silt (Enclosure 15)	1×10^{-6}	1

7.0 GEO-ENVIRONMENTAL CONSIDERATIONS

Excess soil may be generated and removed off-site during the construction activities associated with the proposed site works. The management of excess soil is now governed by O.Reg. 406/19, MECP document entitled “On-Site and Excess Soil Management Regulation”. In accordance with the regulation, the Project Leader is responsible for the handling, storage, reuse, transportation, and removal of all soil. To support off-site removal of excess soil, the following is required:

- Planning Documentation
  - Assessment of Past Use
  - Sampling and Analysis Plan
  - Excess Soil Characterization Report
  - Excess Soil Destination Report
- Tracking
- Registry
- Record Keeping

An initial testing program was conducted during the geotechnical investigation and the analytical results are discussed in the following sections of this report. Additional soil sampling and analysis may be

required as per the above-noted MECP document and/or as per the requirement of the receiving site owner(s), depending on the volume of excess soil generated during construction. The analytical results and environmental assessment findings must be disclosed to the receiving site owner(s) and approval by the receiving site owner(s) be obtained prior to exporting/transferring the materials.

It is noted that the soils condition may differ between and beyond the sampled locations. If any impacted soils are discovered during construction, CVD should be contacted for further sampling and testing to determine the limit of the impacted soils.

Any soils identified during construction to have been environmentally impacted are to be separately stockpiled and analysed to determine the appropriate measures for handling and disposal. Waste characterization testing (TCLP) to classify the material for disposal as prescribed in O.Reg. 347/558 is required. Leachate analysis (mSPLP) is to be carried out if the excess soil is to be disposed to receiving sites under O.Reg. 406/19.

Similarly, groundwater encountered during construction works must also be suitably assessed and handled.

7.1 Applicable Regulatory Standards

The Soil, Ground Water and Sediment Standards for Use Under the New Soil Rules and Excess Soil Quality Standards established in accordance with the O.Reg. 406/19 as amended were consulted in the assessment of the soil at the project site.

The analytical results for soils were compared to the following “applicable regulatory standards”:

• Table 1 (Full Depth Background Site Condition Standards) for Residential/Parkland/Institutional/ Industrial/Commercial/Community Property Use

• Table 2.1 (Full Depth Generic Site Condition Standards in a Potable Ground Water Condition) for Residential/Parkland/Institutional Property Use

• Table 2.1 (Full Depth Generic Site Condition Standards in a Potable Ground Water Condition) for Industrial/Commercial/Community Property Use

7.2 Handling of Excess Soils

Four (4) soil samples were submitted to AGAT Laboratories of Mississauga, Ontario for analysis of metals and inorganics, Petroleum Hydrocarbons (PHCs F1 to F4) and Benzene-Toluene-Ethylbenzene-Xylene (BTEX). The chemical testing was conducted to initially assess the environmental quality of potential excess soil which may be generated and removed off-site during construction activities. The results and laboratory certificates of chemical analysis provided by AGAT Laboratories of Mississauga are enclosed in Appendix “B”. A comparison of the soil chemistry results to the applicable regulatory standard is included in Appendix “C”.

The analytical results for metals and inorganics including Electrical Conductivity (EC) and SAR indicate the tested soils do not exceed the allowable concentration limits under Table 1 and both Table 2.1 standards.

The analytical results for Petroleum Hydrocarbons (PHCs F1-F4) indicate that the tested soils do not exceed the allowable concentration limits under Table 1 and both Table 2.1 standards.

The analytical results for BTEX indicates that the tested soils do not exceed the allowable concentration limits under Table 1 and both Table 2.1 standards.

Any soils identified during construction to have been environmentally impacted are to be separately stockpiled and analysed to determine appropriate measures for handling and disposal. Waste characterization testing (TCLP) to classify the material for disposal as prescribed in Ontario Regulation 347/558 is required. Leachate analysis (mSPLP) is to be carried out if the excess soil is to be disposed to receiving sites under O.Reg. 406/19.

CVD further recommends that a disposal plan for excess soils be established to manage the quantity, as well as where and how the excess soils can be disposed of off-site.

8.0 CLOSURE

The Limitations of Report, as quoted in Appendix A, is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Brianna Cobbe, E.I.T.
Geotechnical Engineering Intern

Eric Y. Chung, M.Eng., P.Eng.
Principal Engineer

LICENSED PROFESSIONAL ENGINEER
E.Y. CHUNG
8345506
Mar 27, 2024
PROVINCE OF ONTARIO

APPENDIX A

LIMITATIONS OF REPORT

APPENDIX "A"

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The design recommendations given 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, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

APPENDIX B

SOIL CHEMISTRY RESULTS

AGAT Laboratories

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(519) 742-8979
ATTENTION TO: Brianna Cobbe
PROJECT: 1526
AGAT WORK ORDER: 23T099265
SOIL ANALYSIS REVIEWED BY: Sukhwinder Randhawa, Inorganic Team Lead
TRACE ORGANICS REVIEWED BY: Radhika Chakraberty, Trace Organics Lab Manager
DATE REPORTED: Dec 08, 2023
PAGES (INCLUDING COVER): 10
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

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Certificate of Analysis

AGAT WORK ORDER: 23T099265

PROJECT: 1526

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2023-11-30 **DATE REPORTED: 2023-12-08**

						SAMPLE DESCRIPTION:	BH 2 - SA 2	BH 5 - SA 2	BH 7 - SA 1	BH 9 - SA 1
						SAMPLE TYPE:	Soil	Soil	Soil	Soil
						DATE SAMPLED:	2023-11-23	2023-11-23	2023-11-23	2023-11-24
Parameter	Unit	G / S: A	G / S: B	G / S: C	RDL		5505985	5506023	5506024	5506025
Antimony	µg/g	1.3	7.5	40	0.8		<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]
Arsenic	µg/g	18	18	18	1		3[<A]	2[<A]	2[<A]	3[<A]
Barium	µg/g	220	390	670	2.0		40.1[<A]	7.1[<A]	36.8[<A]	51.6[<A]
Beryllium	µg/g	2.5	4	8	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	0.6[<A]
Boron	µg/g	36	120	120	5		11[<A]	5[<A]	<5[<A]	8[<A]
Boron (Hot Water Soluble)	µg/g	NA	1.5	2	0.10		<0.10[<B]	<0.10[<B]	0.11[<B]	<0.10[<B]
Cadmium	µg/g	1.2	1.2	1.9	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Chromium	µg/g	70	160	160	5		14[<A]	5[<A]	12[<A]	17[<A]
Cobalt	µg/g	21	22	80	0.8		6.0[<A]	1.9[<A]	4.3[<A]	6.8[<A]
Copper	µg/g	92	140	230	1.0		14.7[<A]	7.3[<A]	6.3[<A]	10.4[<A]
Lead	µg/g	120	120	120	1		7[<A]	4[<A]	9[<A]	8[<A]
Molybdenum	µg/g	2	6.9	40	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Nickel	µg/g	82	100	270	1		11[<A]	3[<A]	8[<A]	12[<A]
Selenium	µg/g	1.5	2.4	5.5	0.8		<0.8[<A]	<0.8[<A]	<0.8[<A]	<0.8[<A]
Silver	µg/g	0.5	20	40	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Thallium	µg/g	1	1	3.3	0.5		<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Uranium	µg/g	2.5	23	33	0.50		<0.50[<A]	<0.50[<A]	<0.50[<A]	<0.50[<A]
Vanadium	µg/g	86	86	86	2.0		23.4[<A]	10.5[<A]	23.1[<A]	27.7[<A]
Zinc	µg/g	290	340	340	5		57[<A]	44[<A]	66[<A]	50[<A]
Chromium, Hexavalent	µg/g	0.66	8	8	0.2		<0.2[<A]	<0.2[<A]	<0.2[<A]	<0.2[<A]
Cyanide, WAD	µg/g	0.051	0.051	0.051	0.040		<0.040[<A]	<0.040[<A]	<0.040[<A]	<0.040[<A]
Mercury	µg/g	0.27	0.27	0.27	0.10		<0.10[<A]	<0.10[<A]	<0.10[<A]	<0.10[<A]
Electrical Conductivity (2:1)	mS/cm	0.57	0.7	1.4	0.005		0.112[<A]	0.084[<A]	0.106[<A]	0.187[<A]
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	5	12	N/A		1.22[<A]	0.471[<A]	0.197[<A]	0.305[<A]
pH, 2:1 CaCl2 Extraction	pH Units				NA		7.48	7.51	7.25	7.32

Certified By:



Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 23T099265

PROJECT: 1526

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2023-11-30 **DATE REPORTED: 2023-12-08**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to O. Reg. 406/19 TABLE 1: Full Depth Background Site Condition - RPIC, B Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - RP, C Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - Com/Ind
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

5505985-5506025 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



Results relate only to the items tested. Results apply to samples as received.

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Certificate of Analysis

AGAT WORK ORDER: 23T099265

PROJECT: 1526

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2023-11-30

DATE REPORTED: 2023-12-08

						SAMPLE DESCRIPTION:	BH 2 - SA 2	BH 5 - SA 2	BH 7 - SA 1	BH 9 - SA 1
						SAMPLE TYPE:	Soil	Soil	Soil	Soil
						DATE SAMPLED:	2023-11-23	2023-11-23	2023-11-23	2023-11-24
Parameter	**Unit**	**G / S: A**	**G / S: B**	**G / S: C**	**RDL**		**5505985**	**5506023**	**5506024**	**5506025**
Benzene	µg/g	0.02	0.02	0.02	0.02		<0.02[<A]	<0.02[<A]	<0.02[<A]	<0.02[<A]
Toluene	µg/g	0.2	0.2	0.2	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
Ethylbenzene	µg/g	0.05		0.05	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
m & p-Xylene	µg/g				0.05		<0.05	<0.05	<0.05	<0.05
o-Xylene	µg/g				0.05		<0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.091	0.091	0.05		<0.05[<A]	<0.05[<A]	<0.05[<A]	<0.05[<A]
F1 (C6 to C10)	µg/g				5		<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	25	25	5		<5[<A]	<5[<A]	<5[<A]	<5[<A]
F2 (C10 to C16)	µg/g	10	10	26	10		<10[<A]	<10[<A]	<10[<A]	<10[<A]
F3 (C16 to C34)	µg/g	240	240	240	50		<50[<A]	<50[<A]	<50[<A]	<50[<A]
F4 (C34 to C50)	µg/g	120	2800	3300	50		<50[<A]	<50[<A]	<50[<A]	<50[<A]
Gravimetric Heavy Hydrocarbons	µg/g				50		NA	NA	NA	NA
Moisture Content	%				0.1		10.5	18.8	12.3	14.9
Surrogate	**Unit**	**Acceptable Limits**								
Toluene-d8	% Recovery	60-140					69	72	69	75
Terphenyl	%	60-140					86	71	96	73

Certified By: R. Chakraberty

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 23T099265

PROJECT: 1526

CLIENT NAME: CHUNG AND VANDER DOELEN

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2023-11-30 **DATE REPORTED: 2023-12-08**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to O. Reg. 406/19 TABLE 1: Full Depth Background Site Condition - RPIC, B Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - RP, C Refers to O. Reg. 406/19 TABLE 2.1: Full Depth Potable Ground Water Condition Volume Independent - Com/Ind
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

5505985-5506025 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

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Quality Assurance

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 23T099265

PROJECT: 1526

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

Soil Analysis

RPT Date: Dec 08, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	5505985	5505985	<0.8	<0.8	NA	< 0.8	118%	70%	130%	89%	80%	120%	108%	70%	130%
Arsenic	5505985	5505985	3	3	NA	< 1	106%	70%	130%	107%	80%	120%	111%	70%	130%
Barium	5505985	5505985	40.1	40.6	1.2%	< 2.0	114%	70%	130%	106%	80%	120%	109%	70%	130%
Beryllium	5505985	5505985	<0.5	<0.5	NA	< 0.5	119%	70%	130%	108%	80%	120%	117%	70%	130%
Boron	5505985	5505985	11	11	NA	< 5	93%	70%	130%	99%	80%	120%	103%	70%	130%
Boron (Hot Water Soluble)	5505985	5505985	<0.10	<0.10	NA	< 0.10	89%	60%	140%	90%	70%	130%	87%	60%	140%
Cadmium	5505985	5505985	<0.5	<0.5	NA	< 0.5	73%	70%	130%	106%	80%	120%	100%	70%	130%
Chromium	5505985	5505985	14	14	NA	< 5	117%	70%	130%	102%	80%	120%	117%	70%	130%
Cobalt	5505985	5505985	6.0	6.1	1.7%	< 0.8	111%	70%	130%	106%	80%	120%	108%	70%	130%
Copper	5505985	5505985	14.7	14.8	0.7%	< 1.0	107%	70%	130%	104%	80%	120%	98%	70%	130%
Lead	5505985	5505985	7	7	0.0%	< 1	104%	70%	130%	96%	80%	120%	89%	70%	130%
Molybdenum	5505985	5505985	<0.5	<0.5	NA	< 0.5	111%	70%	130%	106%	80%	120%	108%	70%	130%
Nickel	5505985	5505985	11	11	0.0%	< 1	112%	70%	130%	106%	80%	120%	107%	70%	130%
Selenium	5505985	5505985	<0.8	<0.8	NA	< 0.8	99%	70%	130%	113%	80%	120%	113%	70%	130%
Silver	5505985	5505985	<0.5	<0.5	NA	< 0.5	102%	70%	130%	103%	80%	120%	94%	70%	130%
Thallium	5505985	5505985	<0.5	<0.5	NA	< 0.5	104%	70%	130%	106%	80%	120%	98%	70%	130%
Uranium	5505985	5505985	<0.50	<0.50	NA	< 0.50	106%	70%	130%	105%	80%	120%	102%	70%	130%
Vanadium	5505985	5505985	23.4	23.7	1.3%	< 2.0	120%	70%	130%	101%	80%	120%	112%	70%	130%
Zinc	5505985	5505985	57	56	1.8%	< 5	113%	70%	130%	110%	80%	120%	101%	70%	130%
Chromium, Hexavalent	5510658		<0.2	<0.2	NA	< 0.2	107%	70%	130%	85%	80%	120%	81%	70%	130%
Cyanide, WAD	5506023	5506023	<0.040	<0.040	NA	< 0.040	93%	70%	130%	97%	80%	120%	89%	70%	130%
Mercury	5505985	5505985	<0.10	<0.10	NA	< 0.10	115%	70%	130%	106%	80%	120%	104%	70%	130%
Electrical Conductivity (2:1)	5505657		0.135	0.132	2.2%	< 0.005	92%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	5506146		0.180	0.164	9.3%	NA									
pH, 2:1 CaCl2 Extraction	5509990		6.69	6.95	3.8%	NA	102%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:



AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Quality Assurance

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 23T099265

PROJECT: 1526

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

Trace Organics Analysis

RPT Date: Dec 08, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	5505691		<0.02	<0.02	NA	< 0.02	110%	60%	140%	104%	60%	140%	74%	60%	140%
Toluene	5505691		<0.05	<0.05	NA	< 0.05	86%	60%	140%	111%	60%	140%	102%	60%	140%
Ethylbenzene	5505691		<0.05	<0.05	NA	< 0.05	111%	60%	140%	97%	60%	140%	84%	60%	140%
m & p-Xylene	5505691		<0.05	<0.05	NA	< 0.05	108%	60%	140%	87%	60%	140%	77%	60%	140%
o-Xylene	5505691		<0.05	<0.05	NA	< 0.05	106%	60%	140%	112%	60%	140%	99%	60%	140%
F1 (C6 to C10)	5505691		<5	<5	NA	< 5	106%	60%	140%	108%	60%	140%	95%	60%	140%
F2 (C10 to C16)	5505929		< 10	< 10	NA	< 10	107%	60%	140%	99%	60%	140%	105%	60%	140%
F3 (C16 to C34)	5505929		< 50	< 50	NA	< 50	106%	60%	140%	118%	60%	140%	116%	60%	140%
F4 (C34 to C50)	5505929		< 50	< 50	NA	< 50	80%	60%	140%	104%	60%	140%	81%	60%	140%
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
F2 (C10 to C16)	5510678		< 10	< 10	NA	< 10	112%	60%	140%	106%	60%	140%	98%	60%	140%
F3 (C16 to C34)	5510678		< 50	< 50	NA	< 50	107%	60%	140%	110%	60%	140%	107%	60%	140%
F4 (C34 to C50)	5510678		< 50	< 50	NA	< 50	67%	60%	140%	80%	60%	140%	87%	60%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: R. Chakraberty

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Method Summary

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 23T099265

PROJECT: 1526

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	SEGMENTED FLOW ANALYSIS
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

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Method Summary

CLIENT NAME: CHUNG AND VANDER DOELEN

AGAT WORK ORDER: 23T099265

PROJECT: 1526

ATTENTION TO: Brianna Cobbe

SAMPLING SITE:720 & 672 Erbsville Road, Waterloo

SAMPLED BY:Brianna Cobbe

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 to C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories
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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Chung & Vander Doelen Engineering Ltd.
Contact: Brianna Cobbe
Address: 311 Victoria Street North
Kitchener, ON, N2H 5E1
Phone: (519)505-6180 Fax:
Reports to be sent to:
1. Email: brianna.cobbe@cvdengineering.com
2. Email: nandou.zhao@cvdengineering.com

Project Information:

Project: 1526
Site Location: 720 & 672 Erbsville Road, Waterloo
Sampled By: Brianna Cobbe
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture *(Check One)* ☐ Coarse ☐ Fine

☑ Excess Soils R406
Table (Indicate One) T1 RPIICC & T2.1 RPI/ICC
☐ Regulation 558
☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm
Region
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 23T09965

Cooler Quantity: 1 large
Arrival Temperatures: 4.1 | 3.1 | 3.7
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: loose ice

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☑ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Potentially Hazardous or High Concentration (Y/N)
BH 2 - SA 2	11/23/23	AM PM	3	S			☑		☑								
BH 5 - SA 2	11/23/23	AM PM	3	S			☑		☑								
BH 7 - SA 1	11/23/23	AM PM	3	S			☑		☑								
BH 9 - SA 1	11/24/23	AM PM	3	S			☑		☑								
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Brianna Cobbe	11/30/23	12:00 PM	[signature]	11/30/23	14:20
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page _____ of _____
N°:

APPENDIX C

COMPARISON OF THE SOIL AND CHEMISTRY RESULTS TO THE APPLICABLE REGULATORY

ANALYTICAL RESULTS FOR SOIL

MECP Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, December 17, 2020 (O.Reg. 406/19)

		Table 1 Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community Property Use Standard	Table 2.1 Residential/ Parkland/ Institutional Property Use Standard	Table 2.1 Industrial/ Commercial/ Community Property Use Standard	BH 2 - SA 2	BH 5 - SA 2	BH 7 - SA 1	BH 9 - SA 1
Metals & Inorganics	Conductivity (mS/cm)	0.57	0.7	1.4	0.11	0.08	0.11	0.19
	% Moisture (%)	-	-	-	10.5	18.8	12.3	14.9
	pH (pH units)	-	-	-	7.48	7.51	7.25	7.32
	Cyanide, Weak Acid Diss (ug/g)	0.051	0.051	0.051	<0.040	<0.040	<0.040	<0.040
	SAR	2.4	5	12	1.2	0.5	0.2	0.3
	Antimony (Sb)	1.3	7.5	40	<0.8	<0.8	<0.8	<0.8
	Arsenic (As)	18	18	18	3	2	2	3
	Barium (Ba)	220	390	670	40.1	7.1	36.8	51.6
	Beryllium (Be)	2.5	4	8	<0.5	<0.5	<0.5	0.60
	Boron (B)	36	120	120	11	5	<5	8
	Boron (B), Hot Water Ext. Available	-	1.5	2	<0.10	<0.10	0.11	<0.10
	Cadmium (Cd)	1.2	1.2	1.9	<0.5	<0.5	<0.5	<0.5
	Chromium (Cr)	70	160	160	14	5	12	17
	Cobalt (Co)	21	22	80	6	1.9	4.3	6.8
	Copper (Cu)	92	140	230	14.7	7.3	6.3	10.4
	Lead (Pb)	120	120	120	7	4	9	8
	Mercury (Hg)	0.27	0.27	3.9	<0.10	<0.10	<0.10	<0.10
	Molybdenum (Mo)	2	6.9	40	<0.5	<0.5	<0.5	<0.5
	Nickel (Ni)	82	100	270	11	3	8	12
	Selenium (Se)	1.5	2.4	5.5	<0.8	<0.8	<0.8	<0.8
	Silver (Ag)	0.5	20	40	<0.5	<0.5	<0.5	<0.5
	Thallium (Tl)	1	1	3.3	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	2.5	23	33	<0.50	<0.50	<0.50	<0.50
	Vanadium (V)	86	86	86	23.4	10.5	23.1	27.7
	Zinc (Zn)	290	340	340	57	44	66	50
	Chromium, Hexavalent	0.66	8	8	<0.2	<0.2	<0.2	<0.2
Petroleum Hydrocarbons F1-F4	F1 (C6-C10)	25	55	55	<5	<5	<5	<5
	F2 (C10-C16)	10	98	230	<10	<10	<10	<10
	F3 (C16-C34)	240	300	1700	<50	<50	<50	<50
	F4 (C34-C50)	120	2800	3300	<50	<50	<50	<50
BTEX	Benzene	0.02	0.21	0.32	<0.02	<0.02	<0.02	<0.02
	Ethylbenzene	0.05	1.1	1.1	<0.05	<0.05	<0.05	<0.05
	Toluene	0.2	2.3	6.4	<0.05	<0.05	<0.05	<0.05
	Xylenes (Total)	0.05	3.1	26	<0.05	<0.05	<0.05	<0.05

NOTES:

1. Units = ug/g
2. "-" - Paramater not included in chemical analysis
3. "nv" - no value
4. Test results shown in highlighted text exceed the Table 1 Standard for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
5. Test results shown in highlighted text exceed the Table 2.1 Standard for Volume Independent Soil for Residential/Parkland/Institutional Property Use
6. Test results shown in highlighted text exceed the Table 2.1 Standard for Volume Independent Soil for Industrial/Commercial/Community Property Use

ENCLOSURES

Soil Abbreviations and Terms Used on Record of Borehole Sheets

TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	-	mixture of soil and humus capable of supporting vegetation
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm		
Silt	0.002 to .075mm		
Sand	0.075 to 4.75mm		
		Fine	0.075 to 0.425 mm
		Medium	0.425 to 2.0 mm
		Coarse	2.0 to 4.75 mm
Gravel	4.75 to 75mm		
		Fine	4.75 to 19 mm
		Coarse	19 to 75 mm
Cobbles	75 to 300mm		
Boulders	>300mm		

TERMINOLOGY

Soil Composition	**% by Weight**
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60˚ conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	**(P.S.F.)**	**Nominal 'N' Value**
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil
DTPL- Drier than plastic limit
APL- About plastic limit
WTPL- Wetter than plastic limit
MWTPL- Much wetter than plastic limit

Cohesionless Soil
Damp
Moist
Wet
Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample (obtained from SPT)	**GS**	Grab Sample	**PP**	Pocket Penetrometer
		BS	Bulk Sample	**VANE**	Peak & Remolded shear
AS	Auger Sample	**TW**	Thin Wall Sample or Shelby Tube	**DMT**	Flat Plate Dilatometer

LABORATORY TESTS

SG	Specific Gravity	**S**	Sieve Analysis	**W**	Water Content
H	Hydrometer	**P**	Field Permeability	**K**	Lab Permeability
W_p	Plastic Limit	**W_l**	Liquid Limit	**I_p**	Plasticity Index
GSA	Grain Size Analysis	**C**	Consolidation	**UNC**	Unconfined compression

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Enclosure A

Enclosure No.: 1
Sheet 1 of 1

FILE No: 1526

BOREHOLE No. 1

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

Ground Elevation: **350.75 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE
350.75 / 0.00	50 mm GRANULAR FILL				
	loose to compact dark brown to black FILL, sandy silt, trace gravel trace organics contains brick fragments moist	0.5	1	SS	7
349.85 / 0.90	compact to very loose dark brown FILL, sand and silt to silty sand trace rootlets moist	1.0 1.5	2 3	SS SS	10 3
348.65 / 2.10	moist --- very loose to compact brown SILTY SAND to SAND AND SILT saturated	2.0 2.5 3.0 3.5 4.0 4.5	4 5 6	SS SS SS	11 11 20
345.55 / 5.20	End of Borehole	5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5			

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

- water level at depth of 3.2 m bgs upon withdrawal of drilling augers
- borehole open upon withdrawal of drilling augers

PROJECT MANAGER: **EYC**

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Enclosure No.: 2
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FILE No: 1526

BOREHOLE No. 2

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

Ground Elevation: **349.16 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	WELL DATA	REMARKS
348.93	230 mm TOPSOIL						
0.23	loose, dark brown FILL, sand and silt moist	0.5	1	SS	6		
348.46							
0.70	dark brown, sand and silt layer						
	------	1.0	2	SS	10	▽	water level at depth of 1.2 m bgs upon withdrawal of drilling augers
	stiff, brown CLAYEY SILT, trace sand occ. sand lenses APL						
347.66		1.5					
1.50	compact brown SILTY SAND to SAND AND SILT saturated	2.0	3	SS	13		
		2.5	4	SS	14		
		3.0					
		3.5	5	SS	12		
		4.0					
		4.5					
	------	5.0	6	SS	21		
343.96	grey below 5.0 m						
5.20	End of Borehole						borehole open upon withdrawal of drilling augers

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

PROJECT MANAGER: **EYC**

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Enclosure No.: 3
Sheet 1 of 1

FILE No: 1526

BOREHOLE No. 3

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

SOIL LITHOLOGY

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL
	Ground Elevation: **349.17 m**		
348.97	200 mm TOPSOIL		
0.20	dark brown silt layer trace organics ------- occ. gravelly seams ------ loose to compact brown Fine to Medium SAND trace to some silt saturated	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0	
345.07			
4.10	compact brown SAND AND SILT saturated ------ grey below 4.9 m	4.5 5.0	
343.97			
5.20	End of Borehole	5.5 6.0 6.5 7.0 7.5 8.0 8.5	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	4
2	SS	10
3	SS	12
4	SS	19
5	SS	14
6	SS	17

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- water level at depth of 1.2 m bgs upon withdrawal of drilling augers
- borehole open upon withdrawal of drilling augers

PROJECT MANAGER: **EYC**

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CVD BOREHOLE (2017) 1526 672 & 720 ERBSVILLE ROAD, WATERLOO.GPJ CVD_ENG.GDT 24-2-15

Enclosure No.: 4
Sheet 1 of 1

FILE No: 1526

BOREHOLE No. 4

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	WELL DATA	DEPTH (m)	REMARKS
	Ground Elevation: **349.54 m**								
349.29	250 mm TOPSOIL								
0.25	very loose, brown SILT, trace sand moist	0.5		1	SS	3		0.5	
348.84									
0.70	compact, brown Fine to Medium SAND trace silt occ. gravelly seams moist	1.0		2	SS	21		1.0	
348.14									
1.40	compact to loose brown SAND AND SILT to SANDY SILT	1.5		3	SS	15		1.5	
		2.0					▽	2.0	water level at depth of 2.1 m bgs upon withdrawal of drilling augers
		2.5		4	SS	9		2.5	
		3.0						3.0	
		3.5		5	SS	16		3.5	
	------ grey below 4.1 m	4.0						4.0	
		4.5		6	SS	14		4.5	
344.34		5.0						5.0	
5.20	End of Borehole	5.5						5.5	borehole open upon withdrawal of drilling augers
		6.0						6.0	
		6.5						6.5	
		7.0						7.0	
		7.5						7.5	
		8.0						8.0	
		8.5						8.5	

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

PROJECT MANAGER: **EYC**

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FILE No: 1526

BOREHOLE No. 5

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	WELL DATA	DEPTH (m)	REMARKS
	Ground Elevation: **349.10 m**								
348.85	250 mm TOPSOIL								
0.25	moist ------ loose to compact brown SILTY SAND to SANDY SILT saturated	0.5		1	SS	5		0.5	
		1.0		2	SS	11		1.0	
		1.5		3	SS	11	▽	1.5	water level at depth of 1.5 m bgs upon withdrawal of drilling augers
		2.0						2.0	
		2.5		4	SS	12		2.5	
		3.0						3.0	
		3.5		5	SS	16		3.5	
		4.0						4.0	
		4.5		6	SS	21		4.5	
343.90		5.0						5.0	
5.20	End of Borehole	5.5						5.5	borehole open upon withdrawal of drilling augers
		6.0						6.0	
		6.5						6.5	
		7.0						7.0	
		7.5						7.5	
		8.0						8.0	
		8.5						8.5	

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

PROJECT MANAGER: **EYC**

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Enclosure No.: 6
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FILE No: 1526

BOREHOLE No. 6

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

Ground Elevation: **351.94 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	REMARKS
351.74	200 mm TOPSOIL					
0.20	loose, dark brown SILT, some sand moist	0.5	1	SS	5	
351.24						
0.70	loose to compact brown Fine SAND trace to some silt moist	1.0	2	SS	7	
		1.5				
		2.0	3	SS	11	
		2.5				
		3.0	4	SS	13	
		3.5				
		4.0	5	SS	11	water level at depth of 4.0 m bgs upon withdrawal of drilling augers
	------ saturated below 4.4 m	4.5				
		5.0	6	SS	13	
346.74						
5.20	End of Borehole					borehole open upon withdrawal of drilling augers

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

PROJECT MANAGER: **EYC**

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FILE No: 1526

BOREHOLE No. 7

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 23 - 23** TO **Nov 23 - 23**

Ground Elevation: **354.05 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE
353.70	350 mm TOPSOIL	0.0			
0.35	very loose, dark brown FILL, sand and silt moist	0.5	1	SS	3
353.05		1.0	2	SS	3
1.00	very loose, brown FILL, sand, trace silt moist ------ trace organics	1.5	3	SS	4
351.85		2.0			
2.20	very loose to compact brown Fine SAND trace silt moist	2.5	4	SS	12
		3.0	5	SS	15
		3.5			
		4.0			
		4.5	6	SS	24
348.85		5.0			
5.20	End of Borehole	5.5			
		6.0			
		6.5			
		7.0			
		7.5			
		8.0			
		8.5			

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

borehole open and dry upon withdrawal of drilling augers

PROJECT MANAGER: **EYC**

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FILE No: 1526

BOREHOLE No. 8

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 24 - 23** TO **Nov 24 - 23**

SOIL LITHOLOGY

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE
	Ground Elevation: **351.85 m**					
351.65	200 mm TOPSOIL					
0.20	firm to very stiff brown CLAYEY SILT trace sand occ. sand seams occ. silt seams APL ------ grey below 2.2 m	0.5		1	SS	7
		1.0		2	SS	7
		1.5		3	SS	19
		2.0				
		2.5		4	SS	16
		3.0				
		3.5		5	SS	12
347.75		4.0				
4.10	compact, grey SILT trace sand, trace clay occ. sandy seams saturated	4.5				
		5.0		6	SS	13
346.65						
5.20	End of Borehole					
		5.5				
		6.0				
		6.5				
		7.0				
		7.5				
		8.0				
		8.5				

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

borehole open and dry upon withdrawal of drilling augers

PROJECT MANAGER: **EYC**

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FILE No: 1526

BOREHOLE No. 9

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Hollow Stem Auger**
Size: **83 mm I.D.**
Date: **Nov 24 - 23** TO **Nov 24 - 23**

SOIL LITHOLOGY

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL
	Ground Elevation: **350.12 m**		
349.92	200 mm TOPSOIL		
0.20	stiff, dark brown CLAYEY SILT, trace sand APL		
349.42			
0.70	compact, brown SANDY SILT wet		
348.92			
1.20	compact, brown Fine to Medium SAND trace gravel, trace to some silt moist		
348.32			
1.80	brown ------ stiff to firm grey CLAYEY SILT trace sand occ. sand seams occ. silt seams APL		
344.92			
5.20	End of Borehole		

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	8
2	SS	14
3	SS	12
4	SS	13
5	SS	6
6	SS	9
7	SS	7

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- steel monument casing set in concrete
- bentonite seal/50 mm I.D. PVC riser
- water level measured at 1.66 m depth on December 14, 2023
- 3.0 m long, 50 mm I.D. PVC screen with sandpack

PROJECT MANAGER: **EYC**

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Enclosure No.: 10
Sheet 1 of 1

FILE No: 1526

BOREHOLE No. 10

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Solid Stem Auger**
Size: **152 mm O.D.**
Date: **Nov 24 - 23** TO **Nov 24 - 23**

SOIL LITHOLOGY

Ground Elevation: **347.73 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)
347.58	150 mm TOPSOIL	
0.15	brown silty sand layer	0.5
	------	
	stiff grey CLAYEY SILT trace sand	1.0
	freq. sandy silt seams	1.5
	APL to WTPL	2.0
		2.5
		3.0
		3.5
344.03		
3.70	loose to very loose grey SANDY SILT to SAND AND SILT	4.0
	saturated	4.5
		5.0
342.53		
5.20	End of Borehole	5.5
		6.0
		6.5
		7.0
		7.5
		8.0
		8.5

SYMBOL

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	11
2	SS	10
3	SS	9
4	SS	10
5	SS	10
6	SS	7
7	SS	2

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

DEPTH (m)

REMARKS

- water level at depth of 1.2 m bgs upon withdrawal of drilling augers
- borehole open upon withdrawal of drilling augers
- Dynamic Cone Penetration Testing (DCPT) conducted at depths between 5.2 and 8.5 m

PROJECT MANAGER: **EYC**

CHUNG & VANDER DOELEN ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1526

BOREHOLE No. 11

Client: **Sunvest Group of Companies**

Project: **Proposed Townhouse Development**

Location: **672 and 720 Erbsville Road, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME 55**
Method: **Hollow Stem Auger**
Size: **83 mm I.D.**
Date: **Nov 24 - 23** TO **Nov 24 - 23**

Ground Elevation: **348.84 m**

ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SAMPLE ID	TYPE	N-VALUE	REMARKS
348.67 / 0.18	175 mm TOPSOIL					steel monument casing set in concrete
	stiff, brown CLAYEY SILT trace sand; occ. silt seams/layers; APL to WTPL; ------ grey below 1.5 m	0.5	1	SS	8	bentonite seal/50 mm I.D. PVC riser
		1.0	2	SS	12	water level measured at 0.90 m depth on December 14, 2023
		1.5	3	SS	10	
346.64 / 2.20	compact grey SANDY SILT to SAND AND SILT; saturated	2.0				
		2.5	4	SS	12	
		3.0	5	SS	22	3.0 m long, 50 mm I.D. PVC screen with sandpack
		3.5				
		4.0				
		4.5	6	SS	21	
343.64 / 5.20	End of Borehole	5.0				
		5.5				
		6.0				
		6.5				
		7.0				
		7.5				
		8.0				
		8.5				

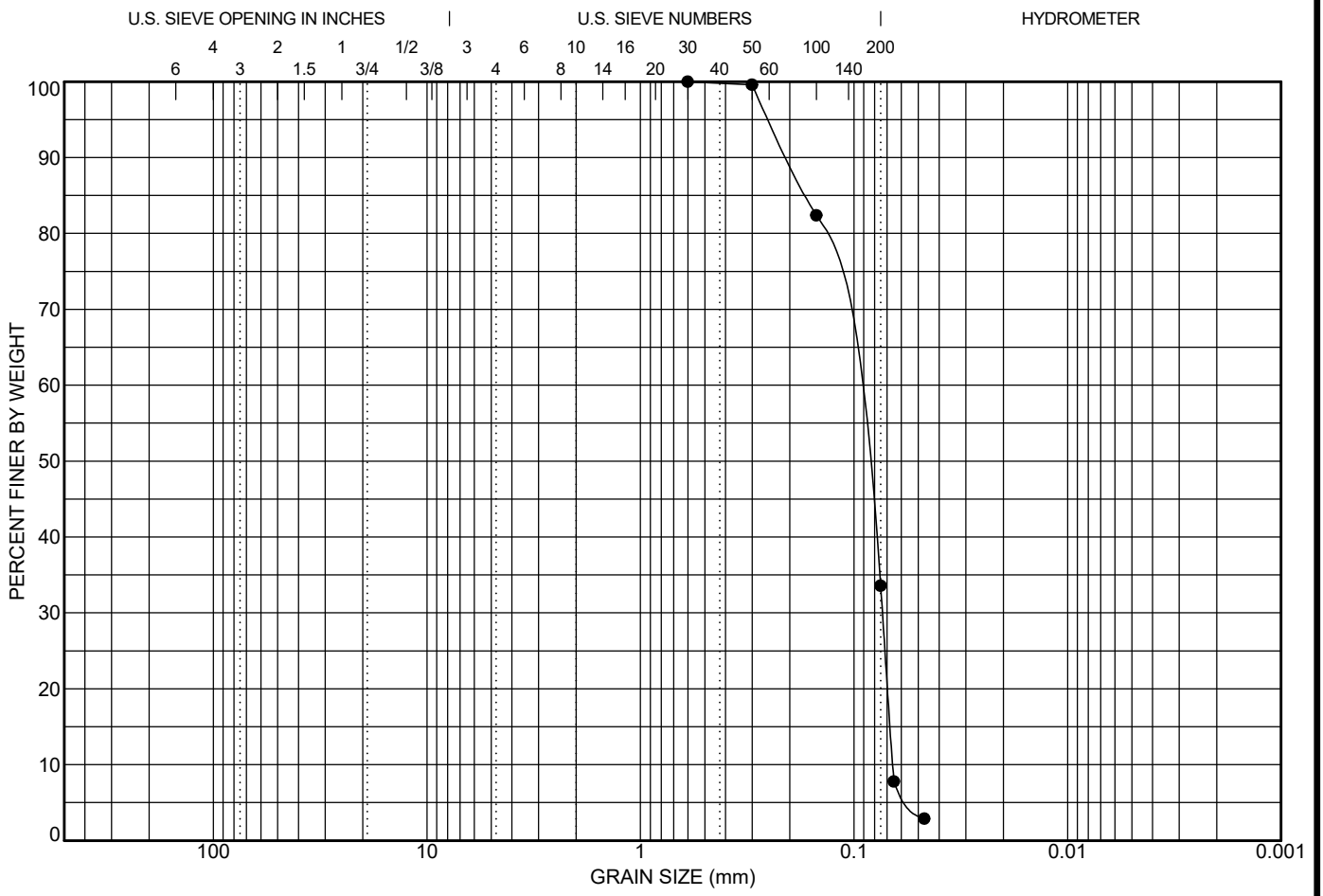
SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

PROJECT MANAGER: **EYC**

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.75	1.66	0.6	0.109	0.074	0.066	0.0	66.4	33.6	

Date: Jan. 25 - 2024
Client: Sunvest Group of Companies
Contractor:
Source:
Sampled From: BH 1 - SA 4; 2.29 to 2.90 m depth
Sample No.: 1-4
Date Sampled: Nov. 23 - 2023
Sampled By: BC
Lab No.: 005
Date Tested: Jan. 08 - 2024
Type of Material: Silty Sand

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

GRAIN SIZE DISTRIBUTION

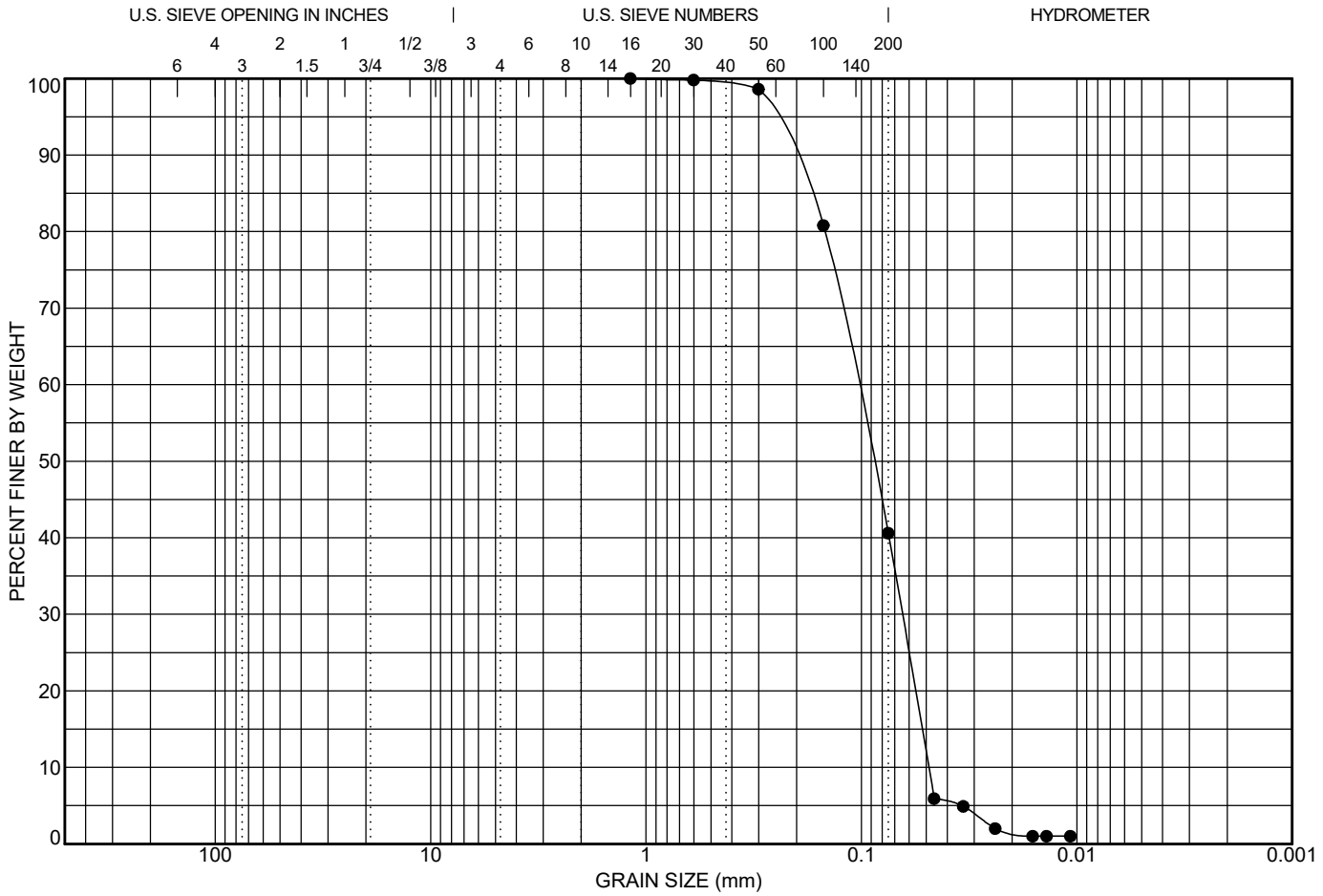
Project: Proposed Townhouse Development

Location: 672 and 720 Erbsville Road, Waterloo, Ontario

File No.: 1526

Enclosure No.: 12

DM - NO SPECIFICATIONS 1526 672 & 720 ERBSVILLE ROAD, WATERLOO.GPJ LAW LNDN.GDT 24-1-25



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.82	2.15	1.18	0.105	0.065	0.049	0.0	59.4	40.6	

Date: Jan. 25 - 2024
Client: Sunvest Group of Companies
Contractor:
Source:
Sampled From: BH 4 - SA 3; 1.52 to 2.13 m depth
Sample No.: 4-3
Date Sampled: Nov. 23 - 2023
Sampled By: BC
Lab No.: 006
Date Tested: Jan. 09 - 2024
Type of Material: Sand and Silt

Sieve Size (mm)	Percent Passing	No Specifications

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GRAIN SIZE DISTRIBUTION

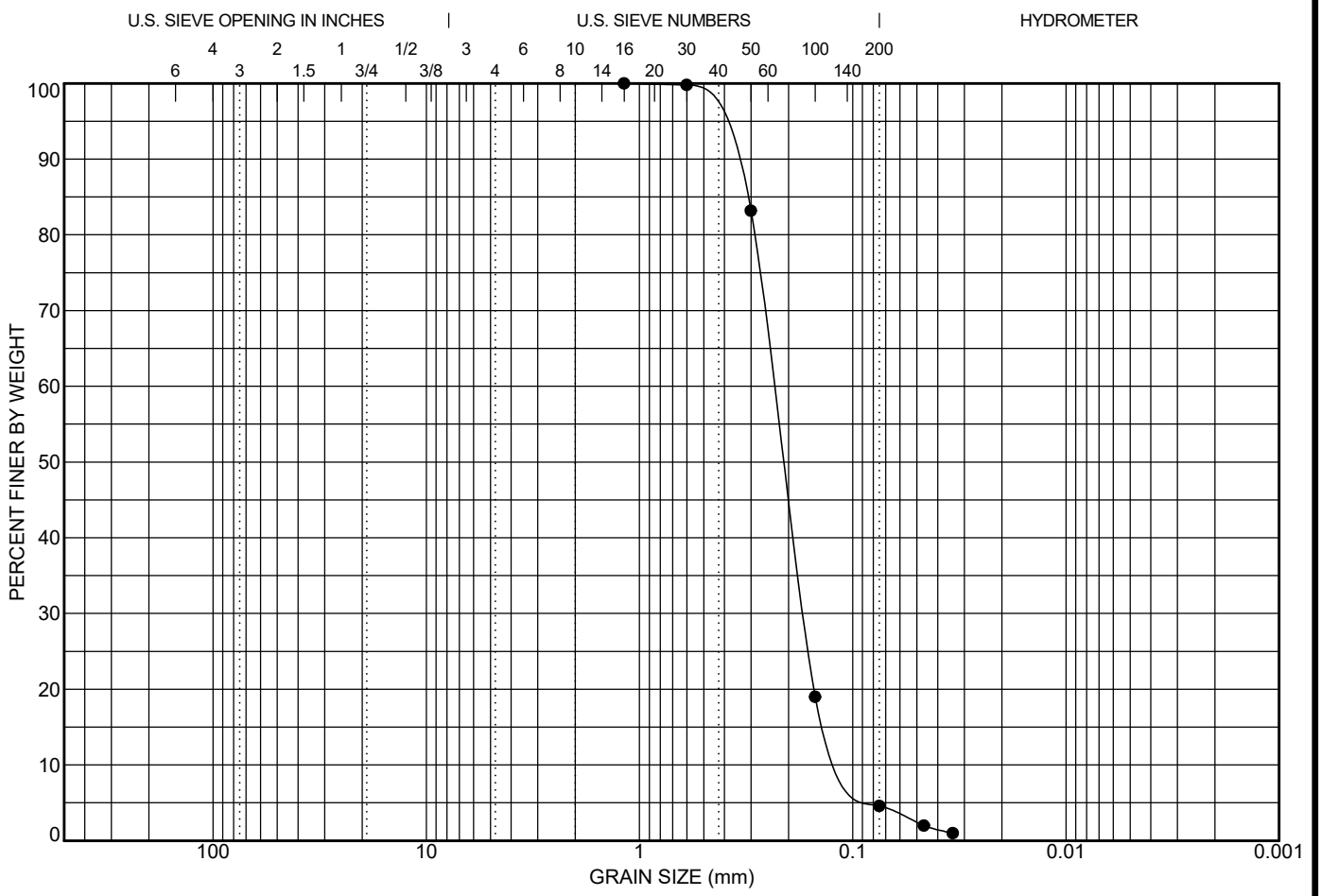
Project: Proposed Townhouse Development

Location: 672 and 720 Erbsville Road, Waterloo, Ontario

File No.: 1526

Enclosure No.: 13

DM - NO SPECIFICATIONS 1526 672 & 720 ERBSVILLE ROAD, WATERLOO.GPJ LAW LNDN.GDT 24-1-25



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.26	2.40	1.18	0.234	0.169	0.097	0.0	95.4	4.6	

Date: Jan. 25 - 2024
Client: Sunvest Group of Companies
Contractor:
Source:
Sampled From: BH 6 - SA 3; 1.52 to 2.13 m depth
Sample No.: 6-3
Date Sampled: Nov. 23 - 2023
Sampled By: BC
Lab No.: 007
Date Tested: Jan. 09 - 2024
Type of Material: Fine Sand, trace silt

Sieve Size (mm)	Percent Passing	No Specifications

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GRAIN SIZE DISTRIBUTION

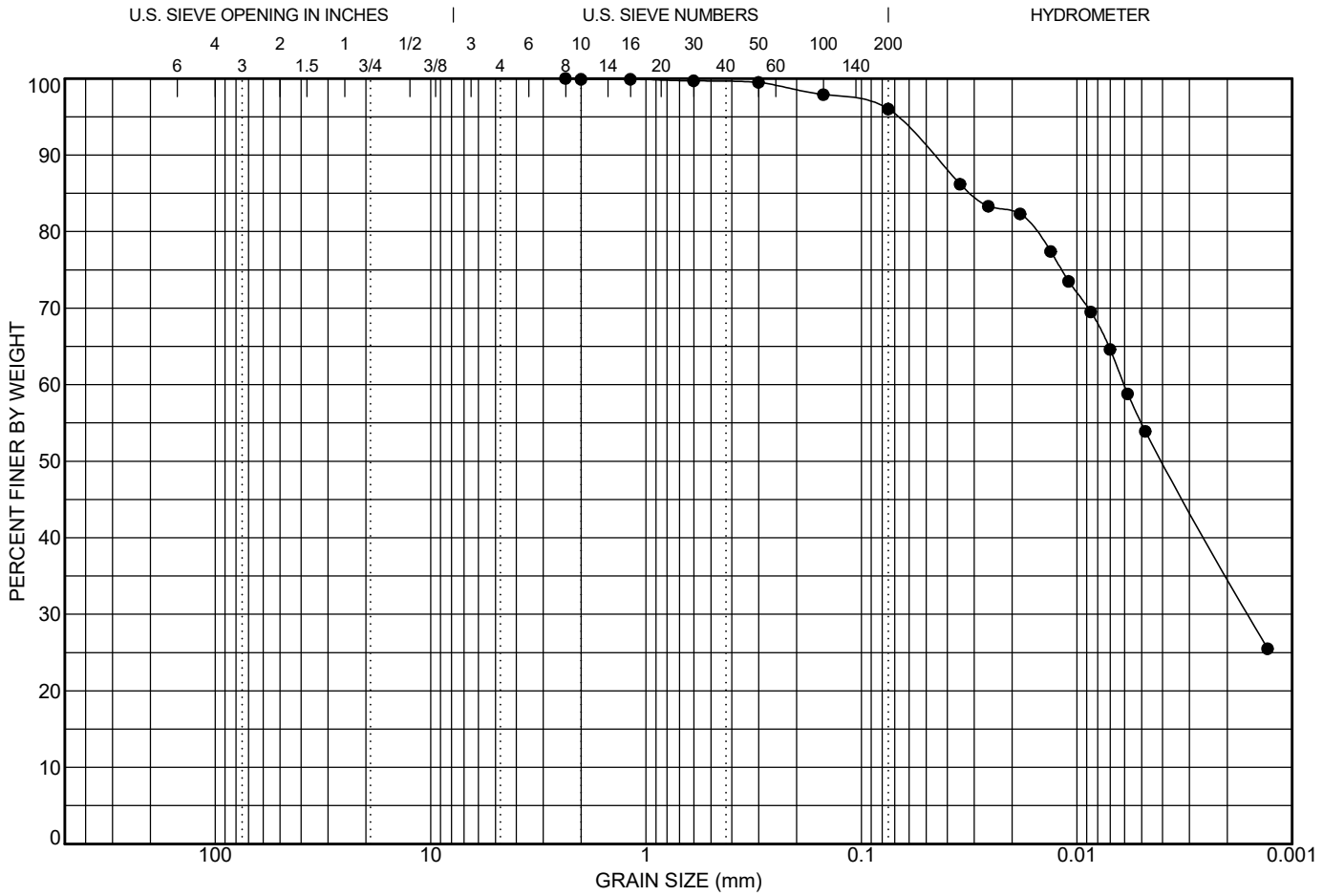
Project: Proposed Townhouse Development

Location: 672 and 720 Erbsville Road, Waterloo, Ontario

File No.: 1526

Enclosure No.: 14

DM - NO SPECIFICATIONS 1526 672 & 720 ERBSVILLE ROAD, WATERLOO.GPJ LAW LNDN.GDT 24-1-25



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					2.36	0.006	0.002		0.0	4.0	96.0	

Date: Jan. 25 - 2024
Client: Sunvest Group of Companies
Contractor:
Source:
Sampled From: BH 9 - SA 5; 3.05 to 3.66 m depth
Sample No.: 9-5
Date Sampled: Nov. 24 - 2023
Sampled By: BC
Lab No.: 008
Date Tested: Jan. 09 - 2024
Type of Material: Clayey Silt, trace sand

Sieve Size (mm)	Percent Passing	No Specifications

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GRAIN SIZE DISTRIBUTION

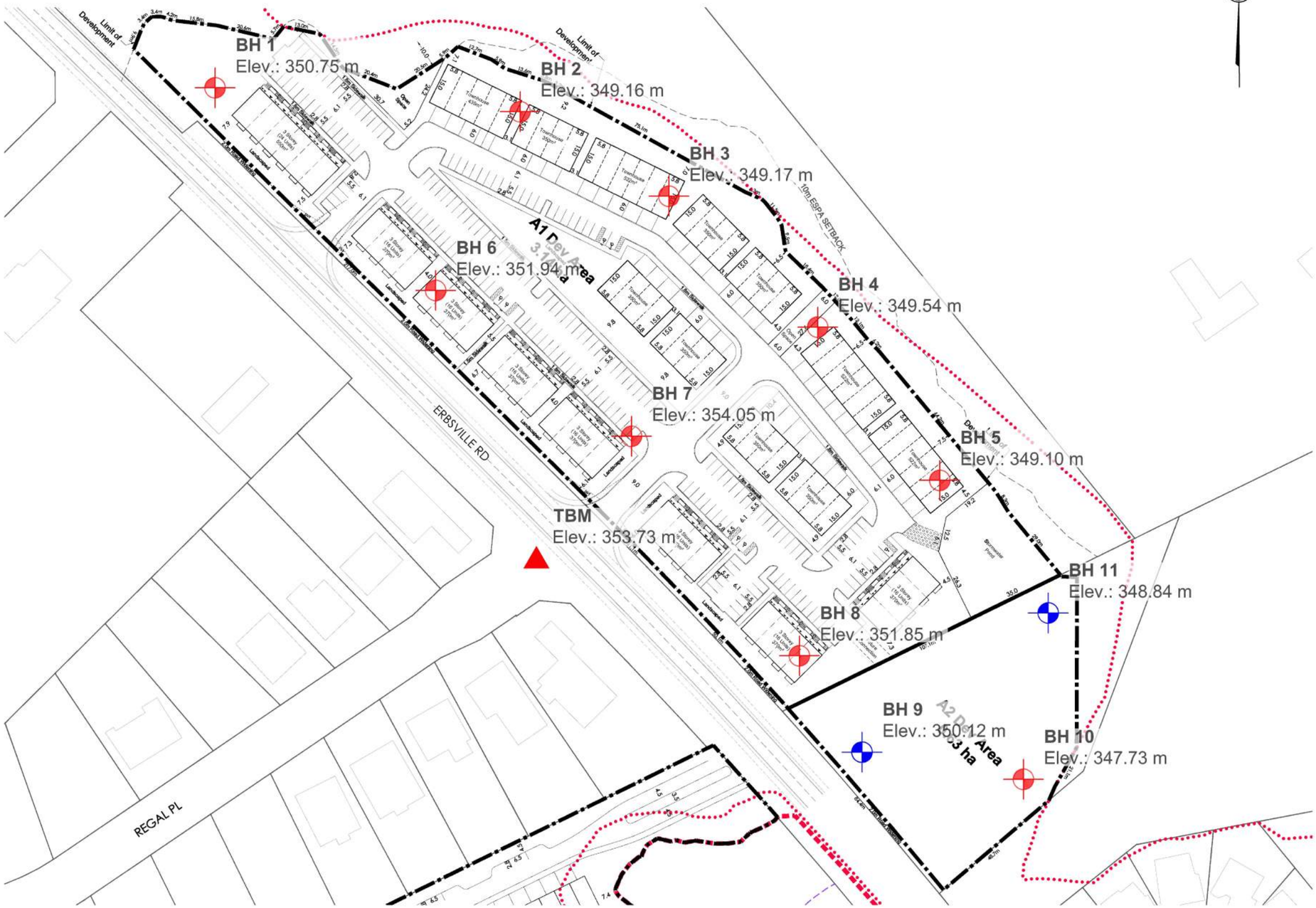
Project: Proposed Townhouse Development

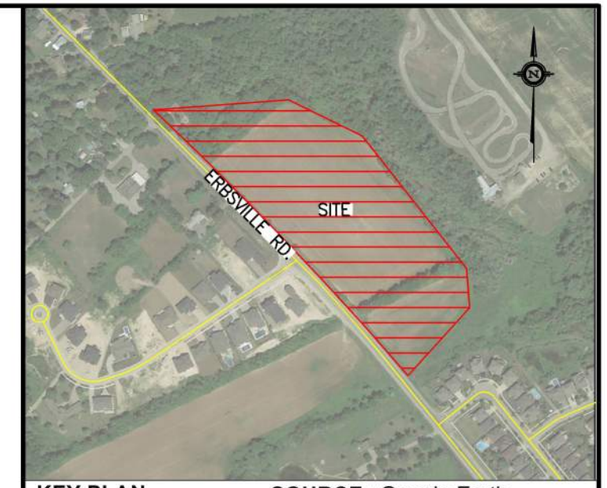
Location: 672 and 720 Erbsville Road, Waterloo, Ontario

File No.: 1526

Enclosure No.: 15

DM - NO SPECIFICATIONS 1526 672 & 720 ERBSVILLE ROAD, WATERLOO.GPJ LAW LNDN.GDT 24-1-25





KEY PLAN **SOURCE:** Google Earth

LEGEND

TBM: Top of manhole in center of roadway at intersection of Erbsville Road and Regal Place.
Elev.: 353.73 m (Geodetic)

Borehole Location

Borehole and Monitoring Well Location

DWG Ref.: MHBC; "Development Areas"; Beaver Creek/Erbsville Development Areas; File No.: 0977D; Dated: February 17, 2023; Dwg. No.: 1 of 1.

Elev. Ref.: The borehole locations and associated ground surface elevations were surveyed using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using UTM Zone 17N Projection, NAD83(CSRS)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28) .

BOREHOLE LOCATION PLAN

Proposed Townhouse Development

672 and 720 Erbsville Road
Waterloo, Ontario

CHUNG & VANDER DOELEN ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979

Drawn By: BC	Date: December, 2023	File No.: 1526
Checked By: EYC	Scale: 1:1500	Drawing No.: 1