



March 30, 2022
File: GE-00692

Attn: Luke Ozlislo
Email: detailsrenovationsdesign@outlook.com

**Reference: Septic Concept Plan and Nitrate Impact Assessment
Proposed Lot Severance
23830 Denfield Road, Denfield**

As requested, this letter provides a review of the site and soil conditions for the property located at 23830 Denfield Road, to determine the general feasibility of a future lot severance. The property includes a Water Pipeline easement which encroaches on the northern part of the site. Considerations for the lot severance have had regard for this easement, and the requirement that no structures (house, or inground infrastructure) be located within the easement.

The current residence located at this site is serviced with a private septic system. Prior to a lot severance proceeding, the existing septic system which services the residence would need to be relocated. As such, the size of the proposed lot severance is expected to allow for the construction of a new septic system on the retained parcel, and the need to accommodate a contingency area. Similarly, the proposed parcel to be severed from the property must also be able to accommodate the building footprint, septic distribution area and contingency area, before it can be approved by the municipality.

Nitrate Impact Assessment

LDS has carried out a nitrate impact assessment for the proposed lot severance, considering a conventional filter bed, and a level IV treatment system within the proposed lot. Calculations were carried out in accordance with the predictive assessment model (calculation) outlined in the MECPC D-5-4 Guideline document. The model has been established to demonstrate the theoretical nitrate concentration which would occur at the downstream property boundary (considered to be the worse case boundary condition), and sets a target value of 10 mg/L, based on the applicable Ontario Drinking Water Objective (ODWO). The following is a mass balance calculation for the theoretical nitrate concentration which would occur at the downstream property boundary based on a conventional Class IV septic system.

$$C_o = [Q_E (N_E) + D_w (N_B)]/[D_w + Q_E]$$

Where:

- C_o = Nitrate Concentration at the property boundary (mg/L);
- N_E = Nitrate Concentration of the sewage effluent (from the tank) (mg/L);
- Q_E = Yearly volume of effluent produced (L/year);
- D_w = Dilution Water available (L/yr);
- N_B = Background Nitrate Concentration, (mg/L).

The average daily design sewage load for a typical residence is 1000 L/day, based on the procedures outlined in D-5-4. This average flow rate is considered a realistic and conservative average daily flow rate and should not be confused with the peak design flow used to design the sewage system, (which is often 2 to 3 times this amount).

The site area used in the calculation is based on the area of the anticipated lot severance.

Precipitation and infiltration through the soil to groundwater normally provide dilution and provide the basis for the following nitrite loading calculations. The values used in the calculation are based on Environment Canada '30-year average' weather data, established at the London Airport and through currently accepted MECP Stormwater management guidance materials.

Nitrate (N) concentrations in conventional septic effluent (without treatment) have anecdotally been identified at 40 mg/L. Using the actual values in the technical case studies and science-based analyses, the average nitrate value in pre-treated septic effluent is identified as 37 mg/L. This value has been utilized in the analysis.

A background nitrate level of 1.2 mg/L is incorporated into the calculation (based on average values in precipitation reported by the US EPA National Air Quality and Emissions Trend Report, 1997, and referenced by Environment Canada in the Canada – United States Air Quality Agreement, 2012).

For analysis considering the Enviro-Septic system, in the same testing program that was carried out to confirm compliance with the Level IV effluent quality, testing on the pre and post-treatment nitrate concentrations indicates a typical nitrate reduction in the range of 30%. LDS has confirmed this value with Makeway Environmental Technologies Inc., the engineering and design company responsible for the design of the Enviro-Septic system.

Sample calculations are appended for reference, and demonstrate the following:

- Proposed Lot Severance with frontage of approximately 39.57 m and depth of 83.02 m, equipped with a conventional septic system (nitrate level in effluent = 37 mg/L) results in a boundary nitrate level of 11.77 mg/L.
- Proposed Lot Severance with frontage of approximately 39.57 m and depth of 83.02 m, equipped with a septic system which produces Level 4 quality effluent and reduced nitrate loading (nitrate level in effluent = 25.9 mg/L) results in a boundary nitrate level of 8.49 mg/L.

Smaller lots (including 2 lots which could potentially be created via severance were also considered by LDS, however nitrate calculations do not support the creation of more than 1 new parcel.

Based on the above calculation, the severed lot can accommodate a septic system which produces Level IV quality effluent. As such, the septic sizing is based on a commonly used Enviro-Septic system, similar to those which have been designed and used for the lots located on the south side of Denfield Road. The Enviro-Septic System is a combined treatment and dispersal system, and also provides a reduction to the nitrate concentration in the septic effluent.

These types of treatment systems were formerly known as tertiary treatment systems, however, under the recent updates to the building code which require the use of effluent filters in new septic systems, and BNQ standards for effluent quality, these types of systems are becoming more common place. In addition to providing the environmental benefit of reducing nitrate levels in the septic effluent, this type of system offers the added benefit of being able to optimize the area required to accommodate the septic distribution bed, having a smaller impact on disturbed subgrade soils within the lot. This system does not require any washed stone, or require any mechanical or electrical components, and therefore has a smaller carbon footprint compared to traditional septic distribution systems.

Soil Conditions and Soil T-time

LDS visited the site on March 17, 2021 to assess the soil conditions at the property. During the site visit, three (3) test pits were hand-dug to collect soil samples at a depth of 0.45 m below existing ground surface. The soil conditions observed in all three holes were described as silt with some sand. Some minor groundwater seepage was observed in the base of Test Pit 1; however, the other test pits were open and dry at completion. A summary of the test pit observations is appended for reference.

One sample (taken from Test Pit 3) was submitted for laboratory testing, to determine the soil percolation T-time. A copy of the gradation analysis is also appended for reference. Based on the results of the gradation analysis, the soil conditions are consistent with a silty loam, with an estimated soil T-time in the range of 20 to 50 min/cm. A design T-time of 45 min/cm is considered appropriate for the purposes of this design. A copy of the gradation results is appended for reference. A factor of safety of 1.2 was applied to the calculated T-time value on the sample collected by LDS to account for local soil variations, in determining the design T-time value used for this septic design report.

Septic Design Flow

For the purposes of estimating a typical footprint for the septic distribution system, a daily design flow of 3000 L/day was utilized in the analysis. This the value associated with a four-bedroom house, with a fixture count of 20, in accordance with Part 8 (Section 8.2.1.3 of the Ontario Building Code (OBC

Minimum design requirements for the Enviro-Septic pipes and dispersal surface, including the design dimensions for a typical distribution system which can accommodate the design flows and soil characterization, are summarized in the following table.

Parameter	Minimum Requirement	Proposed Septic Design
Number of Enviro-Septic Pipes	<p>No. of pipes = $Q / 126 L$ per pipe No. of pipes = 23.81</p> <p>Minimum row length = 6.1 m Maximum row length = 30 m</p> <p><i>Notes: Number of pipes must be rounded up to provide uniform distribution over the dispersal surface.</i></p>	<p>Total no. of pipes = 24 Configuration: 4 rows, 6 pipes long (each row is 18.3 m long)</p> <p>Total length of Enviro-Septic Pipe = 73.2 m (each pipe is 3.05 m in length)</p>
Dispersal Surface (Absorption Bed Size)	<p>Infiltration Surface Required: Area = $QT/400$ Area = 337.5 m²</p> <p>Min. spacing between rows 0.45 m Min. lateral spacing past external rows = 0.45 m Min. extension at the end of each row = 0.3 m</p> <p>Min. System Sand layer under Pipe = 300 mm Min. System Sand layer above Pipe = 100 mm Min. System Sand at end of pipes = 75 mm Min. Topsoil over system sand = 200 mm</p> <p><i>Notes: The dispersal surface shall have the long dimension perpendicular to the direction in which effluent entering the soil will move horizontally</i></p>	<p>Area = 341.6 m² Total Length of Dispersal Surface = 21.9 m Total Width of Dispersal Surface = 15.6 m</p> <p>Spacing between rows = 3.9 m Lateral spacing past external rows = 1.95 m Extension at the end of each row = 1.80 m</p> <p>System Sand layer under Pipe = 300 mm System Sand layer above Pipe = 100 mm Topsoil over system sand = 200 to 500 mm</p> <p><i>Pipes are placed level, lengthwise. Material over pipe (system sand + topsoil) not to exceed 600 mm.</i></p>

Notes:

Q = daily septic flow volume, 3000 L/day

T = design T-time of underlying soil, 45 min/cm

Summary Comments

Based on this preliminary review and analysis, the retained parcel can accommodate a replacement septic system within the retained lands, as well as a contingency area, both of which can be located outside of the water pipeline easement.

In addition, proposed lot severance can also accommodate a typical 4-bedroom house, a septic system which provides Level IV quality effluent, as well as the contingency area for the septic distribution area. The retained parcel can also accommodate a similar septic system and contingency area.

This is demonstrated on the attached Site Plan.

We trust this meets your current requirements. If you require any clarification or technical support, please don't hesitate to contact our office.

Respectfully,

LDS CONSULTANTS INC.

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Attachments:

Site Plan
Site Observation Notes, March 17, 2022
Grain Size Analyses
Nitrate Loading Sample Calculations

23830 Denfield Road, Denfield
Septic Design - Concept Plan

Based on Daily Design Flow, Q - 3000 L/day
Soil T-time = 45 min/cm

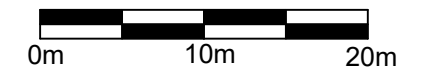
Level IV In-ground Septic System and contingency area (contact area = 341.64 m)

Minimum setbacks:

- Property Line, 3 m
- Building Setback, 5 m
- Cased Well, 15 m

Notes:

1. Actual septic design will be based on building footprint, # of bedrooms and fixture count.
2. Septic bed orientation and location may be shifted to better accommodate the building footprint and lot layout.



LDS CONSULTANTS INC.

2323 Trafalgar Street, London, Ontario N5V 0E1

Client:	Jeff Van Gorp	Date:	March 17, 2022
Project Name:		Project No:	GE-00692
Site:	23830 Denfield Road, Denfield	Location:	43.12311°N, 81.42885°W
Contractor:		Inspector:	C.Gooding
Job Description:	Soil Sampling, Gradation Analysis	Weather:	Sunny (2°C to 16°C)

Site Activity:

- Arrived on site
- Met and had a conversation with the homeowner Jeff Van Gorp about the proposed location of the Septic system
- Tech expressed the need to collect soil samples for analysis at the proposed Septic System location

Observation:

- Upon arrival the technician met with the homeowner, Jeff pointed out the location of an existing Watermain running through the property (see Image 7 & Image 8 & Image 9)
- Homeowner supplied a stamped and certified site plan dated April 2021 prepared by Callon Dietz Ontario Land Surveyors (see Figure 3)
- Homeowner presented Certificate of inspection for existing septic system dated May 01, 1999, from the Middlesex County Private Sewage Disposal Program (see Figure 2)
- As a result, the technician procured soil samples from the following locations: - (see Figure 1)

Sample #	(Approximate) Location	(Approximate) Co-ordinates
1	16.36 M from the rear of the house	43°7'24" N, 81°25'44" W @270°W
2	40.95 M from the rear of the house	43°7'25" N, 81°25'43" W @272°W
3	11.65 M from the front of the house	43°7'24" N, 81°25'45" W @241°W

- The technician observed the infiltration of groundwater upon excavation at the first sample location, the other locations appeared to be moist; however, no infiltration was visible (see Image 1)

Synopsis:

- Scanned copies of Septic System Inspection Certificate and Surveyors Site Plan obtained
- Samples Procured

LDS will continue monitoring of the site, as requested

- Left site at 1540

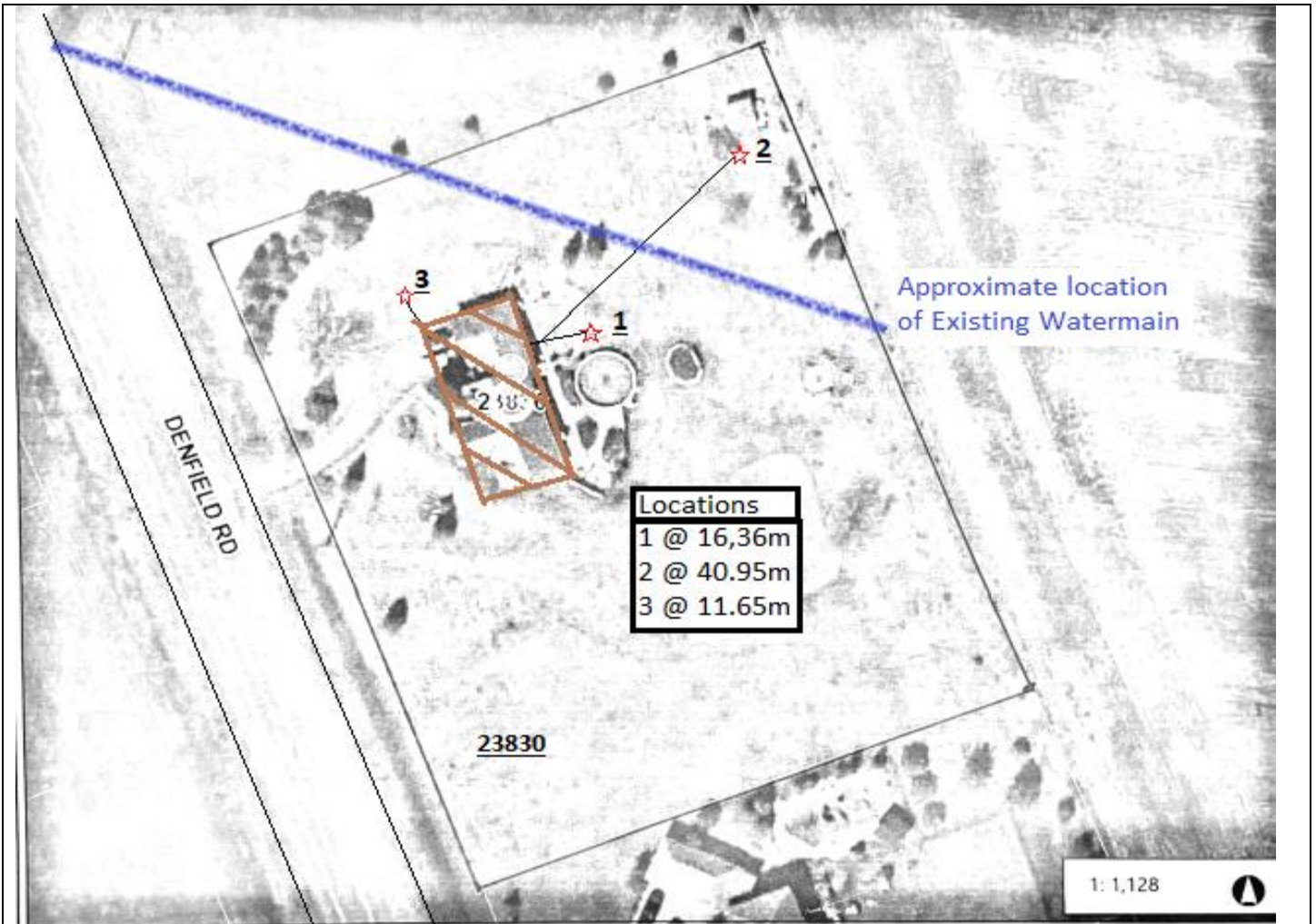


Figure 1 Site Plan for 23830 Denfield Rd



Image 1 Sample 1 Hole Post-Excavation



Image 2 Sample 1 Location



Image 3 Sample 2 Hole Post-Excavation



Image 4 Location of Sample 2



Image 5 Sample 3 Hole Post-Excavation

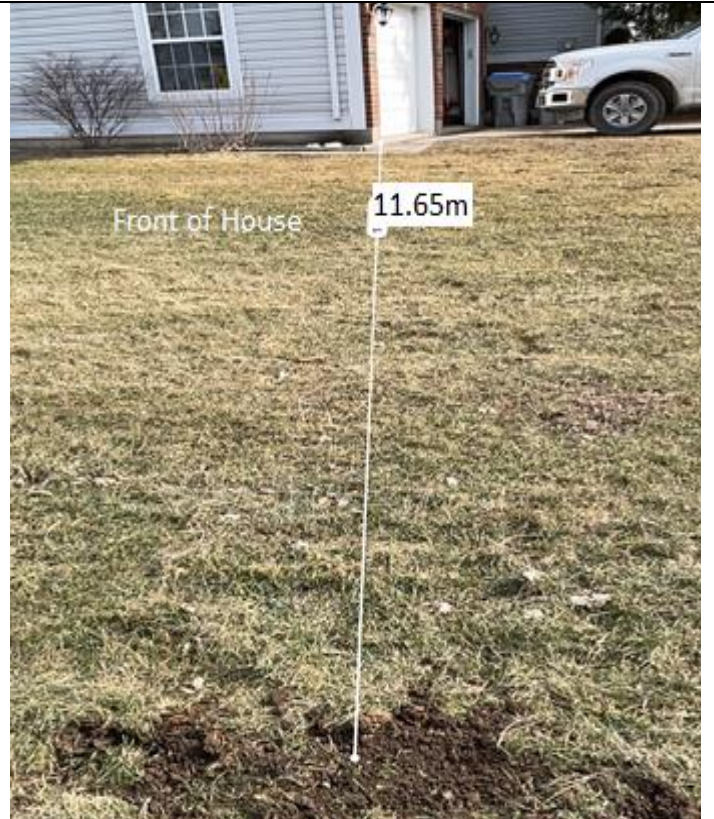


Image 6 Location of Sample 3



Image 7 Existing Watermain



Image 8 Existing Watermain



Image 9 Existing Watermain

MIDDLESEX COUNTY PRIVATE SEWAGE DISPOSAL PROGRAM

Upper Thames River Conservation Authority
 1424 Clarke Road, London, Ontario, N1V 2B9
 (519) 831-2800 Fax: (519) 431-1188
 E-mail: rpalin@thamesrvc.org

Avonlea Bayfield Conservation Authority
 R.R. # 3 Bayton, Ontario, N0M 1S1
 (519) 235-2616 Fax: (519) 235-1963
 E-mail: abca@protonk.com

Kettle Creek Conservation Authority
 R.R. # 8 St. Thomas, Ontario, N5P 2T3
 (519) 831-1278 Fax: (519) 631-2626
 E-mail: kcc@protonk.com

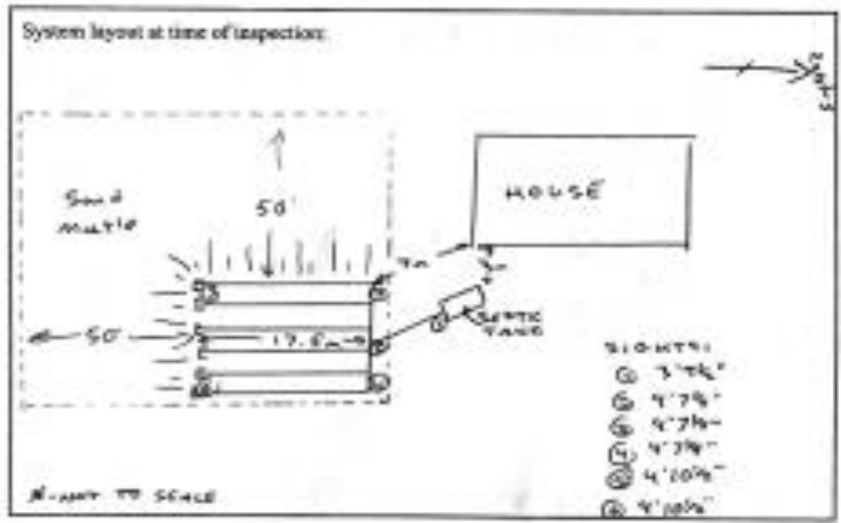
Committed to Protecting and Enhancing the Environment and Public Health

Permit # 993918.00⁴

CERTIFICATE OF INSPECTION RE: READINESS FOR USE

I, Arnold D. Sturman, certify that an inspection has been made of the above-noted system, pursuant to the Building Code Act and I have determined that no outstanding order(s) exist.

Work remaining to be completed:
- Backfill and complete final grading



Comments: I. installed by PVG Excavating, Tank is a
R. T. PINE, 6800 Ave., Pipe is 4" PVC

Date of inspection: May 1, 1999 Inspector: Arnold D. Sturman

Figure 2 Certificate of Inspection

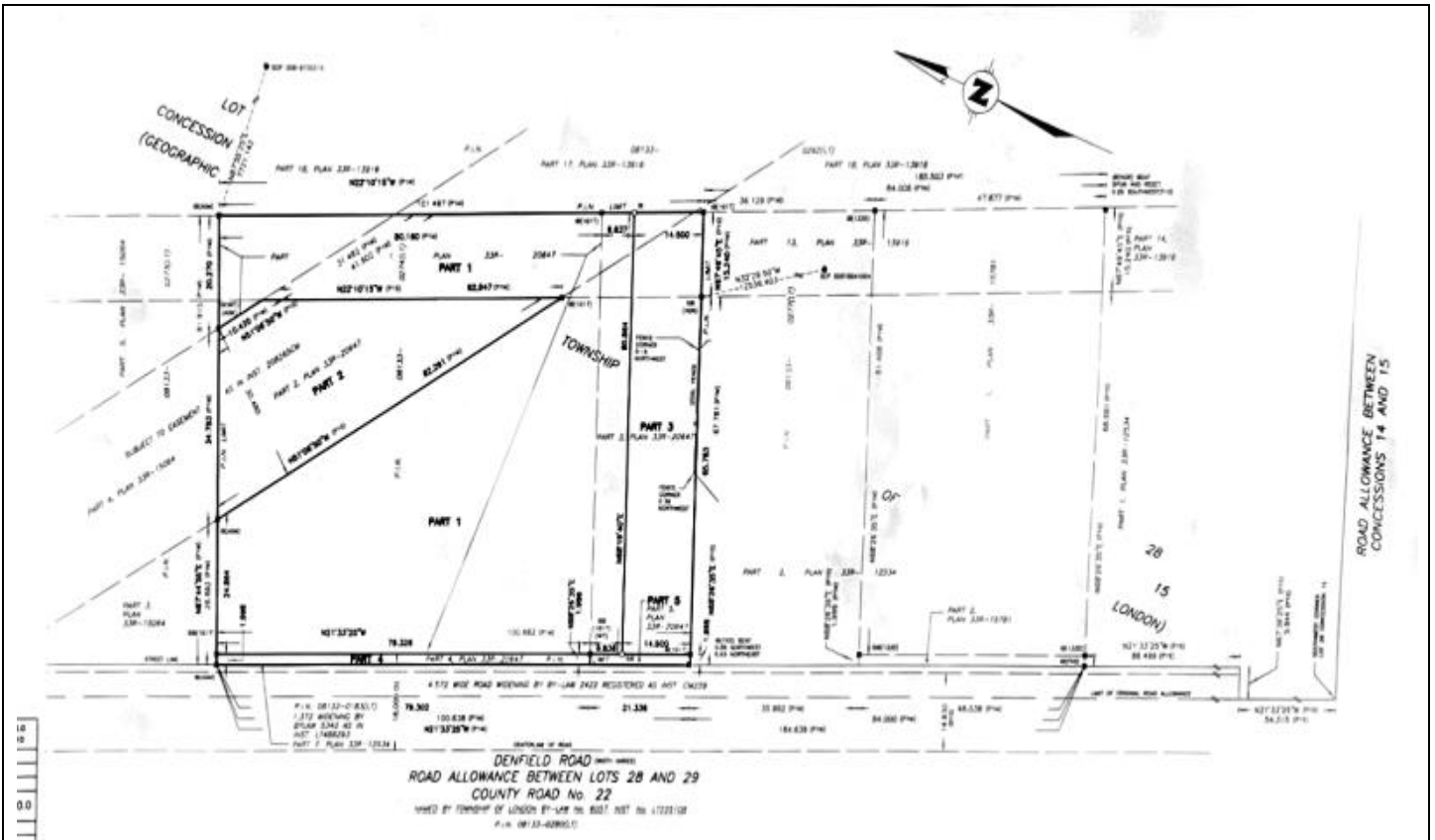


Figure 3 Surveyors Plan

SURVEYOR'S CERTIFICATE

I CERTIFY THAT

(1) THIS SURVEY WAS MADE ACCORDING TO THE SURVEY ACT, THE SURVEYS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

(2) THE SURVEY WAS COMPLETED ON THE 5th DAY OF APRIL, 2021.

April 5, 2021

Paul Crocker

P. PAUL CROCKER
ONTARIO LAND SURVEYOR

Callon Dietz
ONTARIO LAND SURVEYORS
GABLETON PLACE LONDON NORTH ONT
LONDON@CALLONDIEZ.COM

SURVEY BY: P1/25 DRAWN BY: KC FILE No. 18-22923 & PLAN No. P-1157



Particle Size Distribution Results of Sieve Analysis

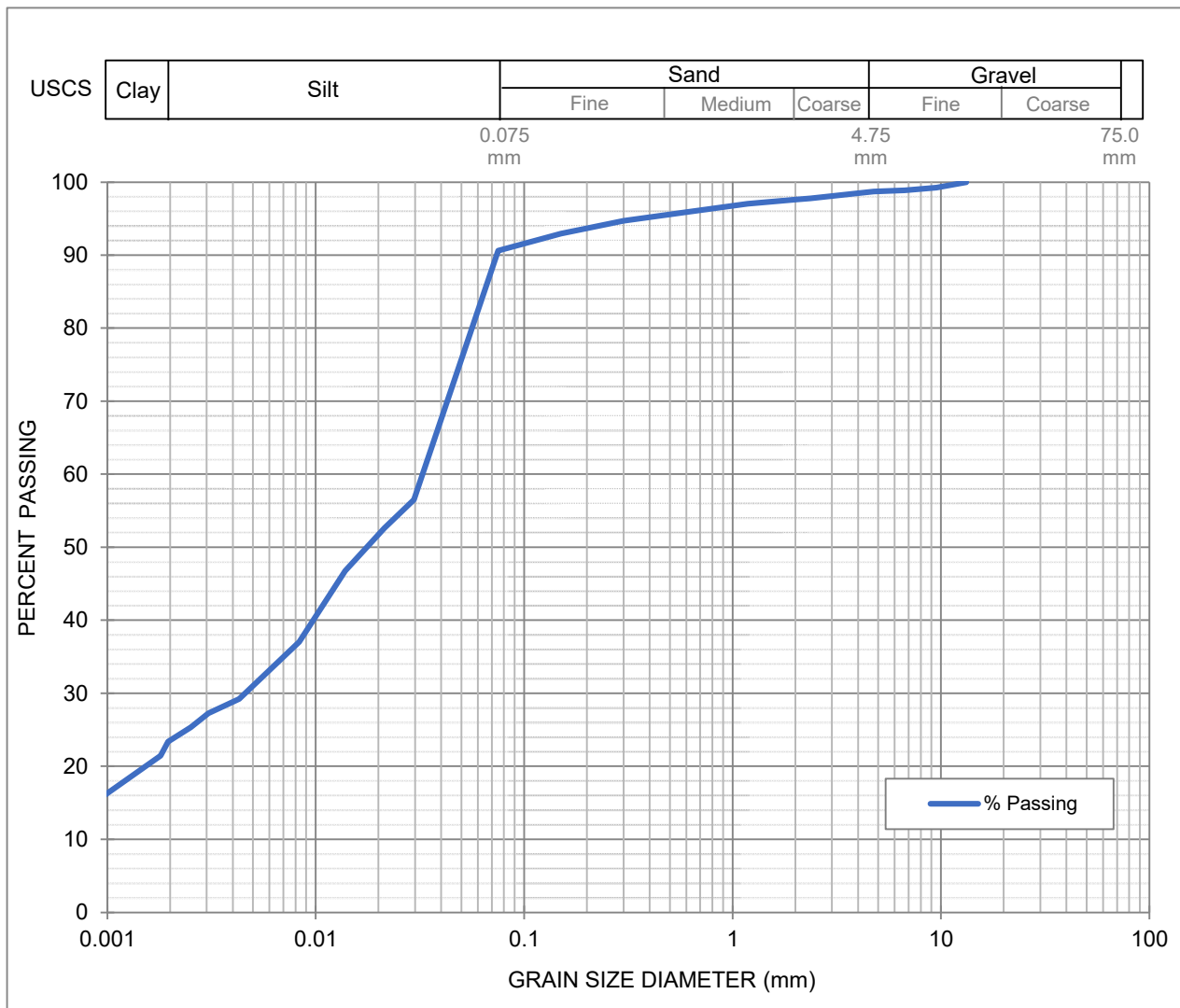
Project Name: T-time Determination

Date: 28-Mar-22

Project Location: 23830 Denfield Road, Denfield

Project No.: GE-00692

Sample ID	Unified Soil Classification				Moisture Content (%)
	% Clay	% Silt	% Sand	% Gravel	
Natural Subgrade Soils Test Pit 3 - 0.45 m depth	23.4	67.2	8.1	1.3	21.7



D-5-4 Septic Calculations - 23830 Denfield Road (1 severed lot ~ 3285 m²)

Residential Lots - Effluent Flow

1 lot
 1000 L/day
 365 days/yr

 365,000 L/year

Surplus Water (Run-off and Infiltration)

Precipitation 1011.5 mm/yr
Based in 1981-2010 Climate Normals @ London Weather Station
 Evapotranspiration 569.3 mm/yr
MECP SWM Manual, 2003
 Surplus Water 0.4422 m/yr

Dilution Water (Infiltration Component of Precipitation)

Determine Infiltration Factor, based on MECP SWM Design

Topography

Flat 0.3
 Rolling 0.2
 Hilly 0.1

Soil

Tight Impervious Clay 0.1
 Medium (Clay & Loam) 0.2
 Open Sandy Loam 0.4

Vegetative Cover

Cultivated Land 0.1
 Woodland 0.2
 Grassland 0.2

Infiltration Factor, I 60%

Site Area 3,285.1 m²

Dilution Water 871.60 m³/yr
 871,603 L/year

Nitrate Concentration

$$N_c = [QE (NE) + DW (NB)]/[DW + QE]$$

N_c = Nitrate Concentration at the property boundary (mg/L);
 N_E = Nitrate Concentration of the sewage effluent (from the tank) (mg/L);
 Q_E = Yearly volume of effluent produced (L/year);
 D_W = Dilution Water available (L/yr);
 N_B = Background Nitrate Concentration, (mg/L).

Maximum Allowable Nitrate Concentration at Boundary

10 mg/L *Based on ODWQ Guidelines*

Calculations

Scenario 1 - Conventional Septic System - Nitrate @ 37 mg/L

NE 37 mg/L *standard nitrate level*
 QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
 DW 871,603 L/year *Dilution water calculated for site*
 NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 11.77 mg/L *does not meet ODWQ Guidelines*

Scenario 2 - Level IV Treatment, Enviro-Septic System - 30% nitrate reduction

NE 25.9 mg/L *30% nitrate reduction*
 QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
 DW 871,603 L/year *Dilution water calculated for site*
 NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 8.49 mg/L *meets ODWQ Guidelines*

Notes:

Calculations based on predictive assessment modelling for residential developments, as outlined in MECP D-5-4 Guidelines.

D-5-4 Septic Calculations - 23830 Denfield Road (2 lots created from severed parcel, each ~ 2089 m²)

Residential Lots - Effluent Flow

1 lot
 1000 L/day
 365 days/yr

 365,000 L/year

Surplus Water (Run-off and Infiltration)

Precipitation 1011.5 mm/yr
Based in 1981-2010 Climate Normals @ London Weather Station
 Evapotranspiration 569.3 mm/yr
MECP SWM Manual, 2003
 Surplus Water 0.4422 m/yr

Dilution Water (Infiltration Component of Precipitation)

Determine Infiltration Factor, based on MECP SWM Design

Topography

Flat 0.3
 Rolling 0.2
 Hilly 0.1

Soil

Tight Impervious Clay 0.1
 Medium (Clay & Loam) 0.2
 Open Sandy Loam 0.4

Vegetative Cover

Cultivated Land 0.1
 Woodland 0.2
 Grassland 0.2

Infiltration Factor, I 60%

Site Area 2,088.8 m²

Dilution Water 554.20 m³/yr
 554,200 L/year

Nitrate Concentration

$$N_c = [QE (NE) + DW (NB)]/[DW + QE]$$

N_c = Nitrate Concentration at the property boundary (mg/L);
 N_E = Nitrate Concentration of the sewage effluent (from the tank) (mg/L);
 Q_E = Yearly volume of effluent produced (L/year);
 D_W = Dilution Water available (L/yr);
 N_B = Background Nitrate Concentration, (mg/L).

Maximum Allowable Nitrate Concentration at Boundary

10 mg/L *Based on ODWQ Guidelines*

Calculations

Scenario 1 - Conventional Septic System - Nitrate @ 37 mg/L

NE 37 mg/L *standard nitrate level*
 QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
 DW 554,200 L/year *Dilution water calculated for site*
 NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 15.42 mg/L *does not meet ODWQ Guidelines*

Scenario 2 - Level IV Treatment, Enviro-Septic System - 30% nitrate reduction

NE 25.9 mg/L *30% nitrate reduction*
 QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
 DW 554,200 L/year *Dilution water calculated for site*
 NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 11.01 mg/L *does not meet ODWQ Guidelines*

Scenario 3 - Enhanced Level IV Treatment Waterloo Biofilter - 50% nitrate reduction

NE 18.5 mg/L *30% nitrate reduction*
 QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
 DW 554,200 L/year *Dilution water calculated for site*
 NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 8.07 mg/L *meets ODWQ Guidelines*

Calculations based on predictive assessment modelling for residential developments, as outlined in MECP D-5-4 Guidelines.