



February 18, 2026

Town of Niagara-on-the-Lake
1593 Four Mile Creek Road
Virgil, ON LoS 1To

Functional Servicing Report & Stormwater Brief

727 East-West Line, Niagara-on-the-Lake

1.0 Background & Information

1.1 Introduction:

We have been retained by Mr. Arnie Lepp of the Niagara Orchard & Vineyard Corp. for the completion of a Functional Servicing Report in support of the development of his property which is located at 727 East-West Line in the Town of Niagara-on-the-Lake, just to the north of the community of Virgil.

The purpose of this report is to describe how the proposed development of this property can be completed in accordance with the requirements of the Town of Niagara-on-the-Lake, the Region of Niagara, the Niagara Peninsula Conservation Authority (NPCA) and the Ministry of the Environment, Conservation and Parks (MECP).

1.2 Site Location & Topography:

The property which is being analyzed within this Functional Servicing Report is municipal address 727 East-West Line, Niagara-on-the-Lake. The site is located to the south of the street and sits within a mix of residential and agricultural properties. To the south of the site sits the Pillitteri Estates Winery, while to the east site the Vineland Growers have a warehouse facility which has recently been approved for expansion. Across the street from the site there are residential dwellings as well as farmland. Figure 1 on the following page illustrates the site location plan.

A topographic survey of the subject lands was completed in 2023 by J. D. Barnes and was recently updated in December 2025. The results of the survey are provided in Appendix 'A' for reference. As can be seen, there is an existing dwelling on the subject lands. In addition there are residential properties to the west at 701 East-West Line and 707 East-West Line. Site drainage and topography will be discussed below in *Section 2.3*.



Figure 1: Site Location Plan

1.2 Proposed Development:

The proposed development layout for the property is described on the Site Plan contained in Appendix 'A' and will entail the construction of a 6473 m² warehouse facility which will be used for produce handling and distribution. Parking areas are proposed at the south-west corner and north-east corners of the site, together with a large loading area along the east limit of the property. As can be seen, the intention is to sever the existing dwelling from the balance of the lands and to retain it as a single-family residential dwelling. The following sections will describe how the servicing of the proposed development for sanitary, storm and water will be facilitated.

2.0 Servicing Analysis

2.1 Water Servicing:

There is an existing 200mm watermain along East-West Line immediately along the frontage of the property as indicated on the Niagara Region's Master Servicing Reports. The watermain figures from that report are attached to this report within Appendix 'B' for reference. There are two hydrants located in proximity to the subject lands; one directly at the northeast corner of the lot within the municipal right-of-way, and a second at the northeast corner of 701 East-West Line approximately 40m from the site frontage.

Water demands for the proposed building construction have been calculated for both domestic usage and fire-flows. Domestic flows have been calculated using the Ontario-Building-Code's 'Fixture Unit Method' as outlined in Part 8 of the OBC; these calculations are contained within Appendix 'B' for reference. The number of expected fixtures within the building was provided by the owner based on his plans for the development. Fire-flows have been calculated in accordance with the Fire Underwriter's Survey (FUS) 1999 methodology, again calculations are provided within Appendix 'B' for reference.

As can be seen, domestic usage for the warehouse use, based on the number of fixtures expected to be constructed within the building, is expected to be approximately 2.20 L/s. Fire-demands for the warehouse building based on the construction type, floor-area and proximity from other buildings have been calculated to be 150 L/s.

Based on the data contained within the Region of Niagara's Master Servicing Plan, the local water system has a static pressure of between 60 – 80 psi, and adjacent watermains can provide fire-flows in excess of 250 L/s. Based on this information we conclude that the adjacent municipal watermain will be sufficient to provide the required fire-flow for the subject lands. More detailed information for the

local watermain can be obtained through private hydrant flow testing (once weather permits) or confirmed via local municipal testing data which has been requested for review.

The existing dwelling has a water service connection from the existing municipal watermain. This connection is at the frontage of the existing dwelling and will remain in place after the construction of the development.

2.2 Sanitary Servicing:

There are no immediately adjacent sanitary sewers in this vicinity of the Town, as such the proposed warehouse building will be required to be serviced through the provision of a septic bed. A septic bed design has been completed on behalf of the owner by Trevor Imhoff of T.I. Services.

The design report completed in support of the proposed septic bed has been included in Appendix 'B' for reference purposes. The location of the septic-bed is noted in the report and has been included on the Preliminary Grading & Servicing Plan located within Appendix 'A'. Given the detailed nature of the septic bed calculations this report is relying on these calculations and the author notes that there is sufficient space in the proposed locations for the construction of the required septic bed and there are no constraints relating to the Site Grading which would preclude their use.

2.3 Stormwater Analysis:

2.3.1 - Existing Drainage Pattern

The existing drainage pattern can be inferred from the topographic survey completed by J.D. Barnes. The site has two drainage outlets, a small portion of the property within the north-east corner of the site drains to the adjacent roadside ditch along East-West Line. The roadside ditch drains westerly along the site frontage towards a 600mm diameter culvert located on the east side of 701 East-West Line; the inlet to that culvert marks the beginning of the municipal drain known as the Sloma Drain. It should be noted that the roadside ditch along the frontage of 701 East-West Line was recently filled, and replaced by a 450mm diameter culvert. The majority of the site drainage is towards the site's south-west corner. There is an existing swale which crosses the corner of the property in that location and discharges to two existing catchbasins located on the property of 701 East-West Line. These catchbasins were investigated and appear to be connected to the local tile-drainage system of the adjacent vineyards and presumably carry site runoff towards the Sloma Drain through the tile.

The drainage outlet for 727 East-West-Line, 701 East-West Line, 707 East-West Line, the Pillitteri Winery (1696 Niagara Stone Road), and other properties fronting Niagara Stone Road from the north is the municipal drain known as the Sloma Drain. The Sloma Drain begins at East-West Line and carries surface drainage via a 300mm underdrain pipe to Four Mile Creek, with several catch-basins

located along the course of the drain to connect flows to the outlet. A Plan & Profile of the drain is attached to this report for reference purposes.

The subject lands and the other properties noted above are included in the lands assessed as part of the Sloma Drain. A map illustrating all the assessed parcels contributing drainage to the drain is contained in Appendix 'C' for reference and the subject lands are included as Parcel 4 and at the time were under the ownership of Lazur and Pauline Weremchuk. The noted plan illustrates an 8" tile drain crossing the subject lands approximately along the alignment of the existing swale, then crossing the adjacent property of 701 East-West Line and discharging to the Sloma Drain.

Historic aerial mapping of this area of the Sloma Drain appears to illustrate that there formerly existed a watercourse that was located in similar location to the noted tile drain and carried surface drainage to the inlet structure on the south side of East-West Line. A memorandum regarding this historic watercourse was prepared by LandX Developments and is included in Appendix 'C' of this report for reference. Unfortunately, it appears that that surface drainage outlet has been blocked through the development of the adjacent property and the alteration of the original grades. As such, surface drainage does not proceed directly to the Sloma Drain inlet under existing conditions.

The existing catch-basins on 701 East-West Line adjacent to the subject lands are located at a low point that is approximately 0.10m lower than the adjacent grade of the road-side ditch directly to the north. The rim elevation of the catch-basins is 88.20m and 88.23m while the ditch at East-West line is 88.30m. Based on the topographic survey by JD Barnes, water would have to pond up to at least an elevation of 88.53m prior to spilling into the road-side ditch. As noted above, the road-side ditch drains from east to west to the Sloma Drain inlet. Along the frontage of 701 East-West Line that roadside ditch has been filled in and replaced with a culvert. The culvert slope is unknown, however the size was measured to be 450mm diameter and is assumed to be laid to the slope of the previously present ditch.

Under existing conditions surface drainage for the subject lands will drain to the south-west corner and enter the tile drainage system via the existing catch-basins on 701 East-West Line. Were the tile drainage system to be blocked water would pond above the catch-basins up to 0.33m until it reached an elevation of 88.53m and spilled into the roadside ditch and continues towards the Sloma Drain inlet, and then to 4-Mile Creek via the Sloma Drain.

A Pre-Development Storm Drainage Area Plan has been provided in Appendix 'C' for reference purposes, and this Figure illustrates the extent of the two site drainage areas, the existing catch-basins, tile drains and outlets.

2.3.2 – Stormwater Management Criteria

Based on the development of the site and the inclusion of significant additional impervious surfaces the amount of runoff from the subject lands would increase without mitigation. Based on the location of the site within the Sloma Drain watershed, the stormwater quantity control criteria will be to match the pre-development drainage conditions and ensuring that peak-flows to the Sloma Drain do not increase through the completion of the development. In addition, given the site’s location within the Lake Ontario watershed, water quality controls should be provided to ensure 70% long-term suspended solids removal.

2.3.3 – Stormwater Management Design

The existing drainage condition has been analyzed using MIDUSS v2, the Town of Niagara-on-the-Lake IDF parameters, and the Chicago 3-hour rainfall distribution. The parameters of the pre-development catchments are illustrated on the Pre-Development Drainage Area Plan contained in Appendix ‘C’ while the MIDUSS v2 output files are also contained in Appendix ‘C’ for review. Based on our analysis the Pre-development runoff rates from Areas 1 and 2 are as follows:

| Drainage Area | Peak Runoff (m ³ /s) | | | Runoff Volume (m ³) | | |
|---------------|---------------------------------|---------|----------|---------------------------------|---------|----------|
| | 5-Year | 25-Year | 100-Year | 5-Year | 25-Year | 100-Year |
| A1 | 0.005 | 0.009 | 0.015 | 16.82 | 26.59 | 36.78 |
| A2 | 0.043 | 0.089 | 0.153 | 200.62 | 337.52 | 483.12 |
| Total | 0.048 | 0.098 | 0.168 | 217.44 | 363.21 | 519.9 |

Table 1: Existing Drainage Conditions

To analyze the effect of the site runoff based on the development of the property the increased imperviousness of the site was calculated, and a Post-Development Drainage Area Plan was prepared. This plan is contained in Appendix ‘C’ for reference purposes. As can be seen, the construction of the warehouse will increase the site’s overall imperviousness from 3.0% to 37.0%. Without stormwater controls being provided on site this would mean that the site runoff would increase, as shown on Table 2 on the following page.

| Drainage Area | Peak Runoff (m ³ /s) | | | Runoff Volume (m ³) | | |
|---------------|---------------------------------|---------|----------|---------------------------------|---------|----------|
| | 5-Year | 25-Year | 100-Year | 5-Year | 25-Year | 100-Year |
| A1 | 0.187 | 0.259 | 0.33 | 410.37 | 593.33 | 775.04 |
| % + / - | 389.5% | 264.3% | 196.4% | 188.7% | 163.3% | 149.1% |

Table 2: Pre vs. Post Drainage Summary (No-SWM)

As can be seen, without stormwater controls being provided on-site the increase in runoff under the post-development condition will be substantial.

To mitigate the post-development flows from the site it is proposed to utilize permeable pavement in the areas indicated on the Site Servicing & Grading Plan. The product selected for use is the ECORASTER E50 Heavy-Duty. This product is used to stabilize the upper-course of a clear-stone gravel parking area, ensuring stability for large vehicles and allowing an under-bed of 2” clear-stone that will act as a stormwater reservoir. The parking areas will appear to be gravel only, however below the surface a 400mm depth 2” clear-stone reservoir is provided. This will direct stormwater runoff to groundwater, limit discharge from the site and promote infiltration to groundwater.

A geotechnical report has been completed for the subject lands, and it indicated that the underlying soils are a mix of clay, silt and sand – with saturated infiltration rates varying between 10mm / hr to 15 mm /hr. This will mean that the draw-down time for the reservoirs, after being filled during a 100-year storm event will be between 26.67 and 40 hours.

ECORASTER E50 is proposed in three locations with provided volumes as follows:

| Location | Area (m ²) | Volume (m ³) |
|-------------------|------------------------|--------------------------|
| North-east Corner | 330 | 52.8 |
| East Parking Area | 890 | 142.4 |
| South-west Corner | 1650 | 264 |

Table 3: ECORASTER E50, Storage Volume Summary

In addition to the ECORASTER E50 Permeable Pavers, areas surrounding the existing dwelling to remain will be furnished with infiltration galleries. These galleries will serve to intercept drainage

from the single-family dwelling and direct it to the site outlet, without impacting the proposed warehouse facility. The infiltration trench details are contained on the Site Servicing & Grading Plan, and the clear-stone base for these trenches will provide an additional 105 cubic meters of stormwater storage. The discharge from the infiltration galleries in the event that they are filled during a 100-year storm event will be to the ECORASTER E50 base reservoir in the south-west corner of the site.

A 100mm HPDE outlet subdrain pipe will be provided from the largest ECORASTER reservoir at the site's South-west corner to the existing drainage outlet – the existing swale that carries drainage to the inlet catch-basins on 701 East-West Line.

In total, the stormwater storage volume being provided on-site is 564.2 cubic meters. This is nearly enough storage volume to ensure that there is zero discharge from the site under the 25-year storm event as the 25 year overall runoff volume for the entire site is 593.3 cubic meters. For all events, up to approximately the 20-year storm the expected runoff from the site will effectively be zero.

A Post-Development Drainage Area Plan is included in Appendix 'C' for reference purposes. Routing for the 100-year storm event has been completed using the Chicago 3-Hour storm and the NotL IDF Parameters for the various areas. Output files for the MIDUUS v2 simulations are contained in Appendix 'C' for reference purposes. As can be seen, the runoff volume for Areas 1 and 2 under the 100-year event of 33.4 m³ and 112 m³ is less than or equal to the provided storage volumes within the ECORASTER E50 reservoir, and Infiltration Galleries respectively. As such runoff from those areas will essentially be zero under all storm events.

For Areas 3 and 4, the ECORASTER E50 reservoirs were routed for the 100-year storm event. The clear stone reservoirs were modelled as rectangular ponds, with the outlet pipes as flow controls. As can be seen, the peak runoff from the site under the 100-year event is 0.087 m³/s. The total volume of runoff between the two catchments is 615 cubic meters, however this volume is reduced by the storage volume within the ECORASTER base for the east and south-west areas of 406 cubic meters, leaving the total runoff volume exiting the site to be 209 cubic meters.

Table 4 is provided below for comparison purposes. As can be seen, the overall stormwater design for the site reduces runoff from the subject lands significantly under the post-development condition.

It should be noted that although the south-west ECORASTER E50 reservoir is located above the suspected location of the existing tile drain, the proposed construction is above the existing grades and would not impact the underlying tile drain (if present). It should also be noted that a small landscaped portion of the site is being left along the south and west limits to allow runoff from the adjacent property which currently crosses the site to continue to do so by skirting around the limits of the proposed construction.

| Scenario | Peak Runoff Rate (m ³ /s) | Runoff Volume (m ³) |
|--------------------------------|--------------------------------------|---------------------------------|
| Pre-Development (A2) | 0.153 | 483.12 |
| Post-Development (Same Outlet) | 0.087 | 208.9 |

Table 4: Stormwater Runoff Comparison

2.3.4 – Stormwater Quality Control

As noted in Section 2.3.2, stormwater runoff from the site continues downstream to the Sloma Drain, 4 Mile Creek and ultimately discharges into Lake Ontario. Given the receiver is one of the Great Lakes MECP ‘Normal’ level protections for stormwater quality will be required to be provided with 70% long-term suspended solids removal.

The ECORASTER E50 will provide the needed level of stormwater quality protection through the direction of all stormwater up to the 20-year storm event to the on-site reservoirs. This represents over 70% of all storm events producing runoff and thus 70% of all long-term suspended solids will be contained on site.

3.0 Conclusion

In conclusion, based on the foregoing analysis we recommend that the development may be serviced in accordance with the requirements of the Town of Niagara-on-the-Lake as follows:

1. Water servicing can be provided through connection to the adjacent 200mm watermain along East-West. Based on the available data there will be sufficient flows available within the main to provide for both domestic and fire-flow requirements.
2. There are no available sanitary sewers in the area, however the development may be serviced through the installation of a septic beds as per the report provided by T.I. Services which is contained within Appendix 'B' in the location indicated.
3. The increase in stormwater runoff due to the proposed impervious surfaces can be mitigated according to MECP requirements through the construction of the ECORASTER E50 Permeable Pavement reservoirs in conjunction with the proposed Infiltration Galleries. These features will also serve to provide the needed levels of stormwater quality control.

Thank you for your consideration of the above Functional Servicing Report and Stormwater Brief, should you have any questions or require clarification with respect to any part of the above please do not hesitate to contact the undersigned.

Respectfully submitted,



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Principal & Director
LandSmith Engineering & Consulting Ltd.
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andrew@landsmithec.com



APPENDICES

Appendix 'A' – Background Information

Topographic Survey
Site Plan
Site Servicing & Grading Plan

Appendix 'B' – Sanitary and Water Analysis

Domestic Water Demand Calculations
Fire-flow Calculations
Pages from Region of Niagara Master Servicing Plan (Water)
Septic Design Report (T. I. Services)

Appendix 'C' – Stormwater Management

Pre-Development Drainage Area Plan
Sloma Drain Background Information
Water Course Memo

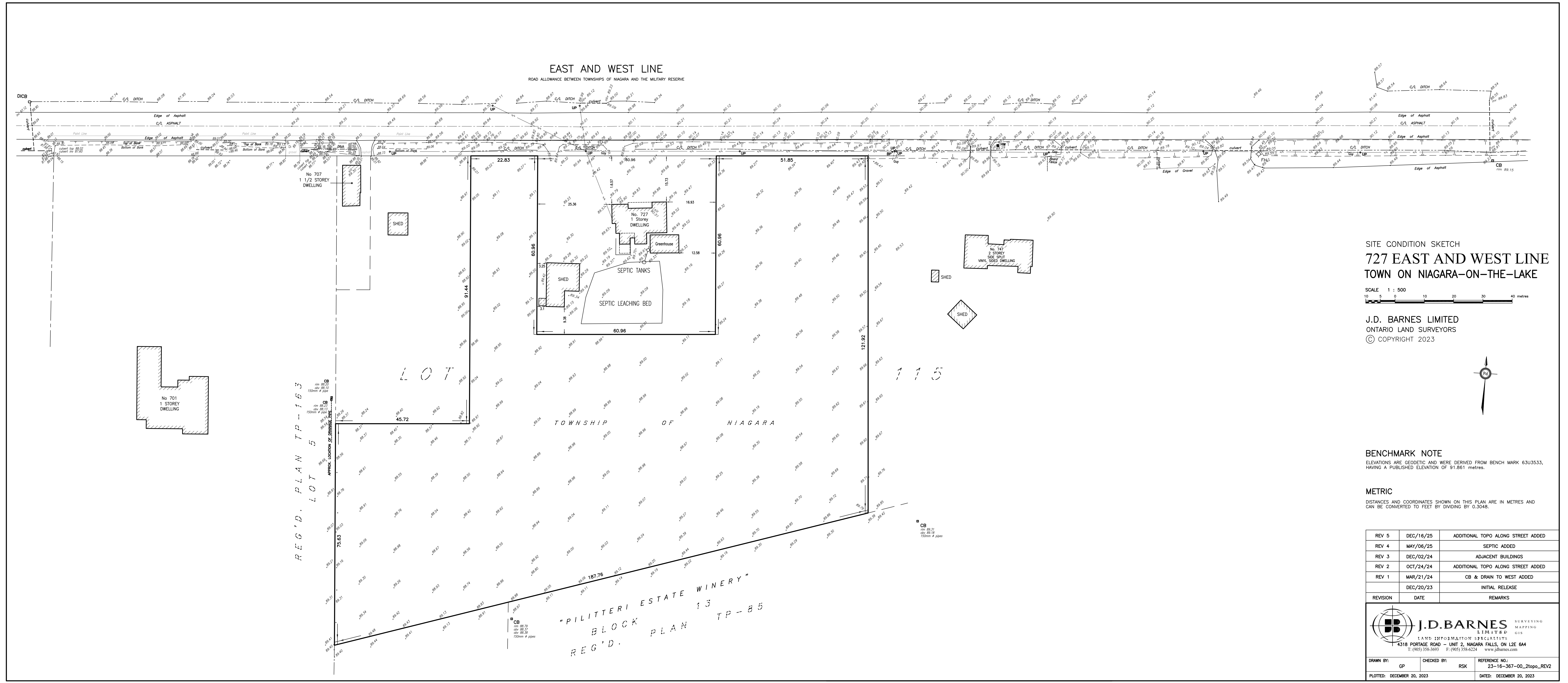
Post-Development Drainage Area Plan
MIDUSS v2 Output Files
ECORASTER E50 Technical Product Information

APPENDIX 'A' – Background Information

Topographic Survey (J.D. Barnes)

Site Plan (2M Architects)

Preliminary Grading & Servicing Plan (LandSmith)



SITE CONDITION SKETCH
727 EAST AND WEST LINE
 TOWN ON NIAGARA-ON-THE-LAKE
 SCALE 1 : 500
 J.D. BARNES LIMITED
 ONTARIO LAND SURVEYORS
 © COPYRIGHT 2023

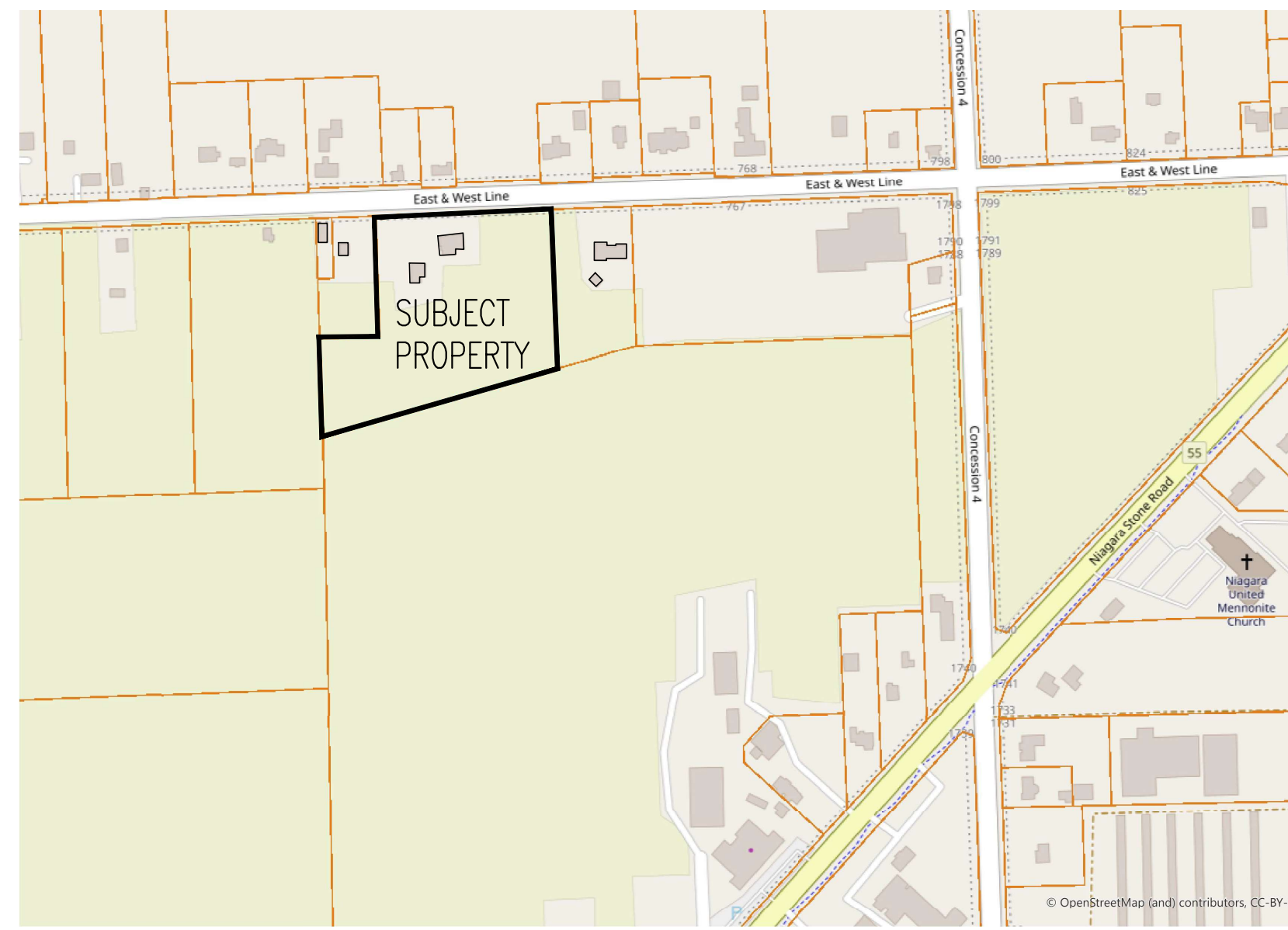
BENCHMARK NOTE
 ELEVATIONS ARE GEODETIC AND WERE DERIVED FROM BENCH MARK 63035533, HAVING A PUBLISHED ELEVATION OF 91.861 metres.

METRIC
 DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

| REVISION | DATE | REMARKS |
|----------|-----------|------------------------------------|
| REV 5 | DEC/16/25 | ADDITIONAL TOPO ALONG STREET ADDED |
| REV 4 | MAY/06/25 | SEPTIC ADDED |
| REV 3 | DEC/02/24 | ADJACENT BUILDINGS |
| REV 2 | OCT/24/24 | ADDITIONAL TOPO ALONG STREET ADDED |
| REV 1 | MAR/21/24 | CB & DRAIN TO WEST ADDED |
| | DEC/20/23 | INITIAL RELEASE |

J.D. BARNES SURVEYING
 MAPPING
 LAND INFORMATION SPECIALISTS
 4318 PORTAGE ROAD - UNIT 2, NIAGARA FALLS, ON L2E 6A4
 T: (905) 335-2661 F: (905) 335-2662 www.jdbarnes.com

DRAWN BY: GP CHECKED BY: RSK REFERENCE NO.: 23-16-367-00_2topo_REV2
 PLOTTED: DECEMBER 20, 2023 DATED: DECEMBER 20, 2023



KEYMAP

SCALE: .N.T.S.

PROPERTY, DIMENSIONS AND BEARING INFO; REFERENCED FROM SURVEYORS DRAWING BY, Roy S. Kirkup O.L.S. OF J.D. BARNES LIMITED, REFERENCE NO. : 23-16-367-00_1LDC, DATED: SEPT. 18, 2024

SITE STATISTICS - 727 EAST & WEST LINE
Zoning: RS - SUBURBAN RESIDENTIAL (ADJACENT TO STREET TO 63.5m SETBACK FROM EXIST. STREET PROP LINE)
A - AGRICULTURAL (63.5m SETBACK FROM STREET AND FURTHER)

PART 1 (EXISTING RETAINED)
LOT FRONTAGE: ±69.76m
LOT AREA: ±4,047m² (4,047m² MIN REQ'D) [1.00 acres]
LOT COVERAGE: ±7.6% (309.3m², Dwelling + Shed)

PART 2 (SEVERED)
LOT FRONTAGE: ±12.50m + 53.38m = 65.88m (38.10m MIN REQ'D)
LOT AREA: ±17,626m² (40,500m² MIN REQ'D) [4.36 acres]
PORTION OF PART 2 (EAST SIDE) TO BE REZONED FROM 'RS' TO 'A' (APPROX. 3,242m²)
LOT COVERAGE: ±36.72% (15% MAX LOT COVERAGE) (PREVIOUSLY 38.32%)
LANDSCAPE COVERAGE: 4,144.1m² / 17,626m² = ±23.5%

OBC BUILDING CLASSIFICATION - 3.2.2.89. GROUP F3 ONE STOREY (Not Sprinklered)
1 STOREY BUILDING: 7,000m² MAX; 6,473m² PROP. (FACING 2 STREETS) (PREVIOUSLY 6,754m²)

FRONT YARD SETBACK: 15.24m MIN REQ'D, 15.24m PROV'D
SIDE YARD SETBACK (WEST): 3.05m MIN REQ'D, 12.05m PROV'D
SIDE YARD SETBACK (WEST) SOUTH BUILDING PORTION: 38.21m (PREVIOUSLY 40.61m)
SIDE YARD SETBACK (EAST): 3.05m MIN REQ'D, 9.0m PROV'D
REAR YARD SETBACK: 15.24m MIN REQ'D, 15.24m PROV'D (PREVIOUSLY 10.04m)

MINIMUM LANDSCAPE BUFFER ADJACENT TO RESIDENTIAL 'RS' ZONED LOTS: 3m MIN REQ'D, >3m PROV'D

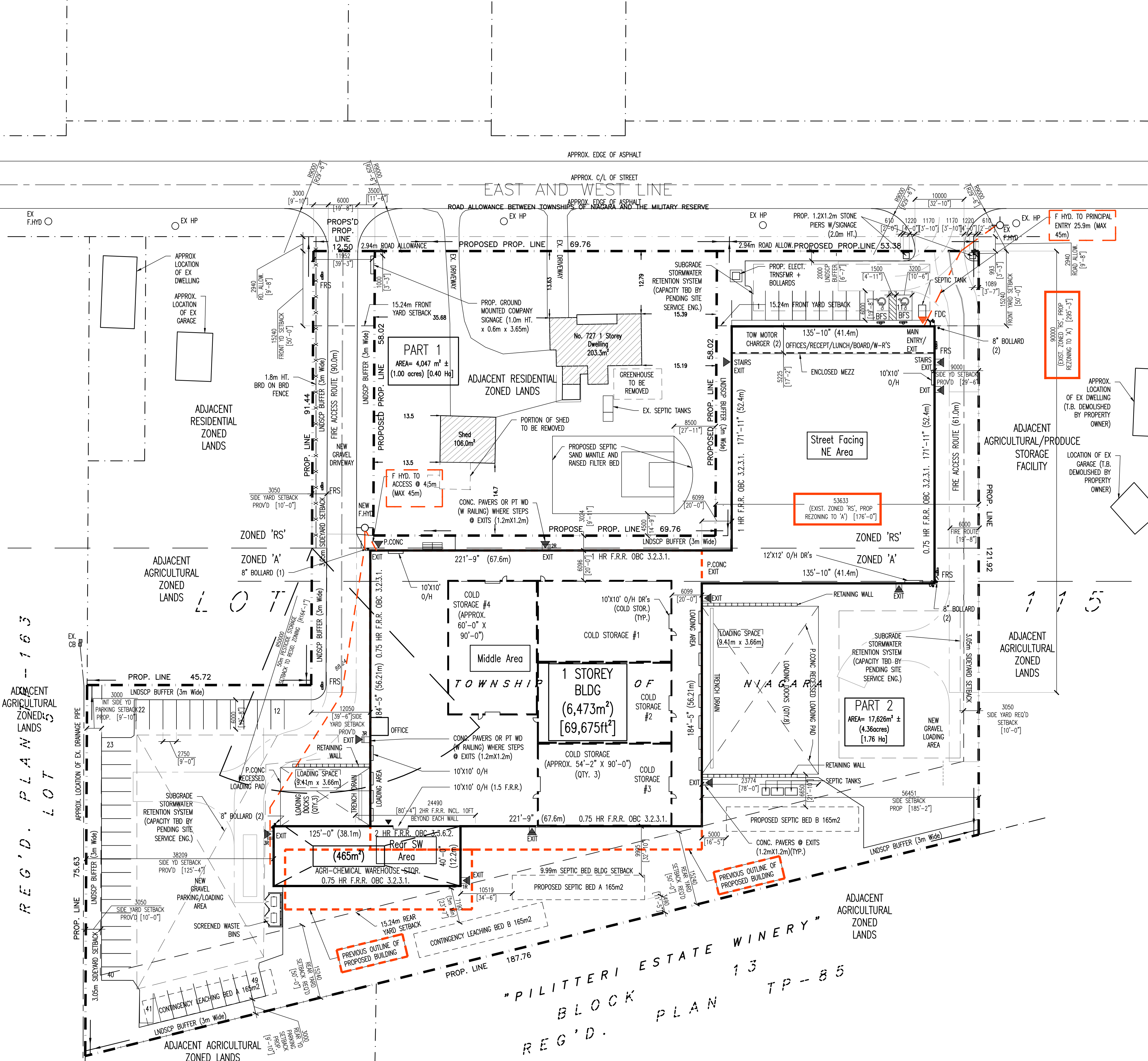
PARKING
MIN P/S Required: 1P/S Per Employee (20 Employees) = 20P/S, Provided: 49
MIN Loading Spaces Required: GFA >4,645 m² = 4, Provided: 11
MIN BFA P/S Required: 1-25 = 1 BFA P/S, Provided: 2

MAXIMUM BUILDING HEIGHT: 7.37m PROV'D FEB. 09, 2026

OCCUPANT LOAD BY DESIGN (20 EMPLOYEES)

LEGEND

| | |
|--|----------------------------|
| | FIRE ROUTE |
| | FIRE ROUTE SIGN |
| | HYDRANT (EX. OR NEW) |
| | BARRIER FREE SIGN |
| | FIRE DEPARTMENT CONNECTION |
| | LIGHT FIXTURE |



THESE DOCUMENTS ARE NOT TO BE SCALED. THE DESIGN AND DOCUMENTS REMAIN THE PROPERTY OF THE ARCHITECT AND ARE PROTECTED BY LAW. THEY MAY NOT BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM. ALL DOCUMENTS TO BE RETURNED AT COMPLETION OF WORK. CONTRACTORS TO SITE VERIFY ALL DETAILS AND DIMENSIONS AND REPORT ANY AND ALL DISCREPANCIES TO THE ARCHITECT BEFORE COMMENCING WITH THAT RELATED PORTION OF THE WORK. ONLY SIGNED SEALED AND STAMPED DOCUMENTS ARE TO BE USED FOR CONSTRUCTION PURPOSES.

NO. BY: DATE: REVISION:
15. MJ 2024-08-11 FOR REVIEW
16. MJ 2024-09-02 FOR REVIEW
17. MJ 2024-09-08 FOR 99-ZONING MARK
18. MJ 2024-11-26 REVISED BUS. SITE TO SETBACK
19. MJ 2024-12-23 REVISED BUS. PER COMMENTS
20. MJ 2024-01-21 FOR OBCO.
21. MJ 2024-01-23 FOR CLIENT REVIEW/CORR.
22. MJ 2024-01-29 FOR CLIENT REVIEW/CORR./MTC.
23. MJ 2024-02-09 FOR OBCO.

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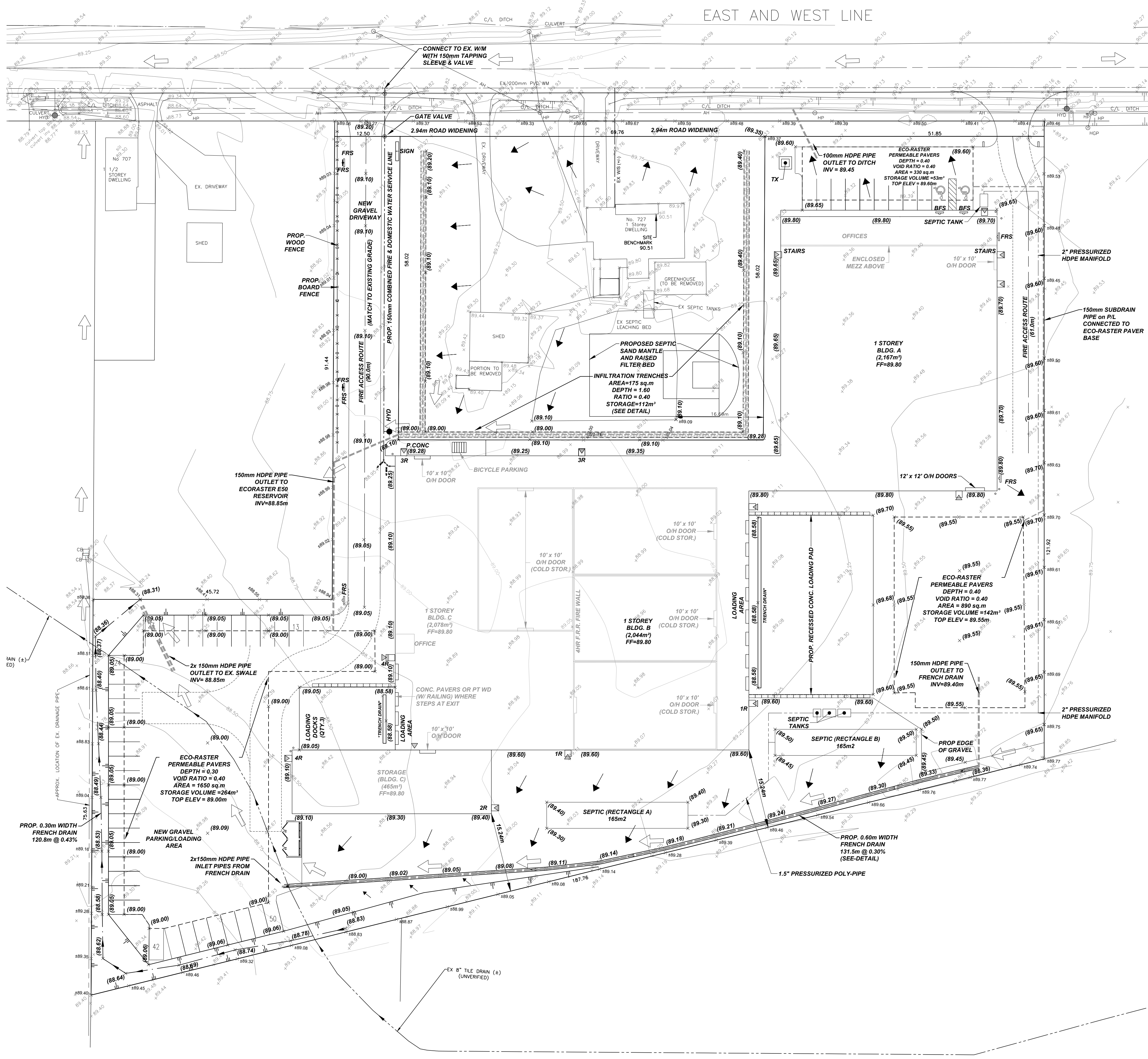
drawn by: MJ
design by: MRW
approved by: LJM
date: FEB 09, 2026

project title: PROP. AGRICULTURAL / PRODUCE STORAGE FACILITY
727 EAST & WEST LINE, NOTL, ON
drawing title: **DRAFT** PROPOSED SITE PLAN

revision number: 23
drawing number: 24-12

SP1

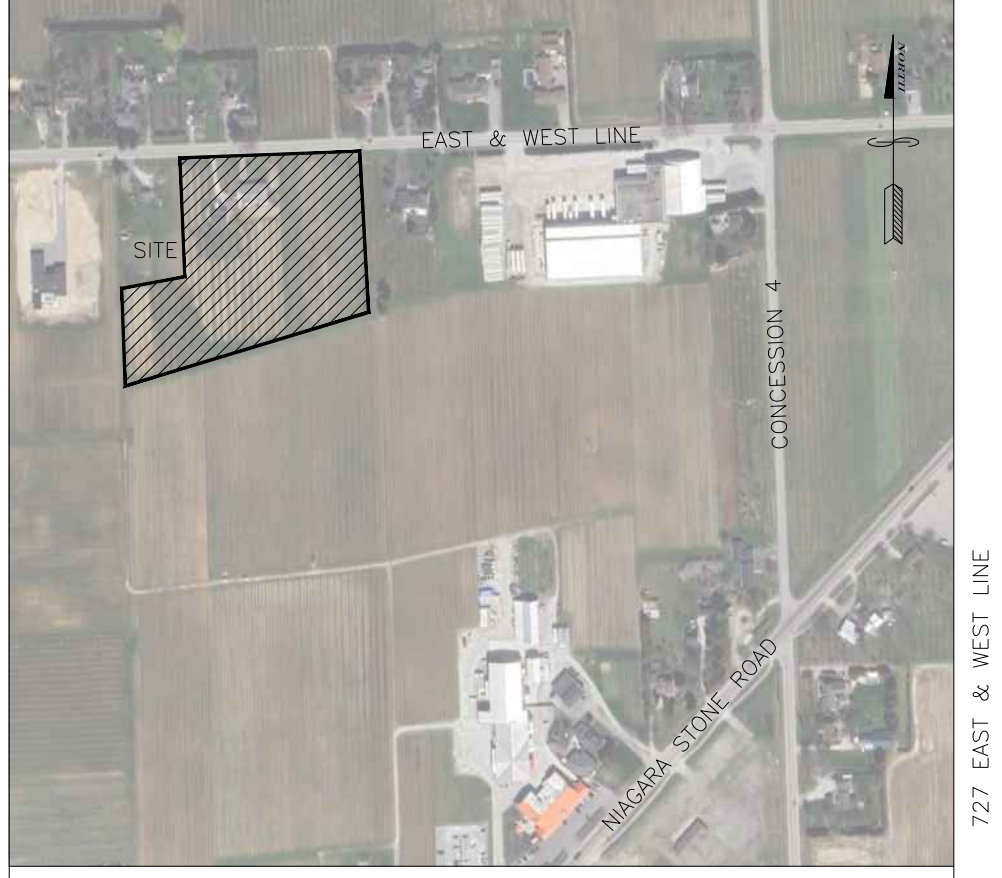
EAST AND WEST LINE



LEGEND

- ×100.50 EXISTING ELEVATION
- ⊕100.50 EXISTING ELEVATION (CALCULATED)
- 0.00% EXISTING SLOPE
- ×(100.00) PROPOSED ELEVATION
- (100.00) PROPOSED APRON ELEVATION
- ×(100.00) PROPOSED SWALE ELEVATION
- 0.00% PROPOSED SLOPE
- ⬇️ PROPOSED DOWNSPOUT
- PROPOSED SWALE
- PROPOSED SILT FENCE
- ▲ PROPOSED ENTRANCE LOCATION
- ⊙(SP) PROPOSED SUMP PUMP

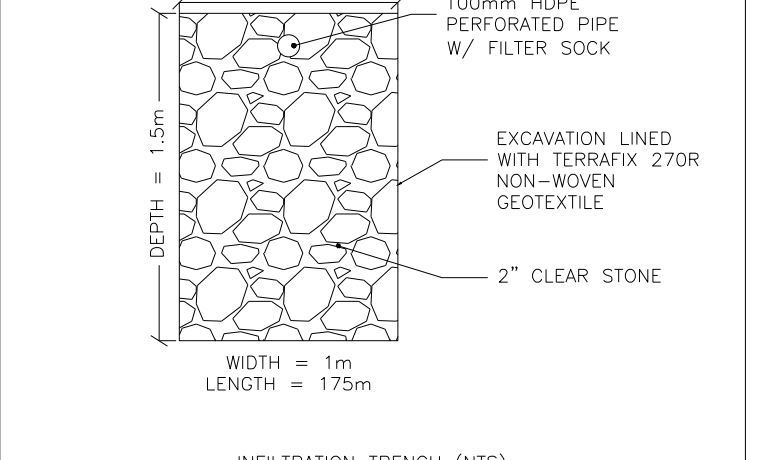
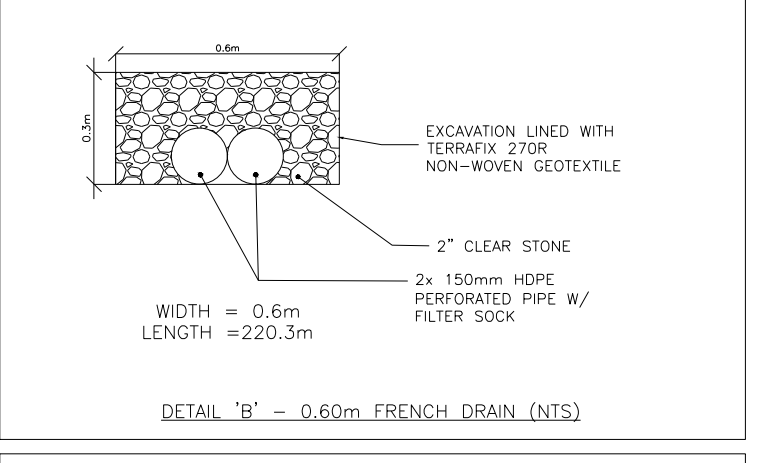
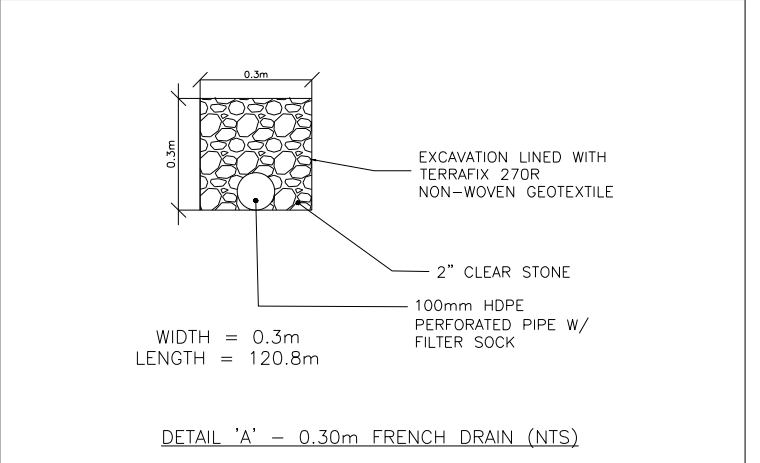
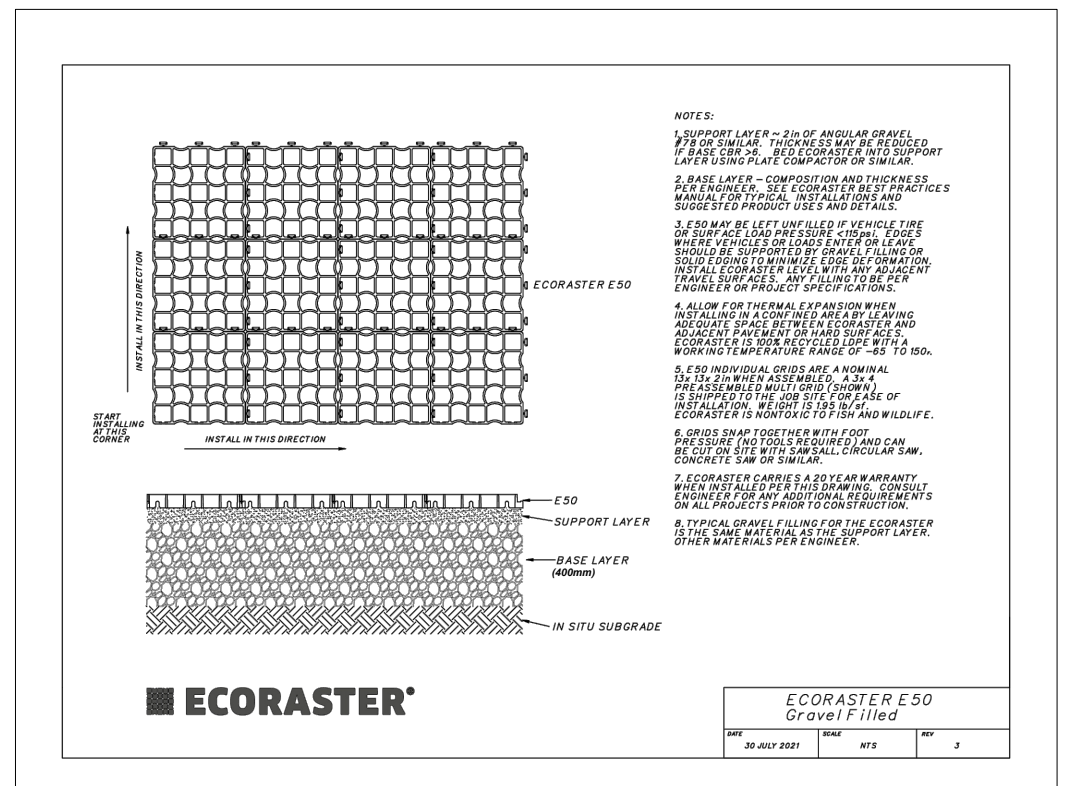
- GENERAL GRADING NOTES:**
- MATCH EXISTING GRADE AT PROPERTY / DEVELOPMENT LIMITS WITH SLOPED SLOPES OF MAXIMUM 3:1 AND/OR RETAINING WALLS AS SPECIFIED.
 - SLOPES OF SWALES FOR BOTH "BACK-TO-FRONT" AND "SPLIT" DRAINAGE SHALL BE NO LESS THAN 2.0% AND NO GREATER THAN 3.3% (3:1).
 - MINIMUM GRADE FOR APRON "WRAP-AROUND" SWALE AT THE REAR OF THE UNIT SHALL BE 1.0%.
 - WHEN MATCHING TO EXISTING GRADE AT THE LIMITS OF THE DEVELOPMENT / PROPERTY WHERE 2.0% SLOPE CANNOT BE REASONABLY ACHIEVED A 1.5% GRADE IS PERMITTED PROVIDED A 150MM SUB-DRAIN IS INSTALLED WITH THE SWALE AS PER 10-121 AND CONNECTED TO A SUITABLE OUTLET.
 - DRIVWAY SLOPES SHALL NOT BE LESS THAN 2.0% AND SHALL NOT BE MORE THAN 7.0%. REVERSED SLOPED DRIVEWAYS ARE NOT ALLOWED FOR ANY NEW CONSTRUCTION.
 - GARAGE FLOOR ELEVATION SHALL BE SET A MINIMUM OF 0.30M HIGHER THAN THE BACK OF WALK, UNLESS OTHERWISE SPECIFIED.
 - THE TOP OF FOUNDATION WALL FOR THE DWELLING UNIT SHALL BE A MINIMUM 150MM (6") ABOVE FINISHED GRADE.
 - UNLESS OTHERWISE NOTED, THE GROUND BETWEEN PROPOSED ELEVATIONS SHALL BE GRADED AS A STRAIGHT LINE.
 - IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE PROPERTY / DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER. OTHERWISE RETAINING WALLS MUST BE USED.
 - ALL RETAINING WALLS SHALL BE PLACED A MINIMUM 0.45M FROM PROPERTY LINES.
 - ANY WALL OF GREATER HEIGHT THAN 1.0M MUST BE DESIGNED BY A PROFESSIONAL ENGINEER.
 - TOP OF RETAINING WALL ELEVATIONS SHALL BE SET A MINIMUM OF 150MM ABOVE THE PROPOSED SIDE-WALK SWALES.
 - RETAINING WALLS 0.60M AND HIGHER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE REAR OF THE WALL. SUCH FENCES OR GUARD RAILS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ONTARIO BUILDING CODE.
 - ALL FILL COMPACTED ON THE LOT(S) SHALL BE PLACED TO A MINIMUM 85% SPD (UNLESS OTHERWISE RECOMMENDED BY A GEOTECHNICAL ENGINEER). MATERIALS SHALL BE COMPACTED IN LIFTS NOT EXCEEDING 300MM DEPTH.
 - FOR DELINEATION OF TREE PROTECTION ZONES, BUFFERS, REMOVALS, AND PROTECTION SCHEMATICS REFER TO THE TREE PROTECTION PLAN (IF APPLICABLE).



KEY PLAN N.T.S.

BENCHMARK NOTE:
 ELEVATION = 91.861 (CGVD-1928)
 MONUMENT: 63U3533
 ELEVATIONS ARE GEODETIC AND WERE DERIVED FROM BENCHMARK 63U3533, HAVING A PUBLISHED ELEVATION OF 91.861 METRES.

SITE BENCHMARK:
 ELEVATION = 90.51
 DOOR SILL OF THE EXISTING DWELLING AS INDICATED ON PLAN.



- GENERAL NOTES:**
- TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
 - ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
 - CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMANS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

| NO: | DATE: | DESCRIPTION: |
|-----|------------|---|
| 4 | 2026-02-18 | PER UPDATED SITE PLAN |
| 3 | 2026-02-13 | ISSUED WITH FUNCTIONAL SERVICING REPORT |
| 2 | 2025-07-09 | ISSUED FOR RE-ZONING APPLICATION |
| 1 | 2025-05-15 | REVISED PER CONSULTANT TEAM FEEDBACK |
| 0 | 2025-03-27 | ISSUED FOR CLIENT REVIEW |

REVISIONS

LandSmith ENGINEERING & CONSULTING LTD.
 LANDSMITH ENGINEERING & CONSULTING LTD.
 1059 UPPER JAMES STREET, SUITE 207
 HAMILTON, ON L9C 3A6
 ANDREW@LANDSMITHC.COM
 289-309-3632

CLIENT: NIAGARA ORCHARDS & VINYARD CORPORATION (NOVC)
 MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
 PROJECT NAME: 727 EAST & WEST LINE

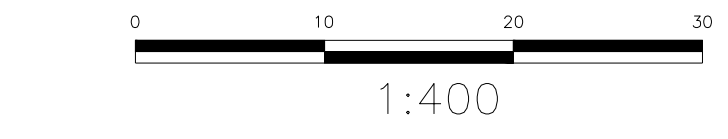
TITLE: PRELIMINARY GRADING & SERVICING PLAN

| | |
|------------------|------------------|
| SCALE: 1:400 | DATE: 2025-02-25 |
| CHECKED BY: AS | DESIGNED BY: OJ |
| DWG No: 25015Nov | SHEET No: GS1 |

ROOFWATER LEADERS / SUMP PUMPS
 ALL ROOFWATER LEADERS SHALL DISCHARGE ONTO SPLASH PADS AND THEN TO GRASSED OR LANDSCAPED AREAS A MIN. OF 0.6M FROM THE BUILDING FACE.
 SUMP PUMPS WITH CHECK VALVES ARE TO BE INSTALLED IN EACH DWELLING TO PUMP THE WEeping TILES TO THE STORM PRIVATE DRAIN. THE SUMP OUTLET SHALL EXTEND A MINIMUM OF 150mm ABOVE THE PROPOSED GRADE AT THE DWELLING (BASEMENT CEILING) PRIOR TO DISCHARGING TO THE STORM PRIVATE DRAIN.

FOUNDATION DRAINS
 WEeping TILES SHALL DRAIN TO SUMP PITS AND BE PUMPED TO STORM SEWER VIA PUMP SUMP WITH BACK-FLOW PREVENTER (SEE DETAILS). MIN. 1 HP PUMP WITH BACK-UP POWER REQUIRED.

- NOTES:**
- LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
 - ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.



APPENDIX 'B' – Sanitary and Water Analysis

Domestic Water Usage Calculations

Fire-Flow Requirement Calculations

Pages from Niagara Master Servicing Plan (Water)

Septic Design Report (T. I. Services)

DOMESTIC WATER USEAGE REQUIREMENTS

Project:
Method: Fixture Unit Method, Per OBC Table 7.6.3.2.A

| Legend | |
|------------------------------|--|
| Input Values | |
| Constants | |
| Drag down formulas to extend | |

Fixtures: The fixtures were based on the floor plans provided by dated 2025-01-01

| <u>Amount</u> | <u>Fixture Item (1-39)</u> | <u>Fixture Name</u> | <u>Private or Public</u> | <u>Fixture Units Per</u> | <u>Total</u> |
|---------------|----------------------------|---|--------------------------|--------------------------|--------------|
| 5 | 19 | Lavatory 8.3 L/min or less | Private | 0.7 | 3.5 |
| 1 | 32 | Sink service or mop basin | Public | 3 | 3 |
| 2 | 14 | Dishwasher domestic | Private | 1.4 | 2.8 |
| 2 | 21 | shower head 9.5 L/min or less per head | Private | 1.4 | 2.8 |
| 8 | 28 | Sink kitchen domestic 8.3 L/min or less | Private | 1.4 | 11.2 |

Total: **23.3**

1 - Reference Table 7.6.3.2.A, Ontario Building Code

Hydraulic Load: Fixture units are then transferred to Hydraulic Load based on Ontario Building Code Table 7.4.10.5.

Maximum hydraulic load is estimated to be **28.98** Imperial Gallons / Minute

23.3 Fixture Units = 28.98 lpgm = 2.20 L/s

The estimated maximum hydraulic load for the proposed building is **2.20** Liters per second.

Water service size required is **1** inches /
25.4 mm
(OBC Sentence 7.6.3.4.(6) and Table 7.6.3.4, Division B)

FIRE FLOW DEMAND REQUIREMENTS

Project: 727 East West Line
 Method: OFM-TG-03-1999
 FIRE PROTECTION WATER SUPPLY GUIDELINE FOR PART 3 IN THE ONTARIO BUILDING CODE
<http://www.mcscs.ius.gov.on.ca/english/FireMarshal/Legislation/TechnicalGuidelinesandReports/TG-1999-03.html>

Formula:

$$Q = K \times V \times S_{Tot}$$

Where: Q = minimum supply of water in litres
 K = water supply coefficient (Table 1)
 V = total building volume in cubic meters
 S_{Tot} = total of spacial coefficient tables

| <u>Volume (V)</u> | | Floor | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------------|----------------|-------|------|---|---|---|---|---|
| Floor Area (Avg): | 6473.0 (sq.m) | Area | 6473 | | | | | |
| Height: | 7.19 (m) | | | | | | | |
| Building Volume: | 46540.9 (cu.m) | | | | | | | |

Water Supply Coefficient (K)

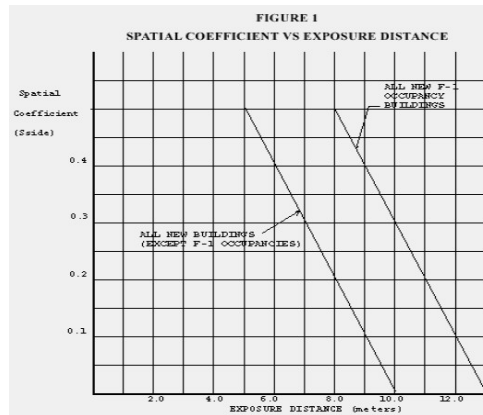
K: 17
 OBC Part: F-2 (Residential)
 Construction Type: *Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2. of the OBC.*

Spacial Coefficients (S)

| | Distance | |
|----------------|----------|--------------|
| S ₁ | 0 | 30.3 (North) |
| S ₂ | 0 | 41.4 (East) |
| S ₃ | 0 | n/a (South) |
| S ₄ | 0 | 18.37 (West) |

S_{Tot} = 1.0 + S₁ + S₂ + S₃ + S₄ = 1

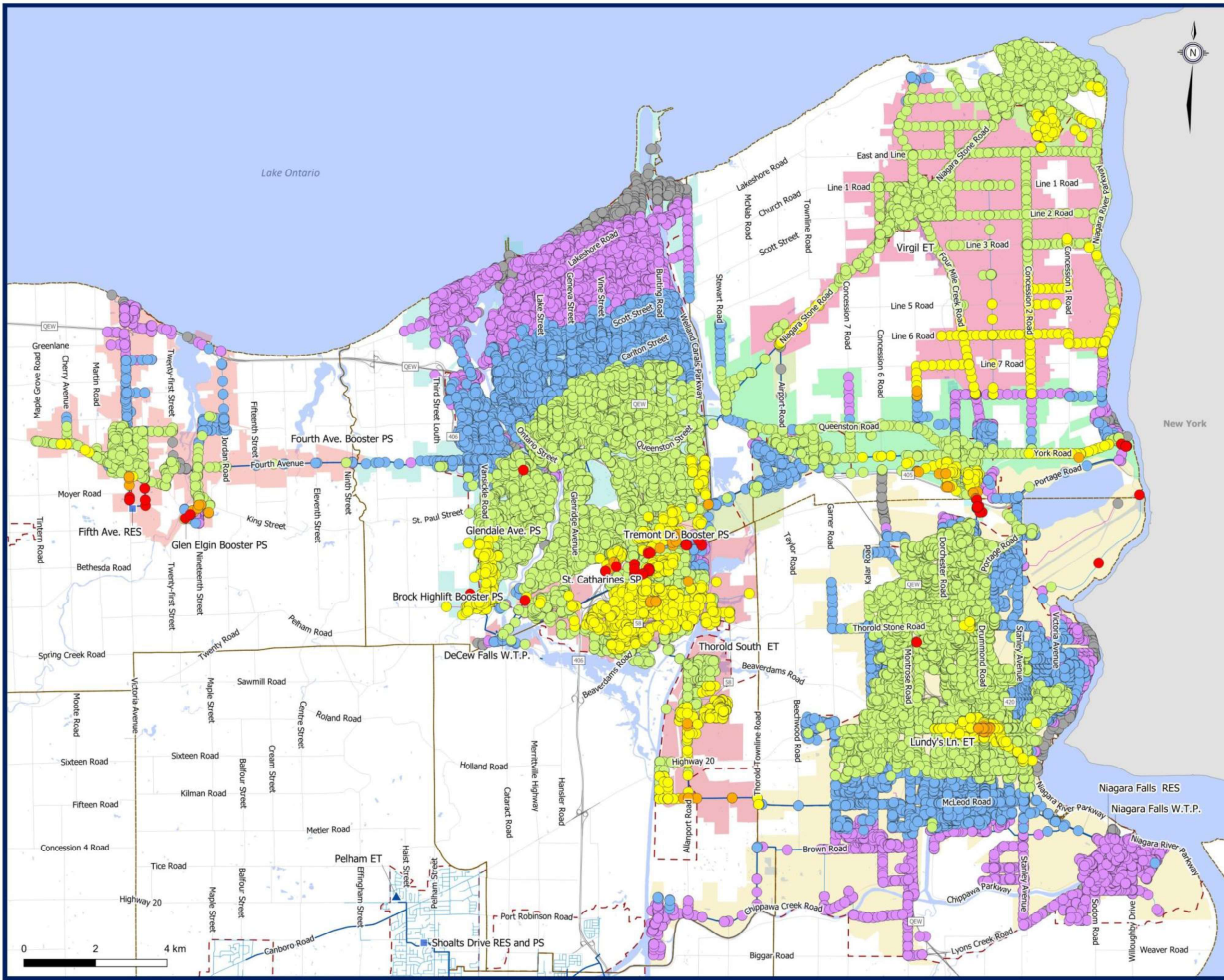
(Ref. Figure 1 attached)



Q = 791,195

Required Flow Rate = 9,000 L / Min
 150 L / Sec

| Building Code, Part 3 Buildings | Required Minimum Water Supply Flow Rate (L/min.) |
|--|--|
| One-storey building with building area not exceeding 600m ² (excluding F-1 occupancies) | 1800 |
| All other buildings | 2700 (If Q ≤ 108,000L) ⁽¹⁾ 3600 (If Q > 108,000L and ≤ 135,000L) ⁽¹⁾ 4500 (If Q > 135,000L and ≤ 162,000L) ⁽¹⁾ 5400 (If Q > 162,000L and ≤ 190,000L) ⁽¹⁾ 6300 (If Q > 190,000L and ≤ 270,000L) ⁽¹⁾ 9000 (If Q > 270,000L) ⁽¹⁾ |



- Existing Water Infrastructure**
- ◆ Water Treatment Plant (W.T.P.)
 - ▲ Pumping Station (P.S.)
 - Elevated Tank (E.T.) / Standpipe (S.P.)
 - Reservoir (RES)
 - Chlorine Facility
 - Region Mains
 - Local Mains
 - Private

Water Pressure Zones (HGL)

| | | |
|-----|-----|----------|
| 127 | 164 | 200 |
| 144 | 168 | 220 |
| 154 | 180 | 227 |
| 161 | 189 | 250 (NF) |

- Other Features**
- ▭ Municipal Boundary
 - ▭ Waterbodies
 - ▭ Urban Area Boundary

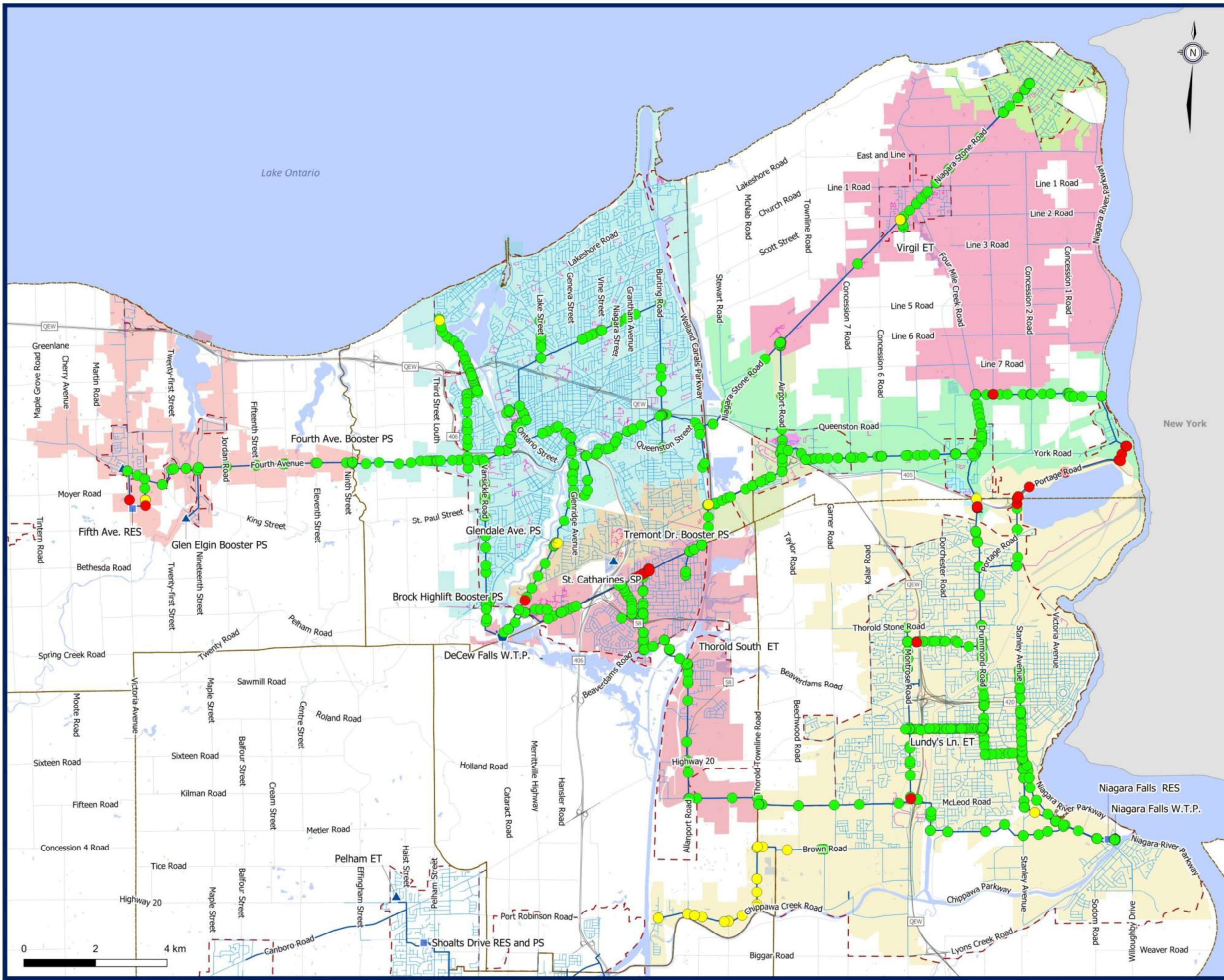
Minimum Pressures (psi)

| | |
|-----------|------------|
| ● < 40 | ● 80 - 90 |
| ● 40 - 50 | ● 90 - 100 |
| ● 50 - 60 | ● > 100 |
| ● 60 - 80 | |



Figure 3.B.4
DeCew Falls System
Existing System Peak Hour Pressures





Existing Water Infrastructure

- ◆ Water Treatment Plant (W.T.P.)
- ▲ Pumping Station (P.S.)
- Elevated Tank (E.T.) / Standpipe (S.P.)
- Reservoir (RES)
- Chlorine Facility
- Region Mains
- Local Mains
- Private

Water Pressure Zones (HGL)

| | | |
|-----|-----|-----|
| 127 | 164 | 200 |
| 144 | 168 | 220 |
| 154 | 180 | 227 |
| 161 | 189 | 250 |

Other Features

- Municipal Boundary
- Waterbodies
- Urban Area Boundary

Regional Mains Available Fire Flow (L/s) - 30 psi Residual Pressure

- < 125
- > 250
- 125 - 250



Figure 3.B.5
DeCew Falls System
Existing System Fire Flows

T.I SERVICES

23 Ludlow Crescent Phone: 519.802.7873
Brantford, ON N3P 1V2 Email: tiservicesinfo@gmail.com

February 10, 2026

Niagara Vineyards & Orchids Corp
C/O Arnie Lepp
R.R #5 1196 Irvine Road
Niagara-on-the-Lake, ON L0S 1J0

Re: Private Onsite Wastewater Servicing Report – Agricultural Service & Supply Facility 727 East & West Line NOTL – Revised February 10, 2026

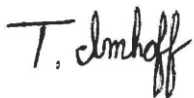
To Whom It May Concern,

T.I Services is pleased to present the private onsite wastewater servicing report for the proposed agricultural warehouse facility located within the municipal jurisdiction of the Town of Niagara-On-The-Lake with a current civic address of 727 East & West Line, Niagara-on-the-Lake, Ontario L0S 1J0.

The purpose of this **revised** report is to provide details on the proposed preliminary onsite wastewater treatment system (commonly referred to as a septic system), including maximum daily sewage flow calculations, proposed septic system components and capacities, as well as septic design and layout meeting all *Ontario Building Code* requirements to support the planning approvals process. It also includes details on existing features related to the existing residential property. **Please note this report has been revised to reflect updated information from onsite inspection, update septic system design and site plan and discussions with Niagara Region Sewage Regulating Office regarding the existing septic system and replacement leaching, as well as contingency leaching bed areas for the proposed in-ground absorption trenches.**

If there are any questions regarding the information contained in this report, please do not hesitate to contact the undersigned.

Warm Regards,



Trevor Imhoff, B.E.S
Owner, T.I Services
23 Ludlow Crescent Brantford, ON N3P 1V2
BCIN # 42698
Ph: (519) 802-7873 | Email: tiservicesinfo@gmail.com

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1.0 Introduction

The proposal includes a severance of the civic address located at 727 East & West Line Niagara-on-the-Lake, Ontario and the development consists of an Agricultural Service and Supply Facility with a total square meter of 7,129m² and includes ten (10) loading bays. The main purpose of the buildings will be orchard and vineyard equipment supply and sales, as well as cold fruit storage and distribution. The floor plans include proposed offices and reception area to support the main purpose of the buildings and will include four (4) water closets, four (4) wash basins, and two (2) showers. The buildings will be serviced by municipal potable water supply and a proposed private onsite wastewater treatment system. The proposed development is to be built in the municipal jurisdiction of the Town of Niagara-On-The-Lake, hereby referred to as the “The Site” with the closest intersection to the east being East & West Line and Concession 4 Road with agricultural fields to the south and rural residential to the east and west of The Site. See *Appendix A –Site Location*

The Site includes an existing rural residential single dwelling unit (SDU) and detached garage. The proposed severance will include two parts; Part 1 having a proposed area of 1.00 acre (0.4 Ha) for the existing SDU, and Part 2 having a proposed area of 4.36 acres (1.76Ha) for the proposed Agricultural Service and Supply Facility.

The proposed onsite wastewater treatment system will include a tertiary Class 4 Level IV system including a sewage lift station and two separate shallow buried trench leaching beds to service the Agricultural Service and Supply Facility.

2.0 Existing Site Features and Soil Characteristics

The Site was inspected by T.I Services on June 27, 2025 at approximately 10:00AM. Visual inspections of the existing agricultural field and visual inspection of the existing well and septic system servicing the existing residential building was completed. A utility probe was used to determine approximate location of existing leaching bed.

The existing Site features include a residential Single Dwelling Unit (SDU) containing 3 bedrooms, 2 bathrooms with a finished floor area of 1,400ft². Based on this the estimated maximum daily sewage flows according to *Table 8.2.1.3.A* of the *Ontario Building Code* is 1,600L/day. The septic system servicing the SDU appears to be a traditional Class 4 Level I septic system with a septic tank and in-ground absorption trenches. At the time of the Site inspection the septic tank was not visible, however it was marked in orange spray paint. At the time of the inspection there were no signs of malfunction with the septic tank and the ground around the septic tank was dry. The existing leaching bed was visually inspected and at the time of inspection was functioning with no evidence of soggy/soft ground or break-out.

At the request of Niagara Region both septic tank lids were exposed and a 12.0m length trench was dug along the proposed property line running east-west, south of the existing SDU. The trench was dug running east-west orientation and approximately 27.5m south of the existing SDU. T.I Services completed another onsite inspection November 4, 2025. Both septic tank lids were opened and inspected. The septic tank appeared to be in overall good condition with effluent levels at normal operating conditions. The primary chamber had effluent levels at or slightly below inlet pipe, it was noted there was no inlet baffle. The secondary chamber

had effluent levels at or slightly below outlet pipe and it was noted there was an outlet baffle, but no effluent filter.

The trench was inspected and it was noted there were four (4) clay distribution pipes and trenches running north-south. A utility probe followed the trenches, and it indicated the existing in-ground leaching bed does not meet current Ontario Building Code setbacks to the proposed property line. This was discussed with Niagara Region and it was agreed a replacement leaching bed would be required to service the SDU. See additional site photos in *Appendix E* and updated Septic Design and Site Layout in *Appendix C*.

The existing well is located north of the SDU in the front yard and contains a steel case with a Well Tag #A092690 (Ministry of Environment, Conservation and Parks, 2025). Please see *Appendix E – Site Photos*.

Soil conditions to determine soil permeability (T-Time) were completed by Soil-Mat Engineering through their Geotechnical study (see separate report). Boreholes were completed within the area of the proposed leaching beds (BH6 and BH7) and existing soil conditions were described as “Silty Clay/Clayey Silt”. Grain size analysis was also completed by Soil-Mat Engineering and was determined for both BH6 and BH7 with T-Time of >50min/cm.

Preliminary groundwater conditions were also assessed by Soil-Mat Engineering and it is noted that although the boreholes were backfilled prior to static groundwater levels to stabilize, based on their investigations, combined with drilling experience in the area, groundwater is estimated at depths of 2 to 3 metres below the existing ground surface.

3.0 Site Specific Design

3.1 Daily Sewage Flow Calculations

Sanitary Sewage Flows

The proposed daily sanitary sewage flow calculations for the proposed Agricultural Facility are broken down by the expected type of use of the building and follows *Table 8.2.1.3.B Other Occupancies* under *Part 8 Sewage Systems* of the *Ontario Building Code Act, 1992 (OBC)*. Confirmation from the owners indicate there will be no irrigation or other process water entering the septic system. The sanitary sewage flow calculations are based on “Warehouse” calculations and broken down as follows:

- Total number of Water Closets; and
- Total number of Loading Bays.

Table 1.0 Maximum Daily Sanitary Sewage Flow Calculations

| Description | Units | # Units | L/d per Unit | L/d |
|-------------------------|--------------------|---------|--------------|-----------------|
| Warehouse Water Closets | # of Water Closets | 4.0 | 950.0 | 3,800.0 |
| Warehouse Loading Bays | # Loading Bays | 10.0 | 150.0 | 1500.0 |
| | | | TOTAL | 5,300.00 |

Therefore the total maximum sanitary sewage flows are estimated at 5,300 L/day.

There is also currently a 1,000L/day contingency used to design the current septic system. This contingency is added only due to the uncertainty of how Niagara Region may require calculating the maximum daily sewage flows and to show the capability of The Site being able to be adequately serviced.

Therefore the total maximum daily sanitary sewage flows that will be used to design the onsite wastewater treatment system will be 6,300 L/d.

For further breakdown on wastewater calculations and minimum septic system component requirements please see *Appendix B – Maximum Daily Sewage Calculations*. Please note a subsequent meeting occurred on December 17, 2025 with Niagara Region’s Private Sewage Inspector, Associate Director of Development Engineering and a Regional Planner to discuss previous comments submitted regarding daily sewage flows. Sewage calculations were discussed and there was no additional requirements indicated at that time.

3.2 Septic Tank Capacity Calculations

The septic tank was designed according to *clause 8.2.2.3. Septic Tanks* of the *Ontario Building Code (OBC)* at three (3) times the calculated daily sanitary sewage flows. The septic tank capacity formula serving the Agricultural Facility is calculated as:

$$Q \times 3 = \text{Minimum (L) Septic Tank Capacity}$$

$$6,300 \text{ L/Day} \times 3 = 18,900 \text{ L}$$

Whereas Q equals the total daily design sanitary sewage flow in liters from the agricultural facility.

Therefore, a double chamber septic tank meeting CSA B66 Construction Standard with a minimum capacity of 18,900 L is proposed. An effluent filter will be equipped on the outlet pipe of the septic tank prior to the tertiary tank.

The effluent from the septic tank will flow by gravity to the tertiary tank, whereby additional treatment will occur prior to flowing to the pump tank. The tertiary tank manufacturer, and therefore sizing is not included in this current design and report to allow for flexibility to decide on final technology and will be confirmed during final building and septic permit applications.

A minimum one (1/2) day capacity is recommended to size the pump tank and therefore the minimum capacity would be 3,150 L.

To see the proposed locations of the septic system please see *Appendix C – Onsite Wastewater Treatment Design and Layout*.

3.3 Shallow Buried Trench Calculations

The treated effluent is proposed to be dispersed into the subsurface environment utilizing two separate Shallow Buried Trenches (SBT) as the leaching beds. The loading rate of the SBT is calculated based on the soil permeability (T-Time of >50min/cm) and is in accordance with *Table 8.7.3.1A. Length of Leaching Chamber in Shallow Buried Trench* with the following formula:

$$L = Q / 30$$

$$210 \text{ m} = (6,300 \text{ L/d}) / 30$$

Whereas L equals the total length of chamber required in meters; and

Whereas Q equals the total daily design sanitary sewage flow in litres.

Therefore, the total minimum length of SBT is calculated at 210 m.

3.4 Proposed Treatment Summary

The proposed onsite wastewater treatment system includes primary and tertiary treatment of sanitary, residential strength sewage, with final treatment occurring within the in-ground Shallow Buried Trenches.

The components of the onsite wastewater treatment system will include:

- One (1) 9,100 L sewage lift station/pump tank equipped with a grinder pump connected to an audible and visual alarm system.
- A 2" high density polyethylene (HDPE) (or equivalent) manifold piping sending sewage from the lift station to the primary septic tank.
- One (1) Primary 18,900 L CSA double chamber septic tank equipped with an effluent filter.
- One (1) Tertiary septic tank sized to handle up to 6,300L/day sewage flows (technology/manufacturer to be determined during final septic permit application).
- Two (2) Shallow Buried Trench (SBT) Leaching beds each containing four (4) trenches each 27.0m in length with 1.5" pressurized PVC piping and chamber spaced 2.0 m on centre. Each trench depth will be between 600mm and 900mm and width will be between 500mm and 1000mm.

4.0 Qualifications of Lead Consultants

Trevor Imhoff, B.E.S is the owner of T.I Services. He received his Honours Bachelor Degree from the University of Waterloo with a Minor in Biology and Diploma in Ecological Restoration and Remediation. He has 12 years experience solving complex environmental problems. Trevor is currently qualified under the Ministry of Housing as a licensed *Independent Designer* for *Part 8 Sewage Systems* and *Part 9 Housing and Small Buildings*. He has over 10 years experience in the onsite wastewater treatment industry conducting hundreds of onsite wastewater inspections and designs for both residential and commercial properties. Over the course of his career he has worked for two engineering firms, spent 2.5 years as a Municipal Septic Inspector and member of the Ontario Building Officials Associations (OBOA). He has been an *Independent Designer* since 2014.

Recent similar successful projects T.I Services have completed include but are not limited to:

- Be In Christ Church Tertiary Septic System Design, Town of Pelham (2024);
- Waterview Farms Septic and Constructed Wetland Greenhouse and Warehouse Operation (2021), Town of Lincoln (Ministry of Environment, Conservation and Parks approval);
- Lepp Distillery Onsite Wastewater Design and Installation (2020), Town of Niagara-On-the-Lake;
- Orchid Greens Greenhouse Expansion (2020), Town of Niagara-On-The-Lake;
- Virgil Greenhouses Help House (2019), Town of Niagara-On-The-Lake;

- Pioneer Farms Advanced Tertiary Wastewater Design (2019), City of St. Catharines.

5.0 Conclusion

T.I Services is confident that the proposed onsite wastewater treatment system was designed conservatively in order to handle the calculated maximum sanitary sewage flows from the proposed agricultural facility. Maximum daily sewage flows were calculated based on past experience working with Niagara Region Sewage Regulating Office with additional contingency sewage flows provided. It is expected the actual maximum daily sewage flows would be less than what is calculated currently.

6.0 REFERENCES

Niagara Region (2025). Navigator. Retrieved from:

<https://navigator.niagararegion.ca/portal/apps/webappviewer/index.html?id=4500745f3cd141ddb707913a444e7886>

Province of Ontario Ministry of Agriculture, Food and Rural Affairs (2021). AgMaps Geographic Information Portal.

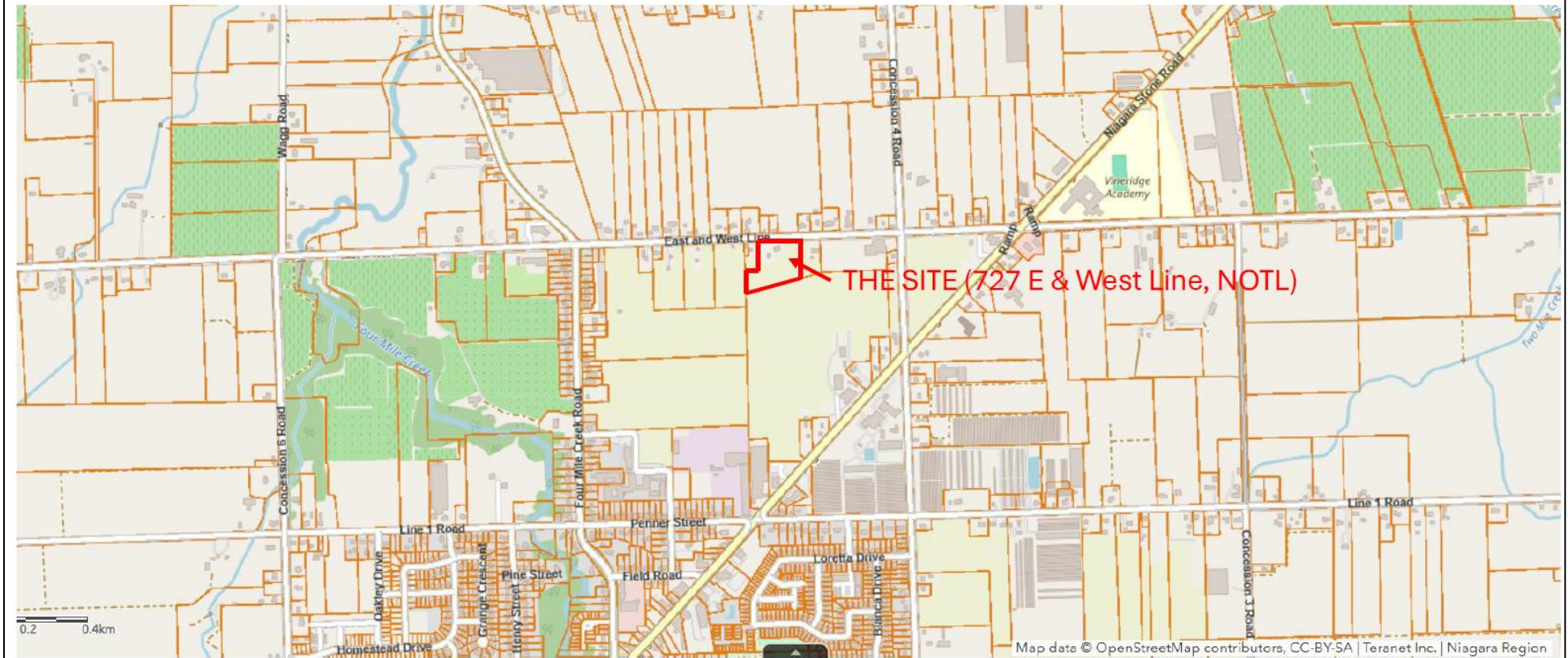
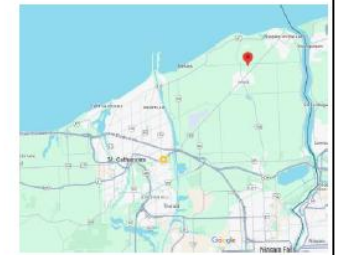
Retrieved from: <http://www.omafra.gov.on.ca/english/landuse/gis/portal.htm>

Province of Ontario Ministry of Environment, Conservation and Parks(2025). Map: Well records. Retrieved from:

<https://www.ontario.ca/page/map-well-records>

APPENDIX A – SITE LOCATION

727 E & West Line,
Niagara-on-the-Lake, Ontario
LOS 1J0



Source: Niagara Region (2025)

APPENDIX B – MAXIMUM DAILY SEWAGE FLOW CALCULATIONS

T.I SERVICES

23 Ludlow Crescent Brantford, ON N3P 1V2
 Phone:(519) 802-7873
 Email: tiservicesinfo@gmail.com
 BCIN # 42698

Owner:
 Niagara Orchids and Vineyards
 Corp.

Site Location:
 727 East and West
 Line, NOTL

EXISTING Sewage Flow

| Description | Units | # Units | L/d per Units | L/d |
|---|---|--|---------------|-------------|
| Existing Residential Building #1 (to be severed) | # bedrooms, # fixture units (FU), sq footage; or | 3 bedroom, 2 bath, 1400ft2 single family dwelling | N/A | 1600 |
| | | | Total: | 1600 |

PROPOSED Sewage Flows

| | | | | |
|---|-------------------------------------|----|---------------|-------------|
| Warehouse Building | # of employees per 8 hour shift; or | 16 | 75 | 1200 |
| | # of toilets; and | 4 | 950 | 3800 |
| | # of urinals; and | 0 | 450 | 0 |
| | # of loading bays | 10 | 150 | 1500 |
| Total Proposed Sewage Flows based on combination of total number of toilets, urinals and loading bays. | | | Total: | 5300 |

Contingency Sewage Flows: 1000

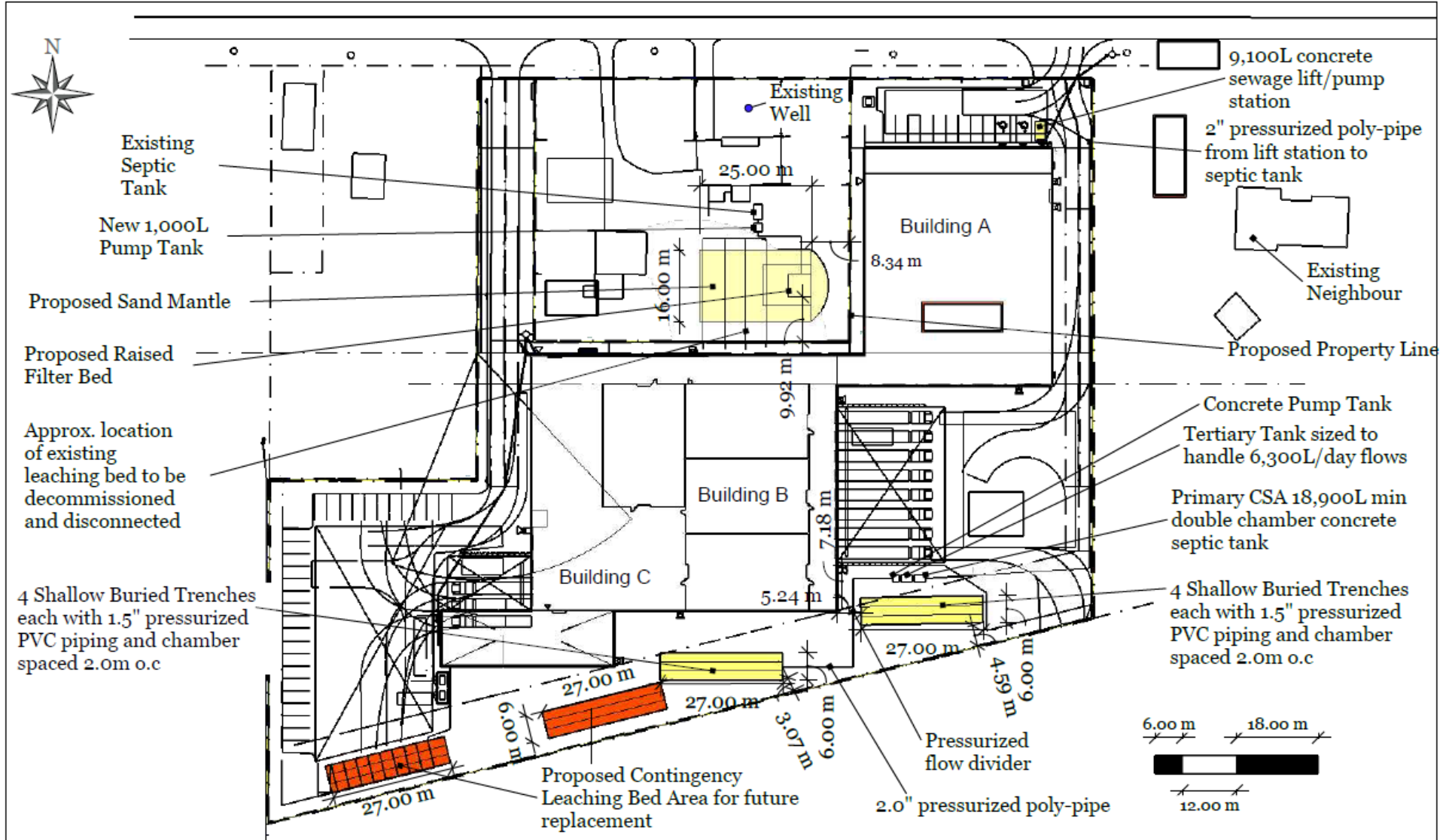
Total Calculated Max Daily Sewage Flows: 6300

Agricultural Facility Septic System Requirements (6,300L/day flow)

| Septic Components | Calculations | Minimum Requirement | Units | Proposed/Required | Units |
|----------------------------------|--------------|---------------------|--------|-------------------|------------------|
| Primary Septic Tank | Q X 3 | 18900 | Litres | 18,900 | Litres |
| Tertiary Septic Tank | N/A | N/A | N/A | 6,300 | Litres/day flows |
| Final Pump Tank | Q / 2 | 3150 | Litres | 3150 | Litres |
| Tertiary Shallow Buried Trenches | Q / 30 | 210 | Meters | 216 | Meters |

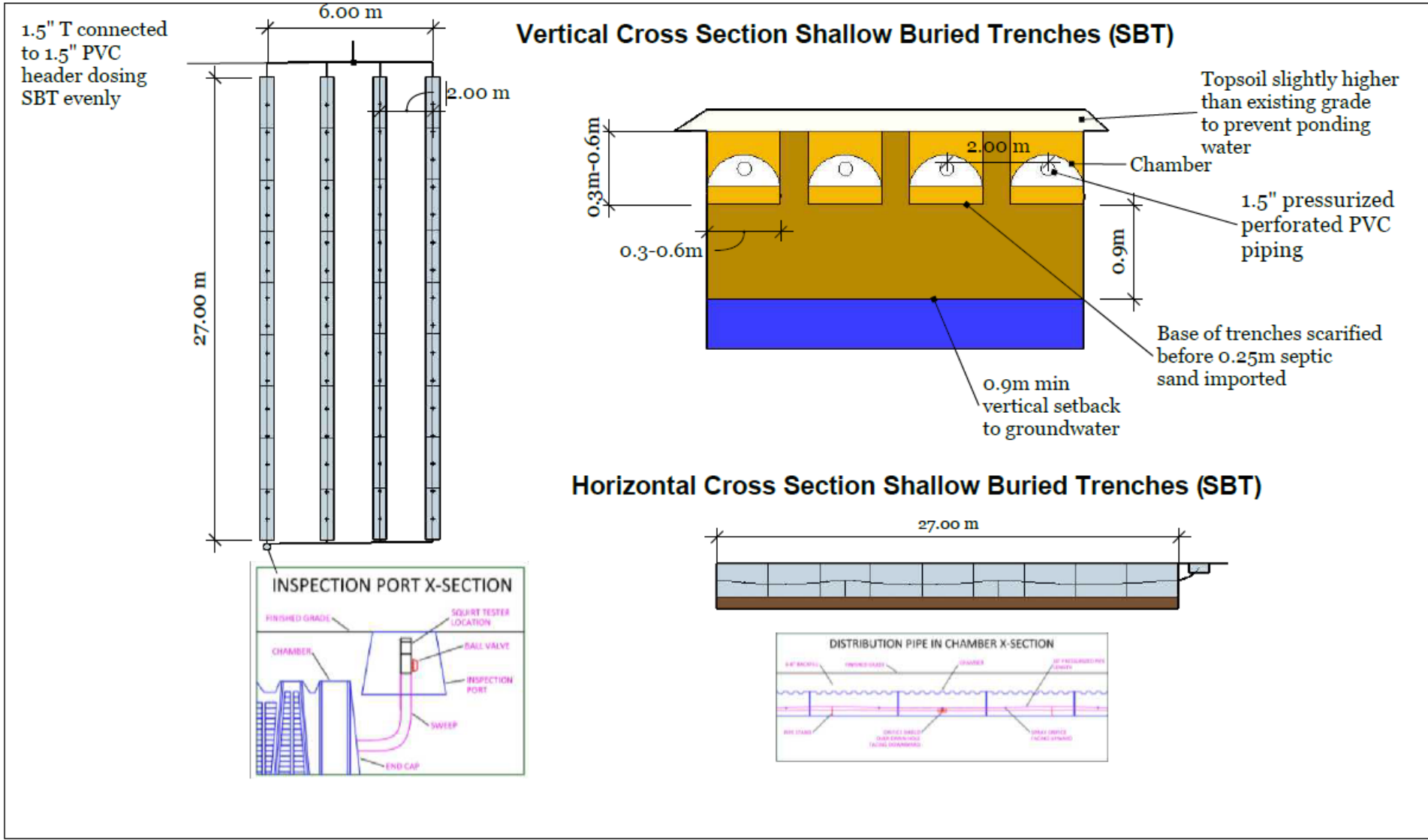
*Soil-Mat T-Time Analysis estimates clay soil with T-Time >=50 min/cm

APPENDIX C – REVISED ONSITE WASTEWATER TREATMENT DESIGN AND LAYOUT



| <p>T.I Services 23 Ludlow Crescent Brantford, ON N3P 1V2 Ph: (519) 802-7873 tiservicesinfo@gmail.com</p> | <p>Title: Tertiary Septic System Design - Agricultural Facility 727 E & West Line NOTL</p> | | <p style="text-align: right;">01 A</p> | | | | | | | |
|--|---|--|--|--|----------|---------|----------------|--|----------------|--|
| | <p>Client: Niagara Orchid and Vineyard Inc.</p> | <p>Designer: T. Imhoff BCIN #: 42698</p> | | <table border="1"> <thead> <tr> <th>MM/DD/YY</th> <th>REMARKS</th> </tr> </thead> <tbody> <tr> <td>1 06 / 13 / 25</td> <td></td> </tr> <tr> <td>2 07 / 10 / 25</td> <td></td> </tr> <tr> <td>3 02 / 10 / 26</td> <td></td> </tr> </tbody> </table> | MM/DD/YY | REMARKS | 1 06 / 13 / 25 | | 2 07 / 10 / 25 | |
| MM/DD/YY | REMARKS | | | | | | | | | |
| 1 06 / 13 / 25 | | | | | | | | | | |
| 2 07 / 10 / 25 | | | | | | | | | | |
| 3 02 / 10 / 26 | | | | | | | | | | |

APPENDIX D – SHALLOW BURIED TRENCH CROSS SECTIONS



| | | | | | | | |
|--|--|--------------|--|--|----------|---------|------|
| <p>T.I Services 23 Ludlow Crescent Brantford, ON N3P 1V2 Ph: (519) 802-7873 tiservicesinfo@gmail.com</p> | <p>Title: Shallow Buried Trenches Cross Sections - Agricultural Facility 727 E & West Line NOTL</p> | | <p>Client: Niagara Orchid and Vineyard Inc.</p> | <p>Designer: BCIN #: 42698</p> | MM/DD/YY | REMARKS | A 01 |
| | 1 | 06 / 13 / 25 | | | | | |
| 2 | 07 / 10 / 25 | | | | | | |
| 3 | --- / --- / --- | | | | | | |

APPENDIX E – SITE PHOTOS

The Site



Septic Tank



Septic Tank Probed



Leaching Bed Area - North



Leaching Bed Area – South



Agricultural Field



Well Location



Well Tag



APPENDIX E – ADDITIONAL SITE PHOTOS

Trench Location – South Facing



Trench Location – North Facing



Existing Clay Distribution Pipes



Septic Tank – Primary Chamber

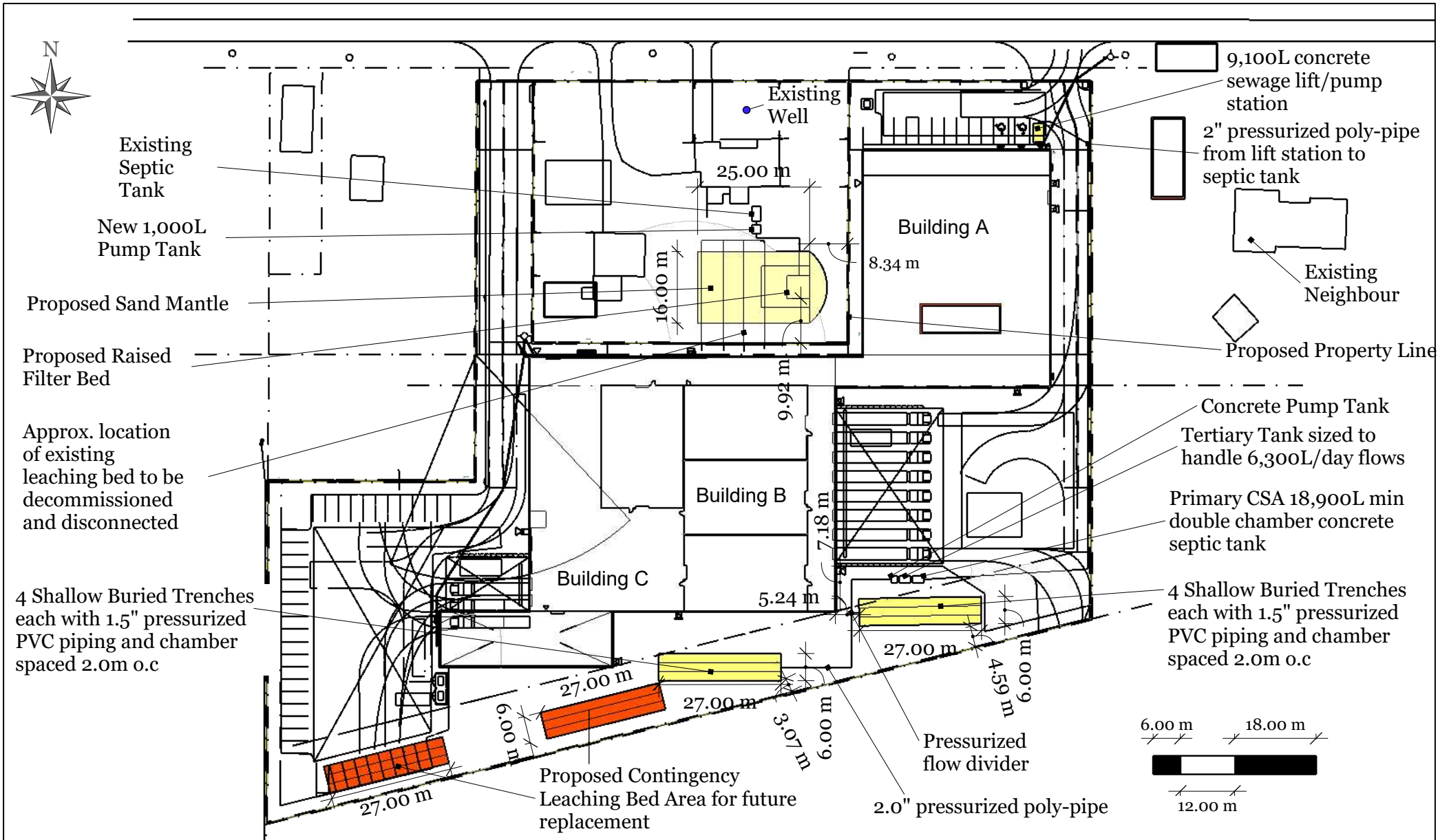


Septic Tank – Secondary Chamber



Septic Tank – Location





T.I Services
 23 Ludlow Crescent
 Brantford, ON N3P 1V2
 Ph: (519) 802-7873 | tiservicesinfo@gmail.com

Title: Tertiary Septic System Design - Agricultural Facility 727 E & West Line NOTL

Client: Niagara Orchid and Vineyard Inc.

Designer: T. Amhoff

BCIN #: 42698

| | MM/DD/YY | REMARKS |
|---|--------------|---------|
| 1 | 06 / 13 / 25 | |
| 2 | 07 / 10 / 25 | |
| 3 | 02 / 10 / 26 | |

A 01

APPENDIX 'C' – Stormwater Management

Pre-Development Drainage Area Plan

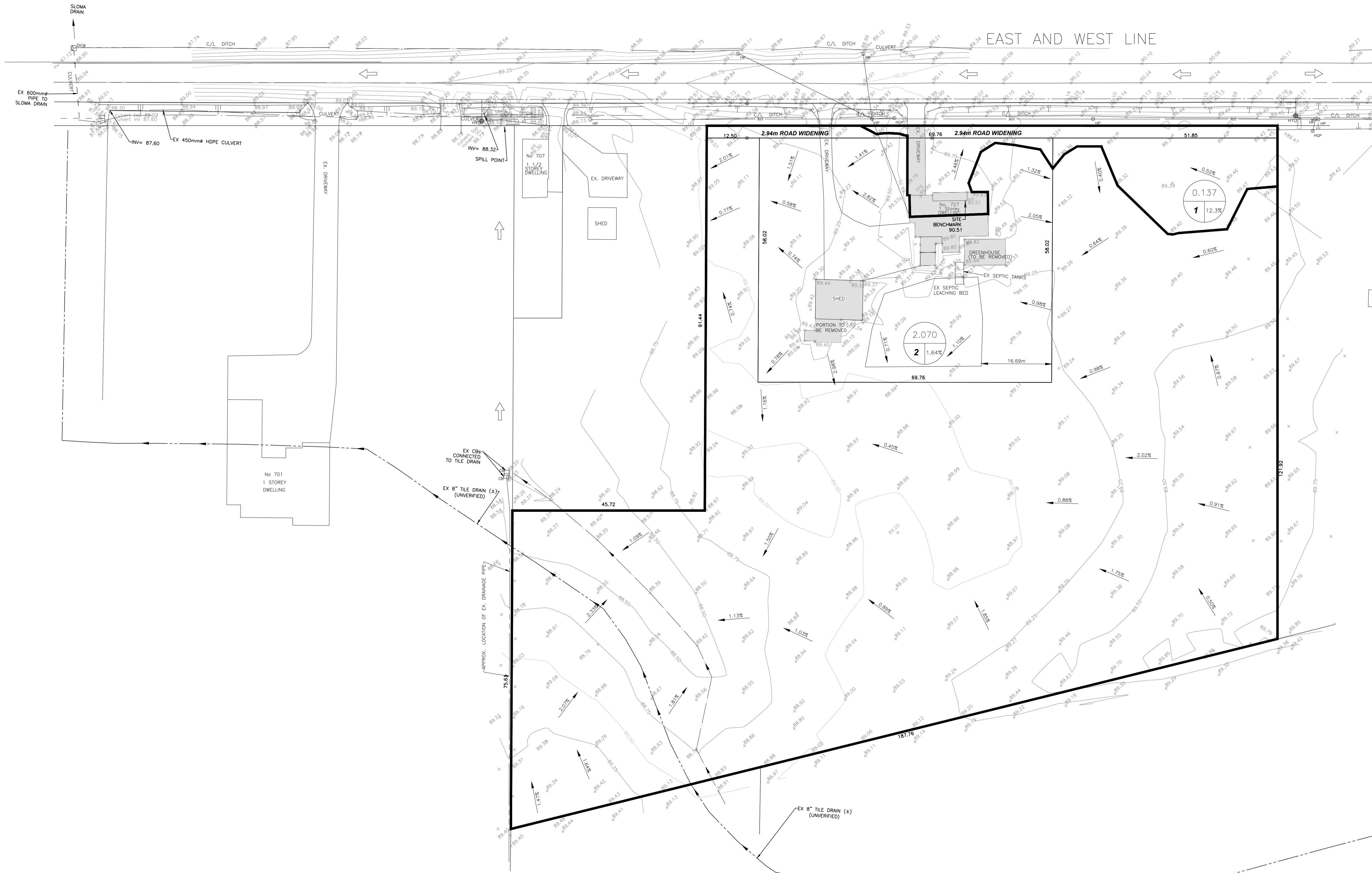
Sloma Drain Background Information

Water Course Memo

Post-Development Drainage Area Plan

MIDUSS v2 Output Files

ECORASTER E50 Technical Product Information



LEGEND

- 0.035 DRAINAGE AREA (HECTARES)
- 1 100% IMPERVIOUSNESS (%)
- DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- IMPERVIOUS SURFACE
- SHEET FLOW DIRECTION



KEY PLAN N.T.S.

BENCHMARK NOTE:
 ELEVATION = 91.861 (CGVD-1928)
 MONUMENT: 63U3533
 ELEVATIONS ARE GEODETIC AND WERE DERIVED FROM BENCHMARK 63U3533, HAVING A PUBLISHED ELEVATION OF 91.861 METRES.

SITE BENCHMARK:
 ELEVATION = 90.51
 DOOR SILL OF THE EXISTING DWELLING AS INDICATED ON PLAN.

- GENERAL NOTES:**
- TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
 - ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
 - CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMANS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

| NO. | DATE: | DESCRIPTION: |
|-----|------------|-----------------------|
| 1 | 2026-02-18 | PER UPDATED SITE PLAN |
| 0 | 2025-11-26 | FIRST SUBMISSION |

REVISIONS

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
 1059 UPPER JAMES STREET, SUITE 207
 HAMILTON, ON L9C 3A6
 ANDREW@LANDSMITHEC.COM
 289-309-3632

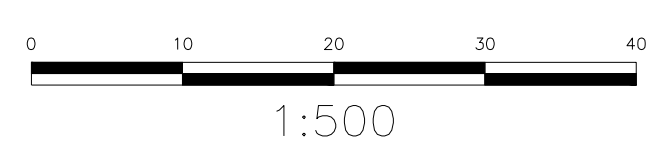
CLIENT: NIAGARA ORCHARDS & VINYARD CORPORATION (NOVC)

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE

PROJECT NAME: 727 EAST & WEST LINE

TITLE: PRE-DEVELOPMENT DRAINAGE AREA PLAN

| | |
|------------------|------------------|
| SCALE: 1:400 | DATE: 2025-02-25 |
| CHECKED BY: AS | DESIGNED BY: BC |
| DWG No: 25015Nov | SHEET No: PD1 |



727 EAST & WEST LINE

TOWNSHIP OF NIAGARA

BY-LAW NO. 1863-63

A By-law to provide for the Sloma Municipal Drain in the Township of Niagara, in the County of Lincoln, and for borrowing upon the credit of the Corporation the sum of \$8,535.01 for completing the same. (Provisionally adopted the 8th day of January, 1963).

WHEREAS Kazimierz Sloma, and others, have petitioned the Council of The Corporation of the Township of Niagara to construct drainage works in connection with Lots 12 to 17, both inclusive, as shown on the Wall Plan, a plan whereof is registered in the Registry Office for the Registry Division of the County of Lincoln as Plan No. 163 for the Township of Niagara, as set out in the said petition; and

WHEREAS the Council has procured an examination to be made by R. Blake Erwin, P. Eng., Township Engineer, being a person competent for such purpose, of the said area, for the said purpose and the means suggested for the drainage thereof and of other lands and roads liable to assessment under The Municipal Drainage Act and has procured plans, specifications and estimates of the drainage work to be made by the said R. Blake Erwin, and an assessment to be made by him of the lands and roads liable for contribution thereto, stating as clearly as he can the proportion of benefit and outlet liability, which, in his opinion, will be derived or incurred as a consequence of such drainage work by every road and lot, or portion of road, the said assessment so made being the assessment hereinafter by this By-law enacted to be assessed and levied upon the roads and lots, or parts of lots, hereinafter in that behalf set forth and described; and the report of the said R. Blake Erwin in respect thereof and of the said drainage work being as follows:

TOWNSHIP OF NIAGARA

COUNTY OF LINCOLN

SLOMA MUNICIPAL DRAIN

The Reeve and Members of Council,
Township of Niagara,
Virgil, Ontario.

Gentlemen,

In accordance with your instructions and in response to the petition of Kazimierz Sloma and others, the owners of Lots 12 to 17 both inclusive, I have examined the watercourse now known as the Sloma Drain. I find that many underdrains are discharging into this drain with insufficient outlet and with illegal outlets, to the extent that the discharge from the said underdrains is causing damage to the lands of owners along the course of the drain.

I therefore, recommend that trunk underdrain outlets be constructed of the various sizes shown on my plan and profile from the junction of the said Sloma Drain with the Four Mile Creek in Lot 173, Corporation Plan No. 7, to a point on the south side of the East and West Line at the northeast angle of Lot 6, according to Registered Plan No. 163.

A petition for improved drainage of Hunter Road was received by Council from the Township Road Superintendent.

I recommend in response to this petition, that a 12 inch underdrain be constructed in the northerly road ditch of Hunter Road from its junction with the main Sloma Drain easterly along Hunter Road to a point near the southeasterly angle of the lands of W. & S. Spiewak, all as shown on the accompanying plans and profiles. This proposed drain on Hunter Road will provide satisfactory road drainage and will satisfactorily eliminate the drainage complaint of W. & S. Spiewak.

I find that the rear parts of Lots 15 and 16, Plan 163 require an improved outlet. I recommend that a ditch approximately one and one half feet deep be constructed with a power grader from the northeasterly angle of Lot 16, Plan 163, easterly 29 feet to the line between the lands of John Nur and J.R. Graham; thence northerly along the said line 332 feet; thence westerly across the lands of John Nur, 412 feet to the line between the lands of John Nur and N. & K. Howard; thence northerly along the said line to the southerly Hunter Road ditch, all as shown on the accompanying plans.

My estimate of the cost of the work proposed herein is as follows:

| | |
|--|----------------|
| Supply, dig, lay and backfill 2,825 lin.ft. 12" concrete field tile @ \$1.00 per foot | \$ 2,825.00 |
| Supply, dig, lay and backfill 1,981 lin.ft. 14" concrete field tile @ \$1.40 per foot | 2,773.40 |

| | |
|--|---------------------------|
| Supply, dig, lay and backfill 1,435 lin.ft. 16" concrete field tile @ \$2.00 | 2,870.00 |
| Supply, bore under East & West Line and install 30' - 12" asbestos cement sewer pipe @ \$11.60 | 348.00 |
| Supply, bore under 4 Mile Creek Road and install 30' - 16" asbestos cement sewer pipe @ \$14.50 | 435.00 |
| Supply, dig, lay and backfill for farm driveways 90' - 12" C.76.57T Class 2 concrete sewer pipe @\$2.50 | 225.00 |
| Supply, dig, lay and backfill for farm driveways 90' - 15" C.76-57T Class 2 concrete sewer pipe @\$3.33 | 299.70 |
| Supply all material and install as per drawing 14 catchbasins complete | 995.00 |
| Construct grader ditch as shown on plan | 50.00 |
| Clerk's fees | 75.00 |
| Court of Revision | 50.00 |
| Legal fees | 350.00 |
| Engineering fees & disbursements for surveys plans, profiles and report | 1,256.42 |
| Inspection during construction | <u>250.00</u> |
| Total estimated cost | <u><u>\$12,802.52</u></u> |

This drain is eligible for a 33 1/3rd per cent subsidy under The Provincial Aid to Drainage Act. The estimated cost of work after receipt of the subsidy is \$8,535.01.

The amount of \$8,535.01 I assess upon the lands and roads benefited or otherwise liable under the provisions of the Municipal Drainage Act, and each road, lot and part of lot paying the proportion set forth in the accompanying Schedule of Assessment.

When the drain is completed it shall be maintained on a pro-rata basis by the Municipal Council of the Township of Niagara at the expense of all the lands and roads herein assessed, each road, lot and part of lot paying in the same relative proportion as herein assessed for construction.

All of which is respectfully submitted.

(sgd) R. Blake Erwin P. Eng.,

R. Blake Erwin, Niagara
Township Engineer.

Dated at Niagara Falls, Ontario, November 8th, 1962.

WHEREAS the said Council is of the opinion that the drainage of the said area is desirable.

NOW THEREFORE THE COUNCIL OF THE CORPORATION OF THE TOWNSHIP OF NIAGARA, pursuant to the provisions of The Municipal Drainage Act, enacts as follows:-

1. That the said report, plans, specifications, assessments and estimates are hereby adopted and the drainage work as therein indicated and set forth shall be made and constructed in accordance therewith.
2. That the Reeve and Treasurer of the said Corporation may borrow upon the credit of the Corporation the sum of \$8,535.01, being the funds necessary for the work not otherwise provided for, and may issue debentures of the Corporation to that amount in sums of not less than \$50.00 payable within twelve years from the date of the said debentures, with interest at the rate of 6% per annum, payable yearly, the said debentures to be payable in lawful money of Canada at the Head Office of the Canadian Imperial Bank of Commerce, in the City of Toronto, at the principal office of the said Bank in the City of Montreal and at the branch of the said Bank in the Village of St. Davids in the Township of Niagara and to have attached to them coupons for the payment of interest.
3. That for paying the sum of \$2,450.98, the amount charged against the said lands and roads for benefit, the sum of \$4,933.49, the amount charged against the said lands and roads for outlet liability, apart from the lands and roads belonging to or controlled by the municipality, and for covering interest thereon for twelve years at the rate of 6% per annum the total special rates, as set out in Schedule "A" attached hereto and forming part of this By-law, over and above all other rates, shall be assessed, levied and collected (in the same manner and at the same time as other taxes are levied and collected) upon and from the undermentioned lots and parts of lots and roads, and the amount of the said total special rates and interest against each lot, or part of lot, respectively, shall be divided into twelve equal parts and one such part shall be assessed, levied and collected as

aforsaid in each year, for twelve years after the final passing of this By-law during which the said debentures have to run.

4. That for paying the sum of \$598.22, the amount assessed against the roads and lands of the municipality, for benefit, and the sum of \$552.16, the amount assessed against the roads and lands of the municipality, for outlet liability, and for covering interest thereon for twelve years at the rate of 6% per annum, a special rate in the dollar, sufficient to produce the required yearly amount therefor shall, over and above all other rates, be levied and collected (in the same manner and at the same time as other taxes are levied and collected) upon and from the whole rateable property in the Township of Niagara in each year for twelve years, after the final passing of this By-law, during which the said debentures have to run.

5. That this By-law shall be printed and served or mailed, as provided by the said Act, and shall come into force upon and after the final passing thereof and may be cited as the "Sloma Drain By-law".

FINALLY PASSED this 21st day of May A.D. 1963.


CLERK.

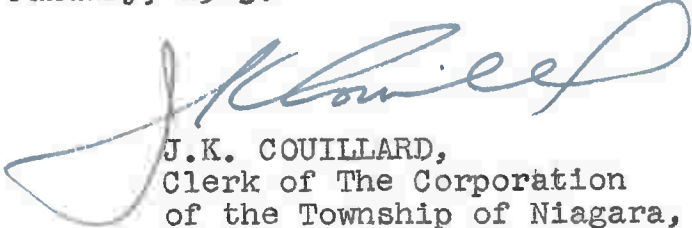

REEVE.

TAKE NOTICE that a special Court of Revision to hear all appeals and complaints respecting the said Sloma Drain assessments will be held at the Township Offices in the hamlet of Virgil, in the Township of Niagara, on Thursday, the 31st day of January, 1963 at the hour of 7:30 o'clock in the afternoon, when all parties interested in such appeals or complaints shall attend.

AND TAKE NOTICE that any person entitled to appeal to the said Court is required to lodge notice of appeal in writing with me, the undersigned, at least ten days prior to the date appointed, as aforesaid, for the holding of the said Court.

AND FURTHER TAKE NOTICE that anyone intending to apply to have the foregoing by-law, or any part thereof, quashed, must, not later than ten days after the final passing thereof, serve a notice in writing upon the Reeve of The Corporation of the Township of Niagara, and also upon the undersigned Clerk, of his intention to make application for that purpose to the Drainage Referee during the six weeks after the final passing of the said By-law.

DATED this 8th day of January, 1963.


J.K. COUILLARD,
Clerk of The Corporation
of the Township of Niagara,
Virgil, Ontario.



F.1638-63

ONTARIO

THE ONTARIO MUNICIPAL BOARD

IN THE MATTER OF Section 64 of
The Ontario Municipal Board Act,
(R.S.O. 1960, c. 274),

- and -

IN THE MATTER OF an application
by the Corporation of the Town-
ship of Niagara for approval of
the undertaking of drainage work
in connection with The Sloma
Municipal Drain at an estimated
cost of \$12,802.52, and of the
borrowing for such purpose of the
sum of \$6,683.34

B E F O R E:

J. V. LUDGATE,
Member

- and -

F.G. BLAKE,
Member

)
)
) WEDNESDAY, the 15th
)
) day of MAY, 1963

THE BOARD ORDERS, under and in pursuance of the
legislation hereinbefore referred to, and of any and
all other powers vested in the Board, that the said
application be and the same is hereby granted, and that
the said Corporation may now proceed with the said under-
taking, and for such purpose may pass all requisite by-
laws, including by-laws providing for the issue of
debentures repayable over a term of not more than twelve
years, and may borrow money to the extent sufficient to
provide an amount not exceeding \$6,683.34 therefor;
provided, however, that the amount to be debentured shall
not exceed the net cost to the Corporation after deduct-
ing any grant or contribution from the Province of Ontario
or from any other source in respect of the said work.



T. B. Vickers

SECRETARY

| |
|------------------------------------|
| ENTERED |
| O. B. No. <i>904</i> |
| Folio No. <i>3411</i> |
| MAY 22 1963 |
| <i>T. B. Vickers</i> |
| Secretary, Ontario Municipal Board |

TOWNSHIP OF NIAGARA - COUNTY OF LINCOLN
MUNICIPAL DRAINAGE ACT SCHEDULE OF ASSESSMENT
- SLOMA DRAIN -

TOTAL ESTIMATED COST OF DRAIN # 12802.52

ESTIMATED SUBSIDY UNDER PROVINCIAL AID TO DRAINAGE ACT 4267.51

ESTIMATED COST OF THIS DRAIN LESS SUBSIDY # 8535.01

THIS SCHEDULE OF ASSESSMENT IS CALCULATED ON ESTIMATED COST, AFTER SUBSIDY, OF
8535.01

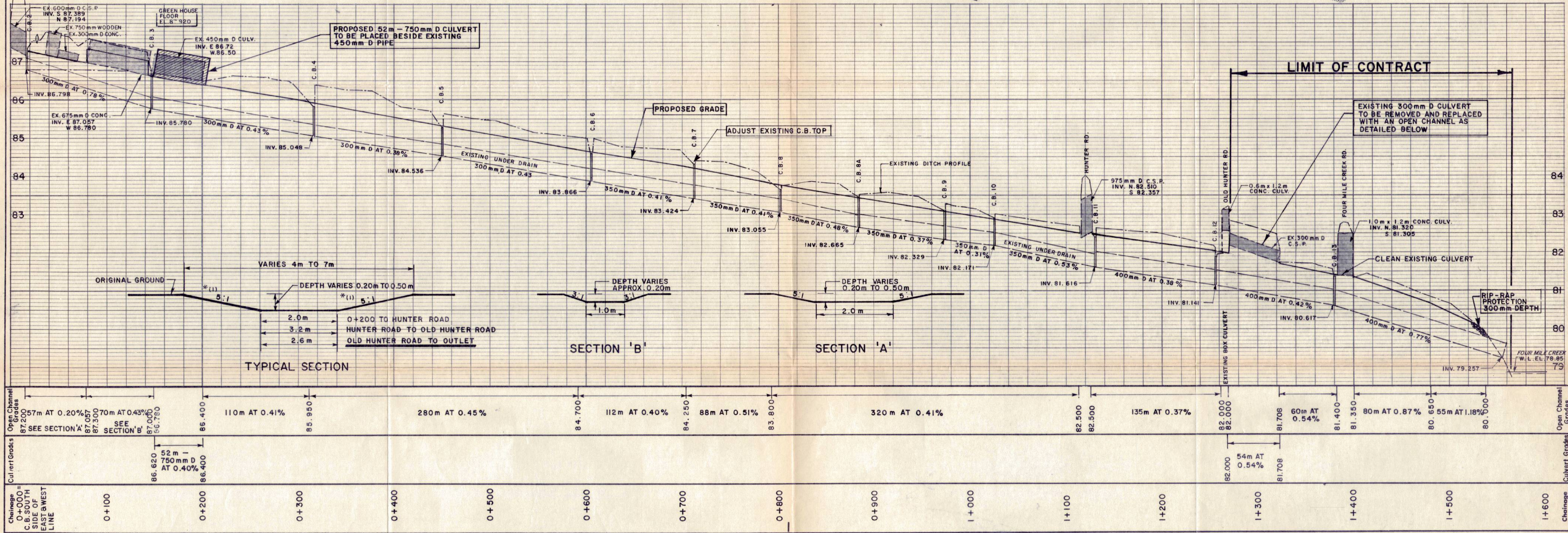
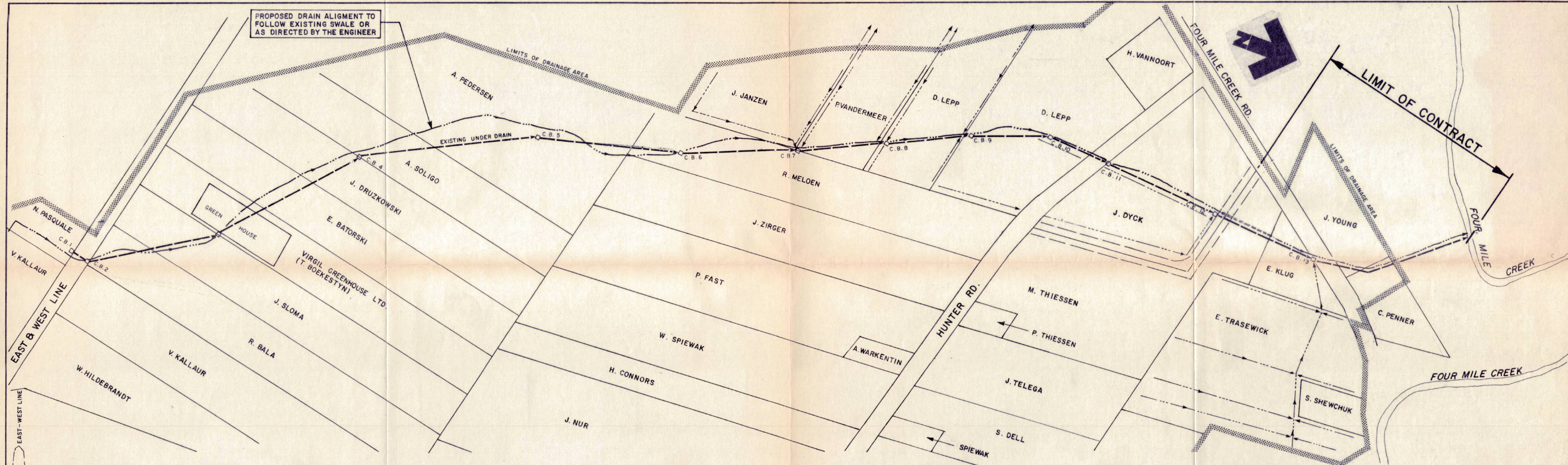
| NAME: | STREET | SIDE OF STREET | TWP. LOT NO. | LOT ON REG. PLAN | REG PLAN NO. | ACRES AFFECTED | VALUE OF BENEFIT | VALUE OF OUTLET LIABILITY | TOTAL BENEFIT \$ | TO COVER INTEREST FOR 12 YRS @ 6% | TOTAL SPECIAL RATES | ANNUAL ASSMT. EACH YR. FOR 12 YRS |
|---|----------------------|----------------|--------------|------------------|--------------|--------------------|------------------|---------------------------|------------------|-----------------------------------|---------------------|-----------------------------------|
| Mrs. M. & Miss E. Bartel | CON. 4 RD. | WEST | | 13 | 85 | 0.35 | 2.13 | 7.55 | 9.68 | 4.16 | 13.85 | 1.15 |
| Mary Helen Janz | " | " | | 13 | " | 2.75 | 18.72 | 59.51 | 76.02 | 32.30 | 108.32 | 9.07 |
| LAZAR & DOROTHY WAREMCHUK DENIS KROPYWNIK | N. STONE RD. | NORTH | | 13 | " | 6.00 | 36.48 | 129.40 | 165.88 | 71.55 | 237.43 | 19.79 |
| E. F. & E. R. ISAACS | " | " | | 13 | " | 15.38 | 93.51 | 331.70 | 425.21 | 183.40 | 608.61 | 51.74 |
| JOHN SKUBEL | " | " | | 13 | " | 7.50 | 45.60 | 161.75 | 207.35 | 89.44 | 296.78 | 24.75 |
| TOM MUCHA | " | " | | 13 | " | 18.75 | 64.70 | 344.96 | 409.66 | 173.59 | 583.25 | 48.77 |
| GEO. POZNIAK | " | " | | 13 | " | 6.00 | 36.48 | 129.40 | 165.88 | 71.55 | 237.43 | 19.79 |
| LAZUR & PAULINE WEREMCHUK | E. & W. LINE | SOUTH | | 13 | " | 4.30 | 26.15 | 92.74 | 118.89 | 51.78 | 170.67 | 14.18 |
| JOHN DANIELLUK Tony Pacyna | " | " | | 13 | " | 0.14 | 0.85 | 3.04 | 3.89 | 1.67 | 5.56 | 0.46 |
| WALTER KALLAUR | " | " | | 5 | 163 | 3.00 | 18.24 | 64.70 | 82.94 | 35.77 | 118.71 | 9.89 |
| JOHN BATORSKI | " | " | | 6 | " | 1.00 | 6.08 | 21.57 | 27.65 | 11.93 | 39.58 | 3.30 |
| JOHN & MARY BIEGA | " | NORTH | | 18 | " | 3.50 | 42.56 | 75.40 | 118.04 | 50.91 | 168.95 | 14.08 |
| W. & V. KALLAUR | " | " | | 17 | " | 5.00 | 37.71 | 107.83 | 145.54 | 64.34 | 209.88 | 17.32 |
| ALBERT & VICTORIA BALA | " | " | | 16 | " | 5.00 | 37.71 | 107.83 | 145.54 | 64.34 | 209.88 | 17.32 |
| KAZIMIERZ SLOMA | " | " | | 15 | " | 5.00 | 37.71 | 107.83 | 145.54 | 64.34 | 209.88 | 17.32 |
| JOHN BATORSKI | " | " | | 14 | " | 5.00 | 37.71 | 107.83 | 145.54 | 64.34 | 209.88 | 17.32 |
| EDWARD BATORSKI | " | " | | 13 | " | 5.00 | 37.71 | 107.83 | 145.54 | 64.34 | 209.88 | 17.32 |
| JOHN DRUZKOWSKI | " | " | | 12 | " | 4.30 | 26.15 | 92.74 | 118.89 | 51.78 | 170.67 | 14.18 |
| DARI & DORA HARENA | " | " | | 11 | " | 4.00 | 40.64 | 90.27 | 130.91 | 56.16 | 187.07 | 15.40 |
| Anders & Grete Pederson D. PA. SZPILKOWSKI | " | " | | 10 | " | 8.00 | 97.20 | 177.53 | 274.73 | 118.37 | 393.10 | 32.16 |
| J. P. GRAHAM | HUNTER RD. | SOUTH | | 5 | 85 | 5.55 | 42.00 | 117.71 | 159.71 | 69.75 | 229.46 | 19.29 |
| JOHN NUR | " | " | | 5 | " | 11.00 | 83.76 | 227.23 | 311.09 | 131.45 | 442.54 | 36.29 |
| N. HOWARD | " | " | | 5 | " | 2.00 | 24.32 | 43.13 | 67.45 | 29.10 | 96.55 | 8.04 |
| W. & S. SPIEWAK | " | " | | 5 | " | 6.52 | 79.23 | 140.62 | 219.85 | 94.85 | 314.70 | 26.22 |
| PETER FAST | " | " | | 5 | " | 6.93 | 24.32 | 43.13 | 67.45 | 29.10 | 96.55 | 8.04 |
| N. HATALUK | " | " | | 5 | " | 5.94 | 24.32 | 43.13 | 67.45 | 29.10 | 96.55 | 8.04 |
| W. & K. KIREJKO | " | " | | 5 | " | 5.30 | 79.45 | 114.34 | 193.79 | 83.57 | 277.36 | 23.11 |
| JACOB FRIESEN | " | NORTH | | 5 | " | 0.50 | | 19.78 | 19.78 | 4.65 | 24.43 | 2.06 |
| N. HOWARD | " | " | | 5 | " | 8.00 | 24.32 | 172.53 | 196.85 | 84.93 | 281.78 | 23.49 |
| W. & S. SPIEWAK | " | " | | 5 | " | 3.48 | 131.60 | 75.05 | 206.65 | 89.13 | 295.78 | 24.65 |
| J. TELEGA | " | " | | 5 | " | 3.48 | 24.32 | 75.05 | 99.37 | 42.86 | 142.23 | 11.85 |
| M. THIESSEN | " | " | | 5 | " | 8.25 | 24.32 | 177.73 | 202.05 | 87.24 | 289.29 | 24.12 |
| HENRY M. WILLMS | 4 MILE CREEK RD. | EAST | | 3 | 167 | 3.50 | 94.11 | 107.83 | 201.94 | 87.11 | 289.05 | 24.19 |
| Est. of Z. KISLASKO & Mrs. Margaret | " | " | | 2 | " | 3.50 | 94.11 | 107.83 | 201.94 | 87.11 | 289.05 | 24.19 |
| A. DYCK | " | " | | 1 | " | 4.25 | 94.11 | 107.83 | 201.94 | 87.11 | 289.05 | 24.19 |
| HARRY & RITA VAN NOORT | " | " | | | | PT. MIL. RES. 1.00 | | 21.57 | 21.57 | 9.30 | 30.87 | 2.57 |
| JACOB DYCK | " | " | | 1 | 167 | 12.62 | 107.01 | 272.17 | 379.18 | 163.55 | 542.73 | 45.25 |
| C. P. PENNER Nieuwenhuysse | " | WEST | | 173 | CORP. 7 | 3.00 | 36.48 | 129.40 | 165.88 | 71.55 | 237.43 | 19.79 |
| L. & J. NEWHOUSE | " | EAST | | | | PT. MIL. RES. 9.90 | 73.54 | 262.16 | 335.70 | 143.03 | 478.73 | 39.72 |
| JOHN KASPAR | " | " | | | | 17.20 | 137.16 | 487.16 | 624.32 | 263.51 | 887.83 | 73.31 |
| TWP. OF NIAGARA | HUNTER RD. | | | | | 4.10 | 586.22 | 50.59 | 636.81 | 271.71 | 908.52 | 75.22 |
| TWP. OF NIAGARA | ABANDONED HUNTER RD. | | | | | 1.00 | 12.11 | 21.57 | 33.68 | 14.55 | 48.23 | 4.02 |
| Co. OF LINCOLN | E. & W. LINE | | | | | 1.80 | 126.46 | 271.74 | 398.20 | 171.75 | 569.95 | 47.50 |
| Co. OF LINCOLN | 4 MILE CREEK RD. | | | | | 1.50 | 76.48 | 276.45 | 352.93 | 150.66 | 503.59 | 41.13 |
| | | | | | | | 3,149.36 | 5,433.65 | 8,583.01 | 3,681.35 | 12,264.36 | 1,013.02 |

PLAN SHOWING
THE DRAINAGE AREA OF THE
SLOMA MUNICIPAL DRAIN
TOWNSHIP OF NIAGARA
COUNTY OF LINCOLN

SCALE: 1" = 200'
FILE NO. 1143

Robert J. Quinn P. Eng.
TOWNSHIP ENGINEER
Niagara Falls, Ont. Nov 7, 1962





Notes: (1) SIDE SLOPES TO BE STEEPENED TO 2:1 MAXIMUM IN AREAS AS DESIGNATED BY THE ENGINEER TO PROTECT EXISTING HEALTHY FRUIT TREES.

Approved

| No. | Zone | Revision | Date | Initial |
|-----|------|---|------------|-----------|
| 1 | - | OWNERSHIP, NEW OWNERS, WATERSHED - CORRECTION | OCT. 11/83 | D.F./W.B. |



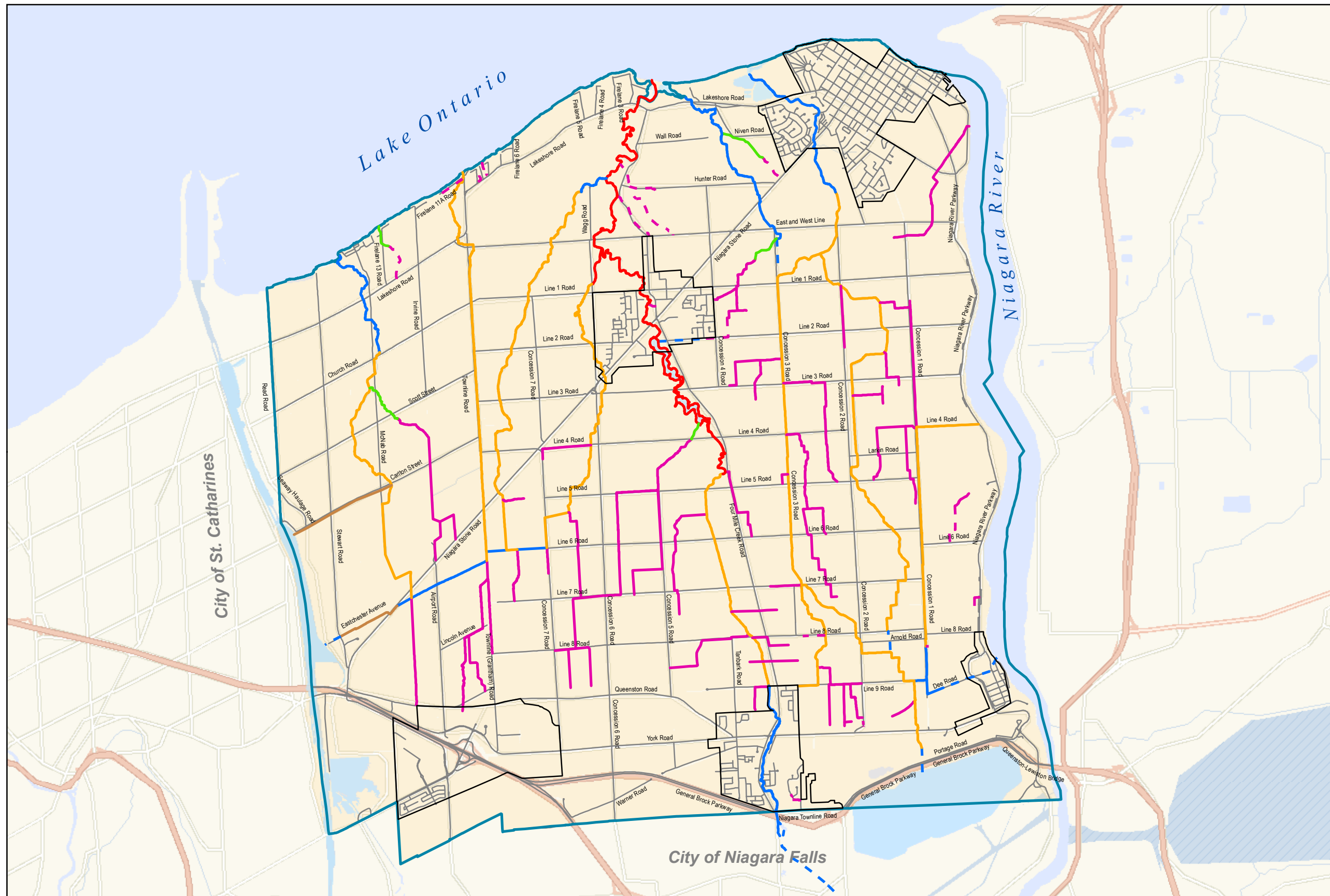
Town of Niagara-on-the-Lake
SLOMA DRAIN

Proctor & Redfern Limited
Consulting Engineers
Toronto St. Catharines

Date: Dec. 1981

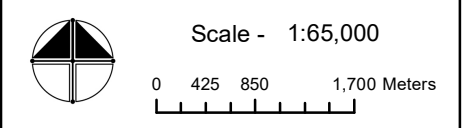
Drawn By: E. H. Cld. By: D.F./W.B. 12892

Drawing No. **A1-80559-PI**



LEGEND:

- Drains**
- Connecting Links
 - Irrigation Road Ditch
 - Irrigation Piped
 - Irrigation Channel
 - Municipal Drain and Irrigation Channel
 - Irrigation Channel / Natural Watercourse
 - Municipal Drain
 - Piped Municipal Drain
 - Urban Area Boundary



NOTES:
 This map forms part of the Official Plan for the Town of Niagara-on-the-Lake and must be read in conjunction with the text, other schedules, and secondary plans. The boundaries and alignments of designations on this schedule are approximate and are not intended to be scaled.



January 23rd, 2026

MEMORANDUM

ATTN: Alex Boekestyn - Planner II - Town of Niagara-on-the-Lake

RE: 727 East and West Line, Niagara-on-the-Lake
Proposed Development Drainage (ZBA-21-2025)
Historical Watercourse and Riparian Rights

1.0 Introduction

The following memorandum has been prepared on behalf of Niagara Orchard and Vineyard Corporation (“NOVC”). NOVC is currently proposing the redevelopment of their property located at 727 East and West Line in Niagara-on-the-Lake (the “Subject Property”). This memorandum will provide commentary related to historical watercourses and drainage implications for the proposed development of the subject property.

1.1 Local Context

The 2.19-hectare (5.41 acre) property has 135.64 metres of frontage on East and West Line. It is developed with a 203.3m² (2188.3 SF) existing single storey residential dwelling and a 106m² (1140.97 SF) shed. The subject property is presently in fallow, not being used for the farming of any crops. The subject property is within an active agricultural area of mainly vineyards and clusters of farm and non-farm residences.

1.2 Proposed Development

This proposed redevelopment will result in the creation of a new Agricultural Supply and Service Facility (“ASF”). The proposed Agricultural Supply & Service Facility will house the head office of NOVC as well as the packing, and storage and distribution of fruit, harvested from NOVC farms and other farms in Niagara. The Agricultural Supply & Service Facility will also sell and distribute a broad array of agricultural tools and equipment to agricultural operators and businesses in Niagara and beyond. An application for zoning by-law amendment to facilitate the proposed development was deemed complete by the municipality on October 22nd, 2025. The proposed development is illustrated by the Site Plan which is attached as **Appendix A** to this memorandum.



1.3 Existing Drainage

To inform the design of the ASF, NOVC has retained a civil engineer to design the site grading and servicing strategy for the proposed development. Under existing conditions, the site has two drainage outlets, approximately 1/10th of the site in the north-east corner drains to the existing ditch along East & West Line, the remaining 9/10ths of the site drains to the north-west corner, in the immediate vicinity of a proposed parking lot for the facility.

Based on available topographic survey data, which is attached as **Appendix B** to this memorandum, there is a low area in the south-west corner of the site which appears to carry drainage across the corner of the property from 1696 Niagara Stone Road (southern neighbour) to 701 East-West Line (westernmost neighbour). Based on the mapping of the Sloma Drain contributing areas there may also be an 8" tile drain along the alignment of this low area, which conveys drainage from the southern neighbour across the subject property, through 701 East and West Line, up to the ditch within East and West Line. This ditch within the municipal right of way ultimately conveys flow into the Sloma Drain.

1.4 Historical Watercourse

Based on Aerial imagery, Sloma Drain engineering reports, archaeological reporting, topographic mapping from governmental and university sources, as well as regulatory mapping from the NPCA, we are of the opinion that the low area identified by topographic surveying is in fact a historical watercourse on the property. The following memorandum will summarize this information as part of demonstrating that the Applicant has a riparian right to continue to discharge water into this historical watercourse.

2.0 Historical Aerial Imagery

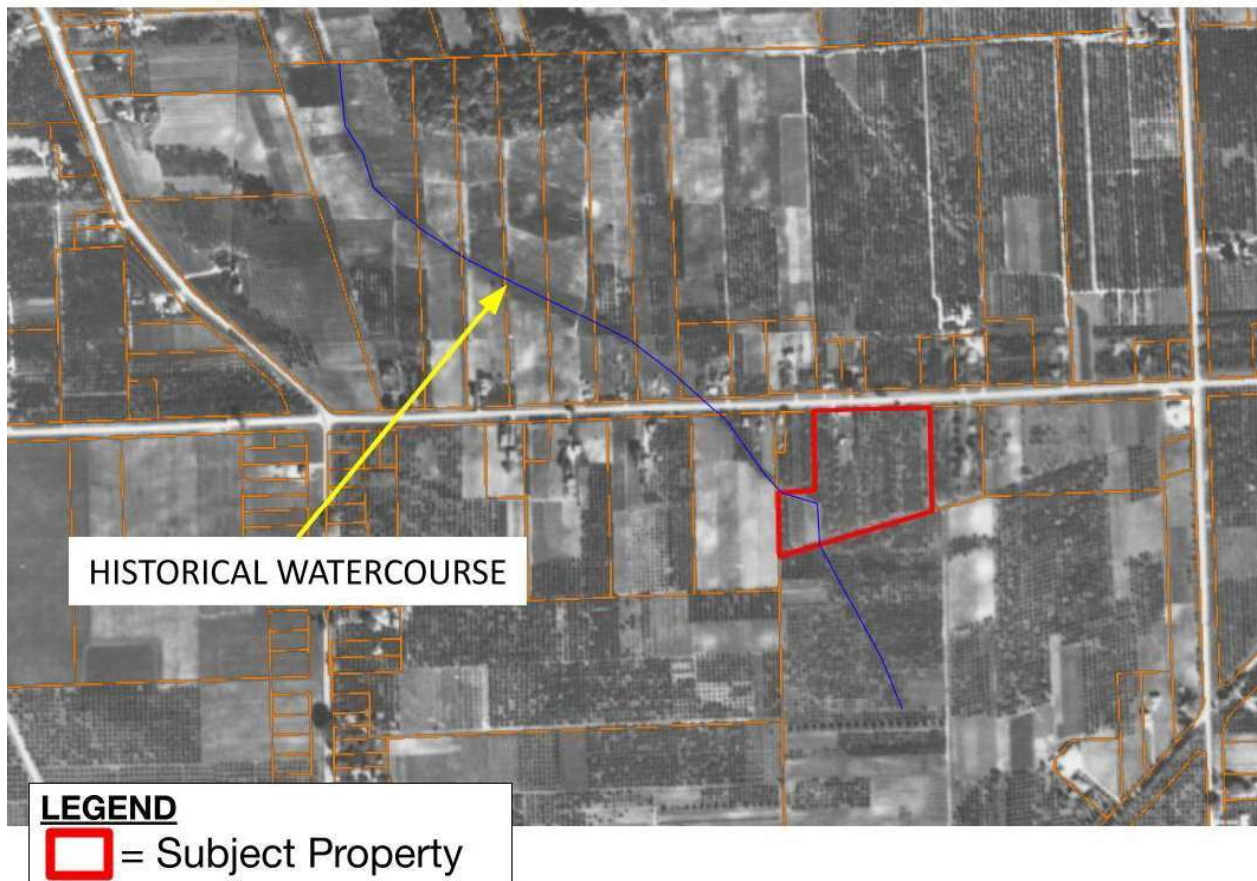
Historical aerial imagery from 1955 and 1965 has been obtained from Niagara Navigator, an interactive mapping tool for geographic data in Niagara Region. Aerial imagery of the subject property and surrounding areas has been consolidated within **Appendix C**, and is summarized below.

- **1955 Aerial Imagery (Appendix C1)**

An annotated version of **Appendix C1** is provided below as Figure 1. The imagery from 1955 illustrates some form of overland seasonal tributary / depression, starting on the lands to the south, crossing the subject property and ultimately flowing into a watercourse which connects with Four Mile Creek.

FIGURE 1

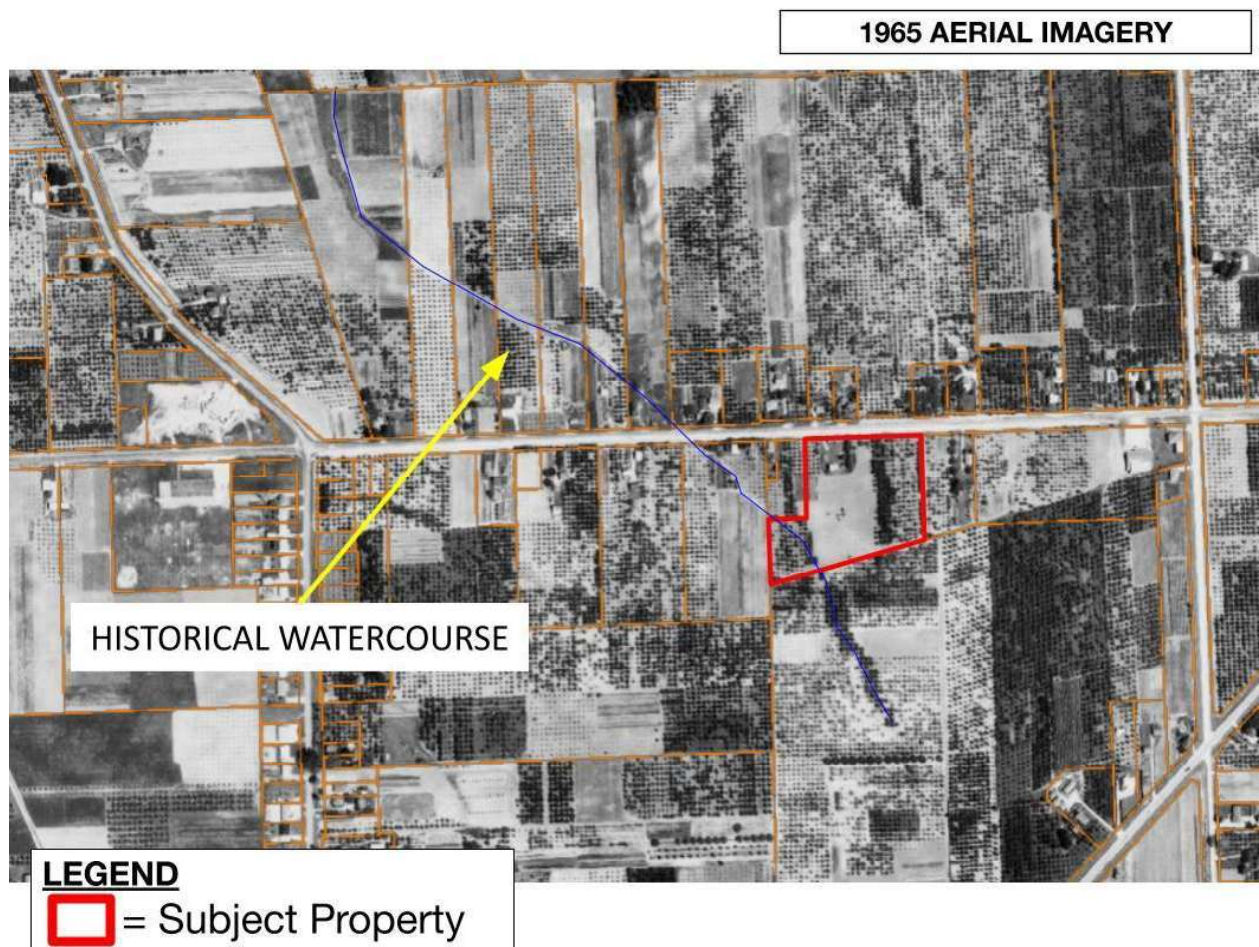
1954-1955 AERIAL IMAGERY



- **1965 Aerial Imagery (Appendix C2)**

An annotated version of **Appendix C2** is provided below as Figure 2. The imagery from 1965 again illustrates some form of overland seasonal tributary / depression, starting on the lands to the south, crossing the subject property and ultimately flowing into a watercourse which connects with Four Mile Creek.

FIGURE 2



2.1 1962 Blake Erwin Sloma Drain Report

The Sloma Drain was initially constructed in accordance with a report of R. Blake Erwin, P. Eng. dated November 8th 1962. Erwin notes that “an existing watercourse” had many tile drains discharging into it with insufficient and illegal outlets. Accordingly, his report provided for the construction of a new 400mm



to 300mm concrete tile drain “under the watercourse” from an outlet in the Four Mile Creek upstream to the limit of East-West Line.

This report confirms that the Sloma Drain follows the pathway of a historical watercourse (the same watercourse detailed by Section 2.0 of this memorandum). This report, and its associated mapping (**Appendix D**), also confirm that while the subject property is within the contributing catchment, and has an 8” contributing tile drain, that the Sloma Drain itself is not located on the subject property, and instead terminates on the south side of East and West Line. Both the Main Sloma Drain, and the 8” tile drain on the subject property, coincide with the location of a historical watercourse.

2.2 Archaeological Report

As part of the technical materials prepared in support of the proposed development, A Stage 1-2 Archaeological Assessment, dated May 13th 2025, was prepared by Detritus Consulting Ltd. The report states:

“The closest source of potable water is a tributary of the Four Mile Creek that passes through the southwestern section of the Study Area according to topographic mapping (Figure 1). No water was visible within the Study Area and this is likely a seasonal tributary no longer extant.”

While no water was visible within the watercourse, given the seasonal nature of the tributary and lack of major storm event at the time of the Archaeologist’s site visit, the archaeological study confirms the existence of a historical watercourse which traverses the subject property.

2.3 Natural Resource Canada Topographic Mapping

Topographic Mapping from Natural Resource Canada is provided as **Appendix E**. This mapping clearly illustrates a defined watercourse crossing the southwestern portion of the subject property.

2.4 Brock University Topographic Mapping

Topographic Mapping from Brock University is provided as **Appendix F**. This mapping again illustrates a tributary of Four Mile Creek crossing the southwestern portion of the subject property.

2.4 NPCA Watercourse Mapping

Regulatory watershed mapping from the Niagara Peninsula Conservation Authority is provided as **Appendix G**. This mapping illustrates some form of contributing tributary/channel which flows into the ditch on East and West Line, and ultimately into the main Sloma Drain to the north.



3.0 Conclusion

Aerial imagery, the 1962 Blake Erwin Report, archaeological reporting, topographic mapping from governmental and university sources, as well as regulatory mapping from the NPCA all confirm that there is evidence of a historical watercourse on the subject property, and adjacent property at 701 East and West Line, conveying flows from the property to the south towards the Sloma Drain. As there is a historical watercourse which has long accepted and conveyed drainage from the subject property, the Applicant has a riparian right to continue to contribute drainage to this watercourse.

With respect to discharge location, the development will continue to discharge water in the same location it does today, and has historically. Overland drainage from the south will not be blocked by the proposed development. The grading and drainage design prepared by Ownership's Civil Engineer will ensure that overland drainage from the south will continue to flow onto the subject property, entering a swale with a 0.3m wide french drain base, directing flow around the proposed parking lot, and ultimately discharging onto the adjacent property in the same location as the historical watercourse.

With respect to discharge quantity, the proposed development will utilize controls to ensure that during storm events flows will not exceed existing/historical conditions. Under the proposed development the south-west corner of the site will be developed into a parking area. In order to mitigate the increased runoff rates due to the added impervious surfaces it is proposed to construct a permeable paver system. The permeable paver system uses a 2" stone base - that stone has 40% void ratio and can store excess stormwater as a reservoir - releasing it to ground-water, and discharging it along the existing drainage pathway at release rates no higher than under existing conditions. This permeable paver system has been used in other locations in Niagara-on-the-Lake and has been accepted by the Town previously. It can be constructed above the existing tile drain, without damaging the existing tile or interrupting its function. If construction works result in conflicts with the existing tile drain, the drain will be reoriented to maintain its function following development of the subject property.

In conclusion, the proposed development will maintain existing drainage pathways. The construction of the future ASF will not result in any changes to existing flow conditions on adjacent properties or within the Sloma Drain.

Please contact our office if you have any questions.

Prepared by,

A handwritten signature in black ink that reads "Stephen Bedford". The signature is written in a cursive, flowing style.

Stephen Bedford, MCIP, RPP, PLE
Principal Planner
LANDx Developments Ltd.



REFERENCES

The following documents, publications, and resources were consulted in the preparation of this report, and are provided as appendices:

- A. *Proposed Site Plan*. 2M Architects Inc. September 8th, 2025
- B. *Site Condition Sketch*. J.D. Barnes Limited. December 16th, 2025
- C. *Niagara Navigator Aerial Imagery*. Regional Municipality of Niagara. Niagara Region GIS Portal, 1954 & 1965. Web. Accessed January 23rd, 2026. <https://maps.niagararegion.ca/Navigator/>
- D. *Plan Showing the Drainage Area of the Sloma Municipal Drain*. Blake Erwin P.Eng. November 7th, 1962.
- E. *Topographic Data of Canada - CanVEC Series, 2017*. Ottawa, ON: Natural Resources Canada. Accessed May 14th, 2025. http://ftp.maps.canada.ca/pub/nrcan_nrcan/vector/canvec/doc/
- F. *Topographic Map of Niagara, 2010*. Brock University Library Digital Maps. Accessed January 23rd, 2026. https://terra.library.brocku.ca/arcgis/rest/services/NiagaraTopos/Toporama_2010s/MapServer/.
- G. *Watershed Explorer Regulatory Mapping*. Niagara Peninsula Conservation Authority, 2026. Online mapping tool, Niagara Peninsula Conservation Authority GIS. <https://www.arcgis.com/apps/webappviewer/index.html?id=c7555050c8f24a7cbc829395557a7988>



LEGEND

- 0.035 DRAINAGE AREA (HECTARES)
- 1 100% IMPERVIOUSNESS (%)
- DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- IMPERVIOUS SURFACE
- SHEET FLOW DIRECTION



KEY PLAN N.T.S.

BENCHMARK NOTE:
 ELEVATION = 91.861 (CGVD-1928)
 MONUMENT: 63U3533
 ELEVATIONS ARE GEODETIC AND WERE DERIVED FROM BENCHMARK 63U3533, HAVING A PUBLISHED ELEVATION OF 91.861 METRES.

SITE BENCHMARK:
 ELEVATION = 90.51
 DOOR SILL OF THE EXISTING DWELLING AS INDICATED ON PLAN.

- GENERAL NOTES:**
- TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
 - ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
 - CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMANS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

| NO. | DATE: | DESCRIPTION: |
|-----|------------|-----------------------|
| 1 | 2026-02-18 | PER UPDATED SITE PLAN |
| 0 | 2025-03-27 | FIRST SUBMISSION |

| REVISIONS | |
|-----------|--|
| | |
| | |
| | |
| | |

LandSmith ENGINEERING & CONSULTING LTD.
 1059 UPPER JAMES STREET, SUITE 207
 HAMILTON, ON L9C 3A6
 ANDREW@LANDSMITHEC.COM
 289-309-3632

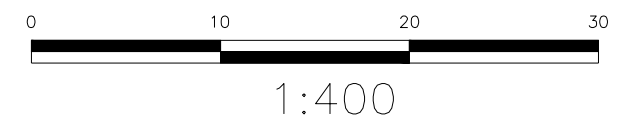
CLIENT:
 NIAGARA ORCHARDS &
 VINYARD CORPORATION (NOVC)

MUNICIPALITY:
 TOWN OF NIAGARA-ON-THE-LAKE

PROJECT NAME:
 727 EAST & WEST LINE

TITLE:
 POST-DEVELOPMENT DRAINAGE AREA PLAN

| | |
|------------------|------------------|
| SCALE: 1:400 | DATE: 2025-02-25 |
| CHECKED BY: AS | DESIGNED BY: BC |
| DWG No: 25015Nov | SHEET No: PD2 |



PRE-DEVELOPMENT - AREA 1 - 5-YEAR STORM:

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PRE-DEVELOPMENT - AREA 1 - 25-YEAR STORM:

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" Rainfall losses 37.830 5.877 33.899 mm"
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PRE-DEVELOPMENT - AREA 1 - 100-YEAR STORM:

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" 1.000 Impervious slope"
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PRE-DEVELOPMENT - AREA 2 - 25-YEAR STORM:

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" Rainfall losses 37.788 6.513 37.007 mm"
" Runoff depth 15.523 46.798 16.305 mm"
" Runoff volume 313.30 24.22 337.52 c.m"
" Runoff coefficient 0.291 0.878 0.306 "
" Maximum flow 0.086 0.017 0.089 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.089 0.089 0.000 0.000"

```

PRE-DEVELOPMENT - AREA 2 - 100-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: PRE_100_A2.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/17/2026 at 3:35:04 PM"
" 31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
" 32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
" 33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 100_Year_Pre"
" 2.500 % Impervious"
" 2.070 Total Area"
" 50.000 Flow length"
" 1.000 Overland Slope"
" 2.018 Pervious Area"
" 50.000 Pervious length"
" 1.000 Pervious slope"
" 0.052 Impervious Area"
" 50.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.899 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.153 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 2.018 0.052 2.070 hectare"
" Time of concentration 23.807 3.224 22.523 minutes"
" Time to Centroid 141.386 101.729 138.913 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 1306.15 33.49 1339.65 c.m"
" Rainfall losses 42.272 6.505 41.378 mm"
" Runoff depth 22.445 58.212 23.339 mm"
" Runoff volume 452.99 30.12 483.12 c.m"
" Runoff coefficient 0.347 0.899 0.361 "
" Maximum flow 0.148 0.021 0.153 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.153 0.153 0.000 0.000"

```

POST-DEVELOPMENT - UNCONTROLLED RUNOFF - 5-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_5_U1.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/17/2026 at 4:14:01 PM"
" 31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
" 32 STORM Chicago storm"
" 1 Chicago storm"
" 664.000 Coefficient A"
" 4.700 Constant B"
" 0.744 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 89.884 mm/hr"
" Total depth 41.024 mm"
" 6 005hyd Hydrograph extension used in this file"
" 33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 5_Year_Post"
" 37.000 % Impervious"
" 2.167 Total Area"
" 75.000 Flow length"
" 1.000 Overland Slope"
" 1.365 Pervious Area"
" 75.000 Pervious length"
" 1.000 Pervious slope"
" 0.802 Impervious Area"
" 75.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.220 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.872 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.187 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 1.365 0.802 2.167 hectare"
" Time of concentration 43.911 5.005 16.704 minutes"
" Time to Centroid 169.090 105.574 124.673 minutes"
" Rainfall depth 41.024 41.024 41.024 mm"
" Rainfall volume 560.06 328.93 888.99 c.m"
" Rainfall losses 31.985 5.233 22.087 mm"
" Runoff depth 9.039 35.791 18.937 mm"
" Runoff volume 123.40 286.97 410.37 c.m"
" Runoff coefficient 0.220 0.872 0.462 "
" Maximum flow 0.023 0.185 0.187 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.187 0.187 0.000 0.000"

```

POST-DEVELOPMENT - UNCONTROLLED RUNOFF - 25-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_25_U1.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/17/2026 at 4:11:48 PM"
" 31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
" 32 STORM Chicago storm"
" 1 Chicago storm"
" 821.000 Coefficient A"
" 4.000 Constant B"
" 0.735 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 118.015 mm/hr"
" Total depth 53.312 mm"
" 6 025hyd Hydrograph extension used in this file"
" 33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 25_Year_Pre"
" 37.000 % Impervious"
" 2.167 Total Area"
" 75.000 Flow length"
" 1.000 Overland Slope"
" 1.365 Pervious Area"
" 75.000 Pervious length"
" 1.000 Pervious slope"
" 0.802 Impervious Area"
" 75.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.291 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.892 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.259 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 1.365 0.802 2.167 hectare"
" Time of concentration 35.223 4.467 15.448 minutes"
" Time to Centroid 157.015 104.034 122.950 minutes"
" Rainfall depth 53.312 53.312 53.312 mm"
" Rainfall volume 727.82 427.45 1155.27 c.m"
" Rainfall losses 37.795 5.732 25.932 mm"
" Runoff depth 15.517 47.580 27.380 mm"
" Runoff volume 211.84 381.49 593.33 c.m"
" Runoff coefficient 0.291 0.892 0.514 "
" Maximum flow 0.049 0.252 0.259 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.259 0.259 0.000 0.000"

```

POST-DEVELOPMENT - UNCONTROLLED RUNOFF - 100-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_100_U1.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/17/2026 at 4:00:08 PM"
31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 100_Year_Pre"
" 37.000 % Impervious"
" 2.167 Total Area"
" 75.000 Flow length"
" 1.000 Overland Slope"
" 1.365 Pervious Area"
" 75.000 Pervious length"
" 1.000 Pervious slope"
" 0.802 Impervious Area"
" 75.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.903 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.330 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 1.365 0.802 2.167 hectare"
" Time of concentration 30.364 4.112 14.489 minutes"
" Time to Centroid 149.914 102.975 121.529 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 883.53 518.90 1402.42 c.m"
" Rainfall losses 42.277 6.263 28.951 mm"
" Runoff depth 22.440 58.455 35.766 mm"
" Runoff volume 306.36 468.68 775.04 c.m"
" Runoff coefficient 0.347 0.903 0.553 "
" Maximum flow 0.082 0.314 0.330 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.330 0.330 0.000 0.000"

```

POST-DEVELOPMENT - AREA 1 - 100-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_100_C1.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/18/2026 at 10:45:04 AM"
31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 100_Year_Pre"
" 30.400 % Impervious"
" 0.092 Total Area"
" 20.000 Flow length"
" 1.000 Overland Slope"
" 0.064 Pervious Area"
" 20.000 Pervious length"
" 1.000 Pervious slope"
" 0.028 Impervious Area"
" 20.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.346 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.906 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.014 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 0.064 0.028 0.092 hectare"
" Time of concentration 13.739 1.860 7.403 minutes"
" Time to Centroid 128.304 99.816 113.110 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 41.44 18.10 59.54 c.m"
" Rainfall losses 42.322 6.112 31.314 mm"
" Runoff depth 22.395 58.605 33.403 mm"
" Runoff volume 14.34 16.39 30.73 c.m"
" Runoff coefficient 0.346 0.906 0.516 "
" Maximum flow 0.007 0.011 0.014 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.014 0.014 0.000 0.000"

```

POST-DEVELOPMENT - AREA 2 - 100-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_100_C2.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/18/2026 at 12:01:17 PM"
31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 100_Year_Post"
" 9.000 % Impervious"
" 0.438 Total Area"
" 50.000 Flow length"
" 1.000 Overland Slope"
" 0.399 Pervious Area"
" 50.000 Pervious length"
" 1.000 Pervious slope"
" 0.039 Impervious Area"
" 50.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.899 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.032 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 0.399 0.039 0.438 hectare"
" Time of concentration 23.807 3.224 19.605 minutes"
" Time to Centroid 141.386 101.729 133.290 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 257.95 25.51 283.46 c.m"
" Rainfall losses 42.272 6.505 39.053 mm"
" Runoff depth 22.445 58.212 25.664 mm"
" Runoff volume 89.46 22.95 112.41 c.m"
" Runoff coefficient 0.347 0.899 0.397 "
" Maximum flow 0.029 0.016 0.032 c.m/sec"
40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.032 0.032 0.000 0.000"

```

POST-DEVELOPMENT - CONTROLLED AREAS (ROUTING) - 100-YEAR STORM:

```

" MIDUSS Output ----->"
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_100_CONTROLS.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/18/2026 at 11:10:35 AM"
" 31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
" 32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
" 33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 No description"
" 57.600 % Impervious"
" 0.493 Total Area"
" 50.000 Flow length"
" 1.000 Overland Slope"
" 0.209 Pervious Area"
" 50.000 Pervious length"
" 1.000 Pervious slope"
" 0.284 Impervious Area"
" 50.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.899 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.117 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 0.209 0.284 0.493 hectare"
" Time of concentration 23.807 3.224 7.774 minutes"
" Time to Centroid 141.386 101.729 110.496 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 135.28 183.78 319.06 c.m"
" Rainfall losses 42.272 6.505 21.671 mm"
" Runoff depth 22.445 58.212 43.047 mm"
" Runoff volume 46.92 165.30 212.22 c.m"
" Runoff coefficient 0.347 0.899 0.665 "
" Maximum flow 0.015 0.113 0.117 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.117 0.117 0.000 0.000"
" 54 POND DESIGN"
" 0.117 Current peak flow c.m/sec"
" 0.058 Target outflow c.m/sec"
" 212.2 Hydrograph volume c.m"
" 10. Number of stages"
" 89.150 Minimum water level metre"

```

```

"      89.650 Maximum water level  metre"
"      89.150 Starting water level  metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"          Level Discharge  Volume"
"          89.150      0.000      0.000"
"          89.200      1.01E-05      17.800"
"          89.250      1.01E-05      35.600"
"          89.300      1.01E-05      53.400"
"          89.350      1.01E-05      71.200"
"          89.400      1.01E-05      89.000"
"          89.450      0.00106      106.800"
"          89.500      0.00375      124.600"
"          89.550      0.00440      142.400"
"          89.650      0.00738      200.000"
"      1.  OUTFLOW PIPE"
"          Upstream Downstr'm      Pipe      Pipe      Manning      Entry"
"          invert      invert      Length      Diameter      'n'      loss Ke"
"          89.400      89.300      13.000      0.100      0.015      0.330"
"          Peak outflow      0.006      c.m/sec"
"          Maximum level      89.609      metre"
"          Maximum storage      176.356      c.m"
"          Centroidal lag      6.176      hours"
"          0.117      0.117      0.006      0.000 c.m/sec"
" 40  HYDROGRAPH Next link "
"      5  Next link "
"          0.117      0.006      0.006      0.000"
" 33  CATCHMENT 102"
"      1  Triangular SCS"
"      1  Equal length"
"      1  SCS method"
"      102 No description"
" 41.800 % Impervious"
" 1.074 Total Area"
" 50.000 Flow length"
" 1.000 Overland Slope"
" 0.625 Pervious Area"
" 50.000 Pervious length"
" 1.000 Pervious slope"
" 0.449 Impervious Area"
" 50.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.899 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
"          0.190      0.006      0.006      0.000 c.m/sec"
"          Catchment 102      Pervious      Impervious      Total Area "
"          Surface Area      0.625      0.449      1.074      hectare"
"          Time of concentration      23.807      3.224      10.414      minutes"
"          Time to Centroid      141.386      101.729      115.582      minutes"
"          Rainfall depth      64.717      64.717      64.717      mm"
"          Rainfall volume      404.53      290.54      695.06      c.m"
"          Rainfall losses      42.272      6.505      27.322      mm"
"          Runoff depth      22.445      58.212      37.395      mm"
"          Runoff volume      140.29      261.33      401.63      c.m"
"          Runoff coefficient      0.347      0.899      0.578      "
"          Maximum flow      0.046      0.179      0.190      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.190      0.190      0.006      0.000"
" 54  POND DESIGN"
"      0.190 Current peak flow      c.m/sec"
"      0.058 Target outflow      c.m/sec"
"      525.9 Hydrograph volume      c.m"
"      11.  Number of stages"
"      88.600 Minimum water level      metre"

```

```

"      89.100 Maximum water level  metre"
"      89.150 Starting water level  metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"          Level Discharge  Volume"
"          88.600    0.000    0.000"
"          88.650  1.01E-05    33.000"
"          88.700  1.01E-05    66.000"
"          88.750  1.01E-05    99.000"
"          88.800  1.01E-05   132.000"
"          88.850  1.01E-05   165.000"
"          88.900  0.00253   198.000"
"          88.950  0.01042   231.000"
"          89.000  0.02107   264.000"
"          89.050  0.02107   300.000"
"          89.100  0.1151    400.000"
"      1.  WEIRS"
"          Crest  Weir  Crest  Left  Right"
"          elevation coefficient breadth sideslope sideslope"
"          89.050  0.900    5.000  3.000  3.000"
"      2.  OUTFLOW PIPE"
"          Upstream Downstr'm  Pipe  Pipe  Manning  Entry"
"          invert  invert  Length  Diameter  'n'  loss Ke"
"          88.850  88.750  20.000  0.150  0.015  0.330"
"          88.850  88.750  20.000  0.150  0.015  0.330"
"          Peak outflow          0.087  c.m/sec"
"          Maximum level          89.092  metre"
"          Maximum storage          383.870  c.m"
"          Centroidal lag          3.467  hours"
"          0.190  0.190  0.087  0.000 c.m/sec"

```

POST-DEVELOPMENT - CONTROLLED AREAS (VOLUMES) - 100-YEAR STORM:

```

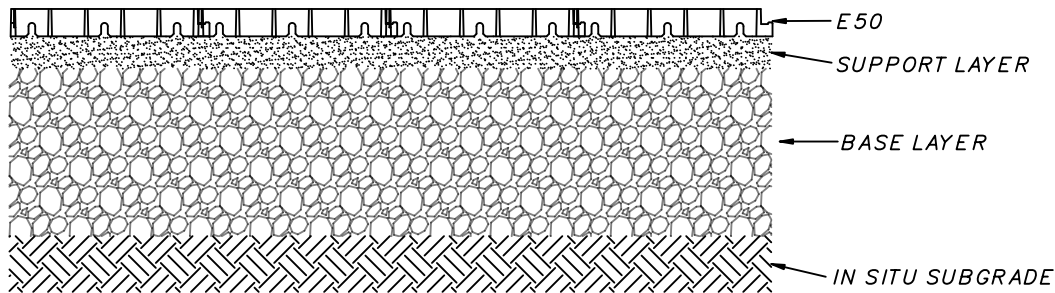
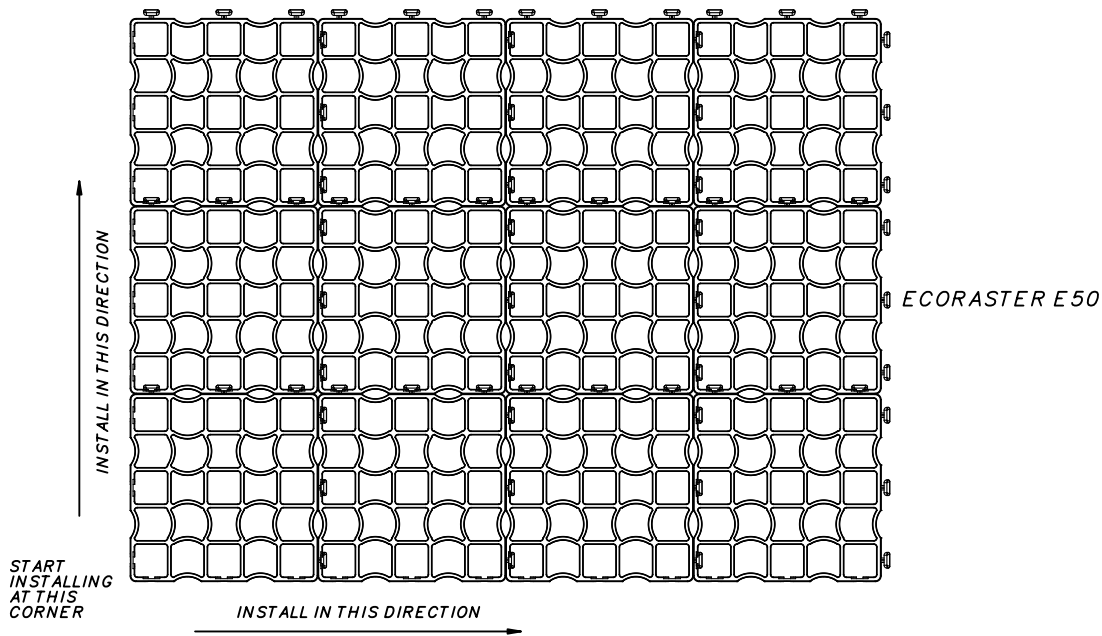
"----->"
" MIDUSS Output
" MIDUSS version Version 2.25 rev. 473"
" MIDUSS created Sunday, February 7, 2010"
" 10 Units used: ie METRIC"
" Job folder: Z:\Project Files\PROJECTS\
" _Niagara-on-the-Lake\727 East-West Line, Niagara-on-the-Lake\SWM\MIDUSS"
" Output filename: Post_100_VOLUMES.out"
" Licensee name: LandSmith"
" Company LandSmith"
" Date & Time last used: 2/18/2026 at 11:45:56 AM"
" 31 TIME PARAMETERS"
" 5.000 Time Step"
" 180.000 Max. Storm length"
" 3600.000 Max. Hydrograph"
" 32 STORM Chicago storm"
" 1 Chicago storm"
" 980.000 Coefficient A"
" 3.700 Constant B"
" 0.732 Exponent C"
" 0.500 Fraction R"
" 180.000 Duration"
" 1.000 Time step multiplier"
" Maximum intensity 144.260 mm/hr"
" Total depth 64.717 mm"
" 6 100hyd Hydrograph extension used in this file"
" 33 CATCHMENT 101"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 101 No description"
" 57.600 % Impervious"
" 0.493 Total Area"
" 50.000 Flow length"
" 1.000 Overland Slope"
" 0.209 Pervious Area"
" 50.000 Pervious length"
" 1.000 Pervious slope"
" 0.284 Impervious Area"
" 50.000 Impervious length"
" 1.000 Impervious slope"
" 0.250 Pervious Manning 'n'"
" 75.000 Pervious SCS Curve No."
" 0.347 Pervious Runoff coefficient"
" 0.100 Pervious Ia/S coefficient"
" 8.467 Pervious Initial abstraction"
" 0.015 Impervious Manning 'n'"
" 98.000 Impervious SCS Curve No."
" 0.899 Impervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"
" 0.518 Impervious Initial abstraction"
" 0.117 0.000 0.000 0.000 c.m/sec"
" Catchment 101 Pervious Impervious Total Area "
" Surface Area 0.209 0.284 0.493 hectare"
" Time of concentration 23.807 3.224 7.774 minutes"
" Time to Centroid 141.386 101.729 110.496 minutes"
" Rainfall depth 64.717 64.717 64.717 mm"
" Rainfall volume 135.28 183.78 319.06 c.m"
" Rainfall losses 42.272 6.505 21.671 mm"
" Runoff depth 22.445 58.212 43.047 mm"
" Runoff volume 46.92 165.30 212.22 c.m"
" Runoff coefficient 0.347 0.899 0.665 "
" Maximum flow 0.015 0.113 0.117 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
" 4 Add Runoff "
" 0.117 0.117 0.000 0.000"
" 33 CATCHMENT 102"
" 1 Triangular SCS"
" 1 Equal length"
" 1 SCS method"
" 102 No description"
" 41.800 % Impervious"

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"      1.074  Total Area"
"      75.000  Flow length"
"      1.000  Overland Slope"
"      0.625  Pervious Area"
"      75.000  Pervious length"
"      1.000  Pervious slope"
"      0.449  Impervious Area"
"      75.000  Impervious length"
"      1.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"      75.000  Pervious SCS Curve No."
"      0.347  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      8.467  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"      98.000  Impervious SCS Curve No."
"      0.903  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.183      0.117      0.000      0.000 c.m/sec"
"      Catchment 102      Pervious      Impervious      Total Area  "
"      Surface Area      0.625      0.449      1.074      hectare"
"      Time of concentration  30.364      4.112      13.256      minutes"
"      Time to Centroid      149.914      102.975      119.325      minutes"
"      Rainfall depth      64.717      64.717      64.717      mm"
"      Rainfall volume      404.53      290.54      695.06      c.m"
"      Rainfall losses      42.277      6.263      27.223      mm"
"      Runoff depth      22.440      58.455      37.494      mm"
"      Runoff volume      140.27      262.42      402.69      c.m"
"      Runoff coefficient      0.347      0.903      0.579      "
"      Maximum flow      0.038      0.176      0.183      c.m/sec"
" 40  HYDROGRAPH Add Runoff "
"      4  Add Runoff "
"          0.183      0.300      0.000      0.000"

```



NOTES:

1. SUPPORT LAYER ~ 2in OF ANGULAR GRAVEL #78 OR SIMILAR. THICKNESS MAY BE REDUCED IF BASE CBR >6. BED ECORASTER INTO SUPPORT LAYER USING PLATE COMPACTOR OR SIMILAR.
2. BASE LAYER – COMPOSITION AND THICKNESS PER ENGINEER. SEE ECORASTER BEST PRACTICES MANUAL FOR TYPICAL INSTALLATIONS AND SUGGESTED PRODUCT USES AND DETAILS.
3. E50 MAY BE LEFT UNFILLED IF VEHICLE TIRE OR SURFACE LOAD PRESSURE <115psi. EDGES WHERE VEHICLES OR LOADS ENTER OR LEAVE SHOULD BE SUPPORTED BY GRAVEL FILLING OR SOLID EDGING TO MINIMIZE EDGE DEFORMATION. INSTALL ECORASTER LEVEL WITH ANY ADJACENT TRAVEL SURFACES. ANY FILLING TO BE PER ENGINEER OR PROJECT SPECIFICATIONS.
4. ALLOW FOR THERMAL EXPANSION WHEN INSTALLING IN A CONFINED AREA BY LEAVING ADEQUATE SPACE BETWEEN ECORASTER AND ADJACENT PAVEMENT OR HARD SURFACES. ECORASTER IS 100% RECYCLED LDPE WITH A WORKING TEMPERATURE RANGE OF -65 TO 150r.
5. E50 INDIVIDUAL GRIDS ARE A NOMINAL 13x 13x 2in WHEN ASSEMBLED. A 3x 4 PREASSEMBLED MULTI GRID (SHOWN) IS SHIPPED TO THE JOB SITE FOR EASE OF INSTALLATION. WEIGHT IS 1.95 lb/sf. ECORASTER IS NONTOXIC TO FISH AND WILDLIFE.
6. GRIDS SNAP TOGETHER WITH FOOT PRESSURE (NO TOOLS REQUIRED) AND CAN BE CUT ON SITE WITH SAWSALL, CIRCULAR SAW, CONCRETE SAW OR SIMILAR.
7. ECORASTER CARRIES A 20 YEAR WARRANTY WHEN INSTALLED PER THIS DRAWING. CONSULT ENGINEER FOR ANY ADDITIONAL REQUIREMENTS ON ALL PROJECTS PRIOR TO CONSTRUCTION.
8. TYPICAL GRAVEL FILLING FOR THE ECORASTER IS THE SAME MATERIAL AS THE SUPPORT LAYER. OTHER MATERIALS PER ENGINEER.

ECORASTER®

| | | |
|--|--------------|----------|
| <i>ECORASTER E50 Gravel Filled</i> | | |
| DATE 30 JULY 2021 | SCALE NTS | REV 3 |



Installation manual

ECORASTER[®] GRAVEL

(ECORASTER[®] + chippings/broken stone = ECORASTER[®] GRAVEL)

ECORASTER® GRAVEL

Why ECORASTER®?

- ✓ Quick and easy to install (about 100 m² per person per hour) because it is lightweight (approx. 5 - 11 kg/m² depending on type)
- ✓ Low transport and handling costs
- ✓ High load capacity (up to 350 t/m²)
- ✓ Safety locking system
- ✓ Surface reinforcement with natural drainage
- ✓ Extremely versatile thanks to additional components like slope angles, Curvepieces, parking space markers
- ✓ Minimises maintenance
- ✓ Non-slip and crackproof
- ✓ Weatherproof and environmentally friendly
- ✓ Resistant to frost and UV radiation
- ✓ Easy to fit to borders or cut to shape

Preparations

Determining how much sand, broken stone etc. you need

Before determining how much chippings / broken stone etc. you need, you should specify exactly the height of the surfaces. With larger surfaces you should work with a spirit level or laser.

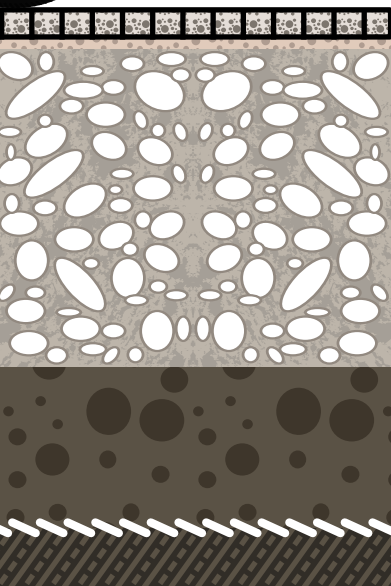
Calculate how much you need to fill the grids as follows:

$$0.95 \times \text{area} \times \text{grid height}$$

If you do not build a base layer, surface drainage is not assured. Not only that, movement in the natural soil can cause unevenness. ECORASTER® considerably increases the load capacity of the surface, but it goes without saying that even ECORASTER® will be tested to its limits if the entire ground gives way extensively.



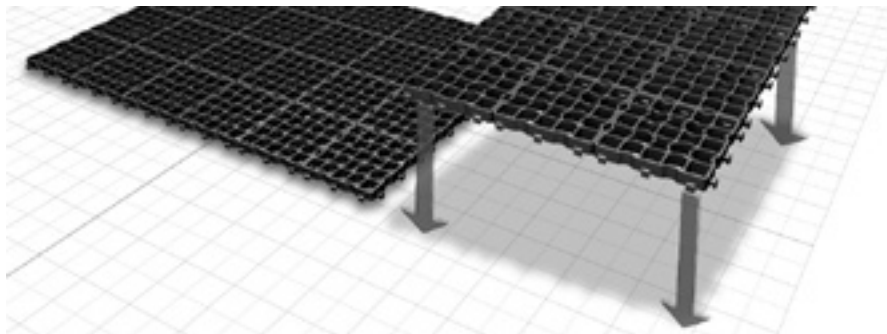
Example: car park with chippings ECORASTER® GRAVEL



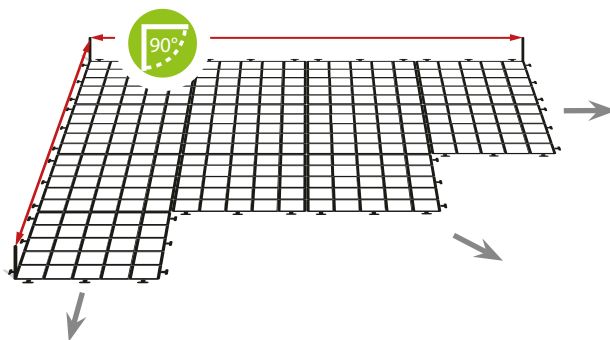
- ◀ **ECORASTER® GRAVEL**
- ◀ **Base Layer**
3 cm [1.18 in] compacted filling material
- ◀ **Draining layer**
20 cm [7.87 in] compacted draining gravel
- ◀ **Substructure** 10 [3.93 in] to 40 cm [15.74 in] draining gravel
- ◀ **Anti-contaminant geotextile**
- ◀ **Foundation**
- ◀ **Fill in the ECORASTER**
Gravel/sand/chippings: Fill in the grids with appropriate material
- ◀ **Levelling course**
Put on a layer of 2/5 mm chippings (height approx. 2 cm) and level off roughly
- ◀ **Drainage layer**
Put on broken stone grain size 5/32 mm or similar and compact (roller or plate vibrator)
Total height of broken stone for cars: approx. 25 cm
Total height of broken stone for trucks: approx. 45 cm
- ◀ **Natural soil**
Create an approx. 1 - 1,5 % gradient in the ground

ECORASTER® GRAVEL

Working with the preconnected grids



ECORASTER® is quick and easy to lay without machinery. The system is delivered in preconnected units of 12 sections and can be taken straight off the pallet and laid in one go.



Installing

To lay the grids, start in one corner of the area. The lugs of the first row must point in the direction you are working in. The subsequent rows are then pressed into the lugs of the laid surface. We recommend to use a plumb line when installing ECORASTER.

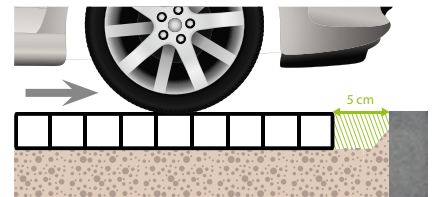
Disconnecting

The preconnected sheets can be taken apart if necessary. Lay the sheet you wish to take apart on another sheet and, using your foot, press the tiles you want to remove down and out of the safety locking system.

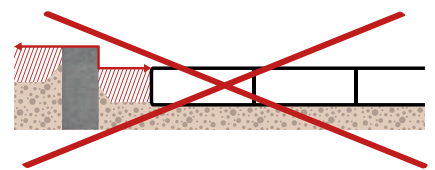
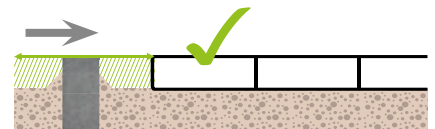
Fitting – cutting to size

For quick and clean tile cutting, the following tools have proved most effective in practice:

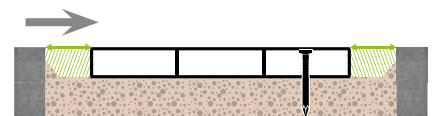
- Circular saw
- Flex (cutting disk)
- Compass saw



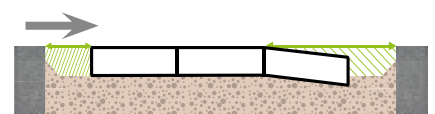
If there should be some kerbstones, make sure to leave a gap of min. 5 cm.*



The ECORASTER System should be installed plain to surrounding edges.*



To avoid surface distortion at the edges caused by the shear forces of cars, the ECORASTER System can be fixed with ground anchors at the rear end of the parking area.*



As an alternative to earthnails you may also just press down the rear part of the ECORASTER.*

* Direction of travel from left to right

ECORASTER® GRAVEL

Things to bear in mind!

Note that, in relation to the height of the base layer, the vibrator action will press in the ECORASTER® by approx. 0.5 cm.

After infilling ECORASTER®, some slight settling may occur. Fleece from geotextiles reliably prevents of mixing up the ground construction layers with the soil. When laying ECORASTER® during the warm summer months, ensure laying ECORASTER®, the grids are infilled and overfilled right after installation.

For areas that mainly used by trucks / heavy vehicles (tight turning circles) we recommend to cover the ECORASTER with a layer of 1 – 2 cm chippings.

Alternatively, you can use the ECORASTER Stone system.

Tip

For quick and clean cutting to size, a circular saw has proved most effective in practice. For smaller corners which must be cut exactly to size, we recommend that you use a compass saw or strong pruning shears. Do not cut the grids in advance. If possible, lay them over the border and then cut them. Use a small base (slat / board / ECORASTER®) to make it easier to cut.

Accessories

- **Parking space markers**
Parking space markers are available in white and can be inserted into the grid without further preparation
- **Slope angles**
Universal Slope angle adjustable up to 90°
- **Curvepieces**
- **Ground anchor**
- **Geotextiles**



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ECORASTER®



Ground reinforcement system

ECORASTER® E50

Technical Data

Product Information

The perfect solution for heav-duty use;
commercial, industrial and mining



Technical specifications

| | |
|-----------------------|---|
| Dimensions | 13 in x 13 in x 2 in |
| Wall thickness | 0.2in |
| Carrying load | Exceeds H20 and HL93 (fill/base dependent) |
| Weight per sq ft | 1.95 lbs |
| Weight per unit | 2.33 lbs |
| Wall height | 2in |
| Material | 100% recycled LDPE |
| Pressure resistance | Up to 20 t axle load in acc. with DIN 1072 |
| Dimensional stability | Temperature range -58° F to +194° F |
| Deformation | 0.5% at normal temperatures 68° F to +176° F |
| Moisture absorption | 0.01 % |
| Solubility | Resistant to acids, alkalis, alcohols, oil, diesel, gasoline, (de-icing salt, ammonia, acid rain, etc.) |

Delivery units

| | |
|-------------------|-------------------------------------|
| Packaging unit | 1 layer (= 12 pieces = 14.08 sq ft) |
| Layer per pallet | 43 |
| Sq ft per Pallet | 615 sqft |
| Pieces per pallet | 516 |
| Dimensions | 41.3 in x 53.1 in x 90.2 in |
| Weight per pallet | 1,232 lbs (incl. pallet) |

Certificates

| | |
|----------------|--|
| TÜV | Unlimited lifespan |
| DIN 1072 | Carrying load up to 20 t axleload |
| DIN 38412 | Environmentally neutral |
| DIN 1072 | Road and footbridges |
| DIN EN ISO 124 | B125 requirements for coverings on car parking areas |

Most suitable for

Commercial, Industrial + Military

- Parking lots and driveways with snow conditions
- Emergency and tire access lanes
- Outdoor warehousing and logistics areas
- Road shoulder reinforcement
- Streetcar track fill reinforcement
- Roads
- Oil and mining applications
- Shooting ranges
- Military applications
- Erosion control
- Runway extensions and taxiways
- Helicopter landing pads
- Grass parking pads
- Paddocks, round pens and equine exercisers