



## REPORT

# Sewage System Preliminary Design Report Lancaster Commercial Vehicle Inspection Facility 2.5 km West of County Road 2/34; Highway 401 Township of South Glengarry, Ontario

*G.W.P. No. 4045-10-01*

*P.O. No. 4010-E-0034*

Submitted to:

### **Dillon Consulting Limited**

130 Dufferin Avenue  
London, Ontario  
N6A 5R2

Submitted by:

### **Golder Associates Ltd.**

1931 Robertson Road, Ottawa, Ontario, K2H 5B7, Canada

+1 613 592 9600

1651503-5000

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## 1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Dillon Consulting Limited (Dillon) for the preparation of this Sewage System Preliminary Design Report (report). This report provides the results of our assessment related to the proposed sewage system to be constructed at the 401 westbound Commercial Vehicle Inspection Facility (CVIF) located southwest of the town of Lancaster, Ontario. It is understood that preliminary sewage loadings, percolation 'T' times and size(s) of the leaching bed footprints are required to determine property acquisition requirements for the project. Detailed design of the sewage systems will be carried out by others as part of the future Detailed Design portion of the project.

The scope of work for this report was outlined in Golder's proposal dated December 2018.

## 2.0 SITE DESCRIPTION

The new westbound CVIF is to be located just north of Highway 401 between Fraser Road and County Road 2/34 in the Township of South Glengarry, Ontario. The proposed location is approximately 2.5 km west of the Highway 401 / County Road 2/34 Interchange.

The lands surrounding the project limits are typically agricultural with a flat topography. Raisin River Road currently crosses the proposed site in a west-east direction parallel to and north of Highway 401. Brush and trees are also present between the Highway 401 right-of-way and Raisin River Road.

Highway 401 at this location has two through lanes in each direction with paved and gravel shoulders. The eastbound and westbound lanes are generally separated by a wide, vegetated median ditch. Storm water drainage in the area is to existing ditches, culverts and Raisin River.

The site plan drawings provided indicate that the new CVIF will contain driving lanes and parking, a triage area, a static scale, covered and noncovered inspection bays, service bays, a building, and septic system structure and septic field area. Drawing No. 1 illustrates the general layout of the proposed CVIF. It is understood that, due to hydrology requirements, a grade raise of between 1.5 and 3.5 m will be required across the proposed CVIF site.

## 3.0 SUBSURFACE CONDITIONS

The Site Stratigraphy is discussed in the *Desktop Foundation Investigation and Design Report, Lancaster Commercial Vehicle Inspection Facility, 2.5 km West of County Road 2/34; Highway 401, Township of South Glengarry, Ontario, G.W.P. No. 4045-10-01, P.O. No. 4010-E-0034*, prepared by Golder Associates Ltd., dated March 2019.

Based on existing geological mapping and the results of previous investigation reports in the area, the subsurface conditions at the site are anticipated to generally consist of surficial deposits, overlying firm silty clay, overlying loose to compact clayey silt overlying non-cohesive, compact to very dense glacial till, in turn underlain by limestone/shale bedrock.

Based on the surficial silty clay soils, an estimated percolation time (T) for the native soils was determined to be over 50 min/cm.

Groundwater levels were measured at depths at or just below existing ground surface during the previous investigations in the surrounding area.

Given the possible high water table and the native soils, with percolation times greater than 50 min/cm, it is assumed that a fully raised bed will be required at the site.

Detailed subsurface investigations have not been completed at the location of the sewage system as part of this assessment, or any previous assessments. Therefore, the subsurface conditions in the location of the leaching bed may differ from those discussed in this report. The subsurface conditions at the proposed location of the leaching bed should be confirmed as part of the detailed design.

## 4.0 SEWAGE SYSTEM

### 4.1.1 General

The site plan drawings provided indicate that the proposed sewage system tanks will be located in the landscaped area adjacent to the building and sewage disposal area (leaching bed) and contingency area will be located on the west side of the facility. Drawing No. 1 illustrates the general layout of the proposed Lancaster CVIF.

Due to the low permeability of the native soils it is anticipated that a fully raised leaching bed system with a pump chamber will be required at this site. A pumped system is less susceptible to differential settlements possible with a grade raise, though future maintenance of the system should be anticipated. It may be feasible, depending on the ultimate proposed grading scheme, to discharge the beds by gravity; however, maintaining grades over time is critical for the system to function properly.

This report provides the results of our assessment related to the proposed sewage system to be constructed at the Site. It is understood that preliminary sewage loadings, percolation 'T' times and size(s) of the leaching bed footprints are required to determine property acquisition requirements for the project. Detailed design of the sewage systems will be carried out as part of the future Detailed Design portion of the project.

### 4.1.2 Sewage System Design Flows

Based on the information provided by Dillon, the CVIF septic system is to be sized to accommodate sewage flows based on a combination of an office building and a service station as per Table 8.2.1.3.B. of the OBC for the following two scenarios:

#### Maximum Typical Staffing (Includes additional 3 TEO on Shift 1C)

- 9 workers on the first shift (varying duration, total of 85.25 hours) and 4 workers on the second shift (varying duration, total of 39 hours). This is equivalent to 16 workers on an 8-hour shift.
- 1 public washroom
- 96 trucks per day pass through the facility

#### Roadcheck Blitz Staffing

- 6 workers on the first shift (varying duration, total of 55.25 hours) and 4 workers on a 24 hour shift. This is equivalent to 19 workers on an 8-hour shift.
- 1 public washroom
- 96 trucks per day pass through the facility

Therefore, the total daily design sanitary sewage flow is calculated to be:

$$Q = 19 (75 \text{ L/d/8 hour shift}) + 1 (950 \text{ L/d}) + 96 (20 \text{ L/d/vehicle})$$

$$Q = 4,295 \text{ L/d}$$

For preliminary design purposes, a total daily design sanitary sewage flow of 4,300 L/d is utilized for sizing of the sewage systems.

### 4.1.3 Sewage System Sizing

The following three alternatives have been considered for the site as outlined below and discussed in more detail in the following separate sections. All three systems are different approaches for the distribution of wastewater into soils at the site. Each differs slightly in the amount of pre-treatment that is required prior to disposal which also impacts the required size, characteristics of sand fill material used and the overall construction of the disposal system to adequately infiltrate the effluent into the soils.

#### 1) Conventional Leaching Bed

A conventional leaching bed system includes a septic tank which receives wastewater from the building via a gravity sewer. A septic tank has two compartments to separate solids and floatables and is sized for three times the daily sewage design flow. Some anaerobic treatment of the wastewater occurs within the tank. In this case, a separate pump chamber is required to pump the septic tank effluent to the raised leaching bed. The leaching bed will consist of a series of pipes in clear stone to distribute the septic tank effluent over a loading area, sized to promote infiltration of the effluent into the underlying soils.

#### 2) Filter Bed

A filter bed disposal system is similar to a conventional leaching bed but the effluent is usually distributed over a smaller sand filter. The sand (filter media) required in a filter bed system has stricter gradation than sand used as leaching bed fill. The system would include a septic tank to receive wastewater from the building via a gravity sewer. A septic tank has two compartments to separate solids and floatables. As per the conventional leaching bed, the septic tank effluent would be discharged to a pump chamber for pumping of the effluent to the raised filter beds.

#### 3) Type A Dispersal Bed

A type A dispersal bed is also similar to the other systems but the effluent is distributed over a smaller stone area and the depth of the bed material is slightly smaller than the other two. The sand used in a dispersal bed system has stricter requirements for percolation rates than sand used as leaching bed fill. The system would include a septic tank to receive wastewater from the building via a gravity sewer. A septic tank has two compartments to separate solids and floatables. This type of disposal system requires additional treatment of the septic tank effluent prior to disposal in the dispersal bed. The aerobic treatment unit would be located downstream of the septic tank and effluent from the treatment unit would be discharged to the pump chamber for pumping of the effluent to the raised dispersal beds.

The following sections provides the preliminary sizing of each type of system and the estimated capital cost.

#### 4.1.3.1 **Alternative # 1 - Conventional Leaching Bed**

Table 8.7.4.1 of the OBC provides loading rates for fill based absorption trenches and filter beds. Based on the total daily design sanitary sewage flow of 4,300 L/d, and a percolation time of greater than 50 min/cm, the loading rate of the bed is 4 L/m<sup>2</sup>/d. This results in a minimum loading area of 1,075 m<sup>2</sup>.

The size of the bed may vary depending on the characteristics of the imported sand and site features. Assuming an imported sand with a percolation time of 6 min/cm is used, the length of distribution trench is 129 m. Based on a bed with 10 runs of 13 m, 4:1 sideslopes, 1.5 m height and a 0.25 m thick mantle extending a minimum 15 m past the distribution piping in one direction only, the proposed bed would measure 27 m by 38 m for a size of 1,026 m<sup>2</sup>. Therefore, the minimum size of 1,075 m<sup>2</sup> will be used. The mantle is a sand layer in contact with the underlying soils to promote infiltration and it is extended in the direction of the base slope to provide at least 15 m of space for this infiltration to occur. There is a minimum setback of 6 m from the piping within the bed to the property limits. Typically, the system is orientated such that the subgrade of the bed and the mantle are sloped towards an adjacent ditch.

The system will require a septic tank sized at three times the daily design flow. Therefore, the septic tank will need to be at least 12,900 L. The septic tank will be installed adjacent to the proposed building and prior to the pump chamber to eliminate the need to pump raw sewage. A pumping station is not required as the length of distribution piping is less than 150 m; however, since the bed will be fully raised and located further away from the septic tank, a pumping station will be required.

The Class D estimate (+100%/-50%) for the above system is \$79,000. Very little maintenance is required for a conventional leaching bed. The system should be visually observed monthly for signs of failure. The pumps should be inspected yearly to maintain proper operation at a cost of about \$500 per year, and the normal life expectancy for the pumps would be in the 5 to 10 year range. Costs to replace the pumps would be about \$3,000. The septic tank should be pumped out approximately once every 5 years.

Refer to Figure 1 for a preliminary layout of the system.

#### 4.1.3.2 **Alternative # 2 - Filter Bed**

Table 8.7.4.1 of the OBC provides loading rates for fill based absorption trenches and filter beds. Based on the total daily design sanitary sewage flow of 4,300 L/d, and a percolation time of greater than 50 min/cm, the loading rate of the bed is 4 L/m<sup>2</sup>/d. This results in a minimum loading area of 1,075 m<sup>2</sup>. The extended base required is 253 m<sup>2</sup> and the effective area is 86 m<sup>2</sup>.

The size of the bed may vary depending on the design of the filter beds. Since the effective area is greater than 50 m<sup>2</sup>, two (2) filter beds are required with 5 m spacing between effective areas, and with 4:1 sideslopes, 1.5 m height, and a 0.25 m thick mantle extending 15 m past the distribution piping in one direction only, the expected bed would measure 29 m by 29 m for a size of 841 m<sup>2</sup>. However, to provide the minimum loading area of 1,075 m<sup>2</sup>, the mantle area should be increased. The mantle is a sand layer in contact with the underlying soils to promote infiltration and it is extended in the direction of the base slope to provide at least 15 m of space for this infiltration to occur. There is a minimum setback of 6 m from the piping within the bed to the property limits. Typically, the system is orientated such that the subgrade of the bed and the mantle are sloped towards an adjacent ditch.

The system will require a septic tank sized at three times the daily design flow. Therefore, the septic tank will need to be at least 12,900 L. Since the daily design flow is less than 5,000 L/d, the system only requires a septic tank

for treatment as per OBC 8.7.5.1 (1). The septic tank will be installed adjacent to the proposed building and prior to the pump chamber to eliminate the need to pump raw sewage. A pumping station is not required as the length of distribution piping is less than 150 m; however, since the bed will be fully raised and located further away from the septic tank, a pumping station will be required.

The Class D estimate (+100%/-50%) for the above system is \$81,000. Very little maintenance is required for a filter bed without a Level II or IV treatment unit. The system should be visually observed monthly for signs of failure. The pumps should be inspected yearly to maintain proper operation at a cost of about \$500 per year, and the normal life expectancy for the pumps would be in the 5 to 10 year range. Costs to replace the pumps would be about \$3,000. The septic tank should be pumped out approximately once every 5 years.

Refer to Figure 2 for a preliminary layout of the system.

#### **4.1.3.3      *Alternative # 3 - Type A Dispersal Bed***

Since the percolation time of the underlying soil is greater than 15 min/cm, the loading area of the Type A dispersal bed is determined by Sentence 8.7.7.1.(5)(b) of the OBC. Based on the total daily design sanitary sewage flow of 4,300 L/d, and a percolation time of greater than 50 min/cm, the loading area is 537.5 m<sup>2</sup>.

The size of the bed may vary depending on the design of the Type A dispersal bed. Based on an area of 86 m<sup>2</sup> for the stone layer, 4:1 sideslopes, 1.2 m height, and a 0.25 m thick mantle extending 15 m past the distribution piping in one direction only, the expected bed would measure 22 m by 28 m for a size of 616 m<sup>2</sup>. The mantle is a sand layer in contact with the underlying soils to promote infiltration and it is extended in the direction of the base slope to provide at least 15 m of space for this infiltration to occur. There is a minimum setback of 6 m from the piping within the bed to the property limits. Typically, the system is orientated such that the subgrade of the bed and the mantle are sloped towards an adjacent ditch.

All Type A dispersal beds require a Level IV treatment unit as described in Table 8.6.2.2 of the OBC. The system will also require a septic tank sized in accordance with the treatment unit approval. Assuming a Bionest BN-1250 which is designed for daily design sanitary sewage flow from 4,000 L to 5,000 L, the septic tank will need to be at least 7,600 L. The septic tank and Level IV treatment unit will be installed adjacent to the proposed building and prior to the pump chamber to eliminate the need to pump raw sewage. A pumping station will also be required as the bed will be fully raised, located further away from the system and to meet MMAH Supplementary Standard SB-5.

The Class D estimate (+100%/-50%) for the above system is \$83,500. A maintenance agreement is required for the treatment unit, which may include site inspections 1-2 times per year. The cost for this maintenance is estimated at approximately \$1,000/year. The system should also be visually observed monthly for signs of failure. The pumps should be inspected yearly to maintain proper operation at a cost of about \$500 per year. The normal life expectancy for the pumps would be in the 5 to 10 year range. Costs to replace the pumps would be about \$3,000. The septic tank should be pumped out approximately once every 5 years. Most treatment units include a media within the unit that needs to be replaced or regenerated after certain time periods. Typically, this time period is about once every ten years.

Refer to Figure 3 for a preliminary layout of the system.

#### 4.1.4 Sewage Discussion

The areas shown in each of the three alternatives are provided for preliminary layout purposes. The final dimensions and orientation of each system could be modified from those shown to accommodate a different layout or to account for variations in topography or other site features. The natural soils underlying the loading area and mantle are fine grained, over time the interface may become saturated or less efficient for infiltrating the effluent and liquid may breakout at the toe of the mantle. Although breakout after the 15 m mantle is acceptable, it may appear on the surface and could be considered undesirable. A 100% contingency area should be considered for the leaching/filter/dispersal bed.

Given the possible high water table and the depth to soils with percolation times less than 50 min/cm, it is assumed that a fully raised bed will be required at the site. The excavation for the leaching bed will be limited to stripping of organic materials and shaping of the existing silty clay soils. Therefore, excavations will typically be less than 0.3 m below ground surface and groundwater control will not be required.

The excavation for the underground tanks will be approximately 3 to 4 m below ground surface, depending on the invert elevation of the sanitary service at the building. Refer to Sections 5.3.6 and 5.3.7 for excavation and ground water control requirements.

The following table provides a comparison of the three alternatives listed above:

Proposed Alternative	Advantages	Disadvantages
Alternative # 1 – Conventional Leaching Bed	■ Minimal maintenance required.	■ Larger footprint.
Alternative # 2 – Filter Bed	■ Minimal maintenance required.	■ Larger footprint.
Alternative # 3 – Type A Dispersal Bed	■ Smaller footprint.	■ Maintenance agreement required. ■ Increased electrical demand for aeration of treatment unit and additional pumping step.

## 5.0 CLOSURE

We trust the above is sufficient for your current purposes, please let us know if you have any questions.

Yours truly,

**Golder Associates Ltd.**



Scott Taylor, P.Eng.  
*Civil Engineer*



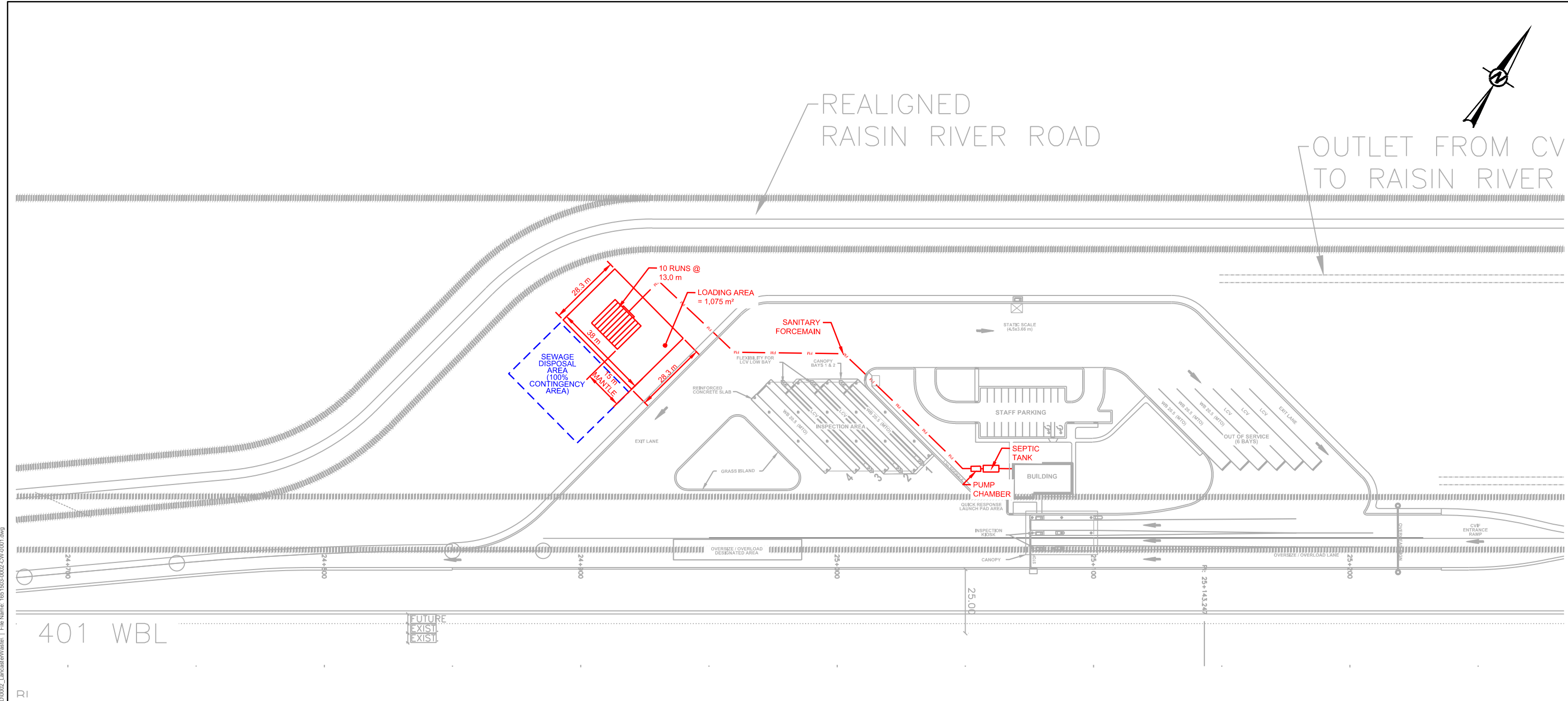
Douglas Kerr, P.Eng.  
*Associate, Senior Civil Engineer*

SWT/DVK/mvrd

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REFERENCE(S)  
BASE INFORMATION PROVIDED BY DILLON CONSULTING LIMITED, DRAWING FILE NO.  
LANCASTER CVIF - OPTION 2- 800M.DWG. RECEIVED MARCH 3, 2019



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CONSULTANT	YYYY-MM-DD 2016-01-17
	DESIGNED SWT
	PREPARED ABD
	REVIEWED SWT
	APPROVED DVK



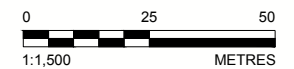
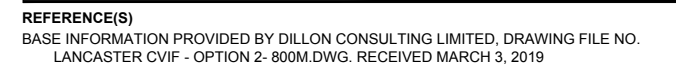
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TITLE	ALTERNATIVE # 1 CONVENTIONAL LEACHING BED
PROJECT NO.	1651503
CONTROL	0002
REV.	A
FIGURE	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3/B

28 mm



# -OUTLET FROM CVIF TO RAISIN RIVER



CLIENT  
MTO

PROJECT  
LANCASTER CVIF  
CONCEPTUAL LAYOUT

CONSULTANT

YYYY-MM-DD 2016-01-17

DESIGNED	SWT
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PREPARED	ABD
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REVIEWED	SWT
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APPROVED DVK

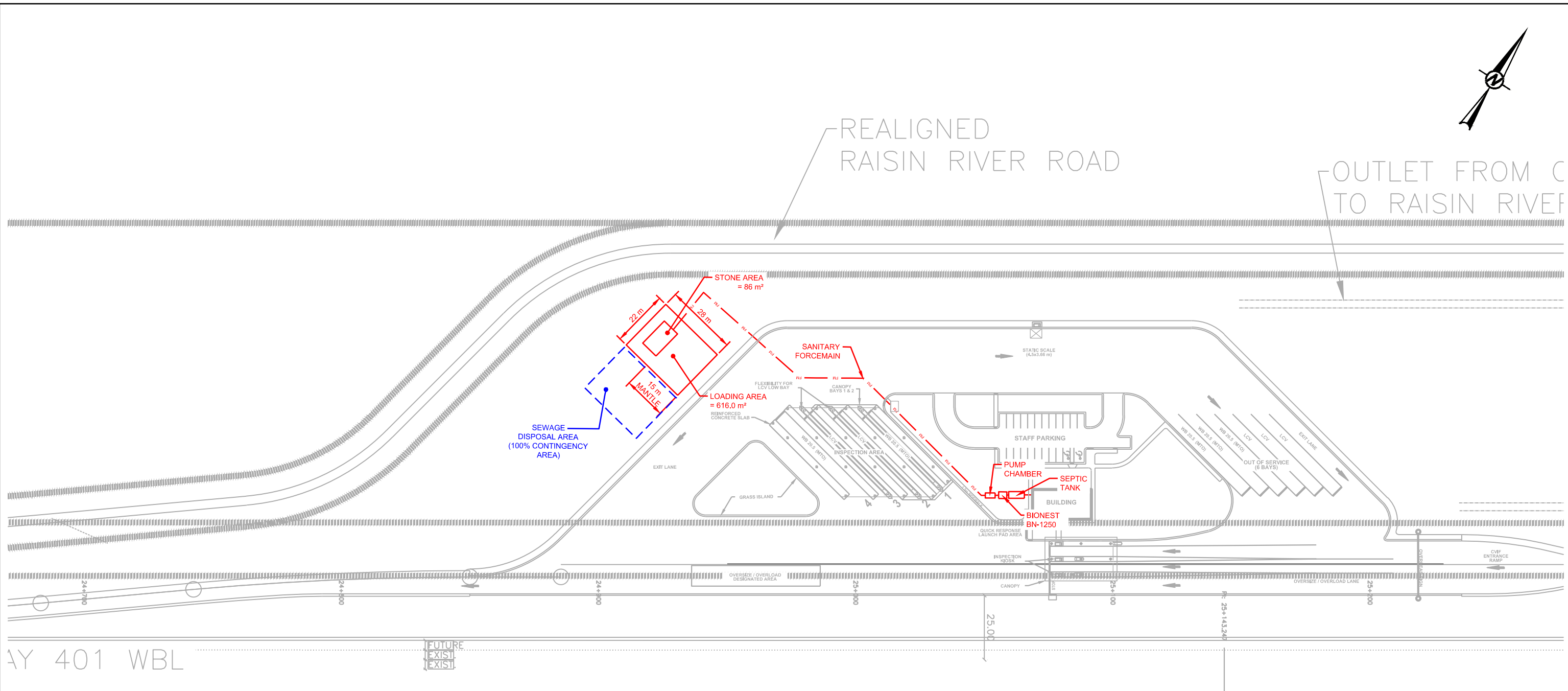
TITLE  
**ALTERNATIVE # 2  
FILTER BED**

PROJECT NO.  
1651503

CONTROL  
0002REV.  
A

FIGURE 2






AY 401 WBL

FUTURE  
EXIST.  
EXIST.

**REFERENCE(S)**  
BASE INFORMATION PROVIDED BY DILLON CONSULTING LIMITED, DRAWING FILE NO.  
LANCASTER CVIF - OPTION 2- 800M.DWG. RECEIVED MARCH 3, 2019



CLIENT MTO			PROJECT LANCASTER CVIF CONCEPTUAL LAYOUT		
CONSULTANT			TITLE <b>ALTERNATIVE # 3</b> <b>TYPE A DISPERSAL BED</b>		
			YYYY-MM-DD	2016-01-17	PROJECT NO. 1651503
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			PREPARED	ABD	REV. A
			REVIEWED	SWT	FIGURE 3
			APPROVED	DVK	

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3S B



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