

BOS Engineering & Environmental Services Inc.

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October 1, 2019

BY EMAIL

Sanderson Group Inc.
103 - 21578 Richmond St.
Arva, ON
N0M 1C0

Att: Mr. Rob Sanderson

Dear Sir:

**RE: Soil Testing & Domestic Wastewater Treatment Systems for Proposed
Subdivision, 10283 Ilderton Road, Coldstream**

On September 11 2019, a representative of BOS Engineering met onsite with a backhoe & operator supplied by T. M. Mahon Backhoe Services to dig test pits at the above mentioned site.

Soil Testing

Seven test pits were excavated throughout the site as identified on the site sketch in Appendix A. Test pit logs are presented in Appendix B. Elevations at the test pits were recorded and related to a local benchmark set as a spike placed in a tree near the northeast corner of the site. The benchmark location is identified on the site sketch in Appendix A.

At all test pits a layer of organic topsoil was encountered to depths ranging from 30 to 45 cm. Below this elevation, at test pit 1, coarse SAND was documented to a depth of 122 cm. A soil grain size analysis was conducted on the shallow sand sample and may be found in Appendix C. The classification of the sand is "SW – Well Graded SAND". Based on this classification, the sand has an estimated percolation time ranging from 2 to 8 min/cm. At all remaining test pits, CLAY soil was encountered under the topsoil layer and continued to termination depths of 1.82 to 2.44m. Grain size analyses were not conducted on the clay which has an estimated percolation time in excess of 50min/cm.

It should be noted that sandy soil was found only at TP1 which is near the existing home and is not representative of the area to be developed. This area is known for its soil variability. It is unknown whether or not this sand is connected to an aquifer around the Mill pond on the north side of Ilderton Road.

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Shallow Groundwater

Minor groundwater seepage was encountered at test pit 4 at a depth of 132cm. The estimated elevation of seepage on Sept 11th was 99.36. The seepage at this isolated location is not considered a water table. Longer-term groundwater monitoring was not conducted as part of this investigation and no attempts were made to reach an aquifer. Impact of septic systems on groundwater quality is not expected to be an issue at this site due to the impermeable clay soils in the area to be developed.

Wastewater System Design

For sewage system design, the top of the clay at 30 to 45 cm below the topsoil should be used as the shallow groundwater elevation or “confining layer” from which minimum vertical separation distances to distribution systems should be measured. Hence raised beds using imported sand will be required.

Based on clay soil, the maximum unit-area loading rate of the sand contact area is 4 L/m² for conventional septic tank pretreatment or 8 L/m² for enhanced tertiary pretreatment. Therefore tertiary pretreatment allows a sewage system footprint that is half the size of that for conventional pretreatment.

Likewise, the separation distance from the top of the clay soil to the bottom of the stone in the distribution system is 60 cm and 90cm respectively for tertiary and conventional pretreatment. This results in finished grades over the raised bed areas that will be either 90cm or 120cm above existing ground elevations.

In order to size the required beds, assumptions must be made regarding the anticipated size of the proposed homes to be built on the lots. Such assumptions are made for a design load of 2800 L/day design load, representing typical larger homes in the area. Following are the assumptions used in arriving at this sewage system design load.

FIXTURE UNITS - SUMMARY

<u>ITEM</u>	<u>No.</u>	<u>LOAD</u>	<u>TOTAL</u>
1.FULL BATHROOM	4	6	24
INDIVIDUAL ITEMS :			
2. ANY TYPE OF BATH	1	1.5	1.5
3. FLUSH TANK TOILETS	0	4	0
4a.SHOWER(1 HEAD)	0	1.5	0
4b.SHOWER(3 HEAD)	0	4.5	0
5.FLOOR DRAIN	1	2 - 4	3
6.LAVATORY (DOMESTIC)	2	1	2
7.BIDET	0	1	0
8. KITCHEN SINK	1	1.5	1.5
9. DISHWASHER	1	0 (TO SINK TRAPS)	0
10. LAUNDRY TUB	1	1.5	1.5
11. CLOTHES WASHER	1	1.5	1.5
12. DRINKING FOUNTAIN	0	0.5	0
TOTAL UNITS			35.0
NO. OF BEDROOMS:	4		
TOTAL LIVING AREA:	280 m2		

WASTEWATER SYSTEM - DESIGN CAPACITY

BASE LOAD (4 BEDROOM):	2000
1. F. U. OPTION (35- 20) X 50:	750
2. L. A. OPTION (280 -200)/10 X 100:	800
(ADD HIGHEST OF 1 OR 2 ABOVE)	

DESIGN LOAD = 2800 L/DAY

With a minimum parcel width of 128m at its narrowest southerly end, and allowing for a road width of 20m perpendicular to Ilderton road, lot depth for lots on each side of the proposed new road is 54m. Lot width of 46m allows for a liberal building envelope and 0.25ha (0.61 ac) lots.

Tables 1 & 2 on the following two pages respectively, demonstrate the bed size calculations using the assumed design load of 2800 L/day and a typical layout for each of a conventional and tertiary sewage system on 46m x 54m lots. In both cases, the smaller tertiary bed footprint was indicated as a contingency bed area.

Wells on the property should be deep drilled and cased, assuming an adequate deep aquifer is available. They should be positioned at the fronts of the homes with the septic systems at the rear to ensure that at least 15m setback is maintained from the septic beds and tanks.

**TABLE1: TYPICAL CONVENTIONAL WASTEWATER TREATMENT SYSTEM
DESIGN CALCULATIONS & SPECIFICATIONS
(FOR DESIGN LOAD = 2800 L/d)**

**CONVENTIONAL RAISED BED DESIGN
CALCULATIONS & DIMENSIONS**

1. DESIGN LOAD = 2800 L/DAY (SEE "DESIGN CAPACITY")
2. DISTRIBUTION PIPE : 6 RUNS X 18.67m. LONG @
1.6m. SPACING FOR IMPORTED SAND (T = 8 min/cm).
3. TOTAL AREA INCL MANTLE = 26.67 x 26.50 = 707m²
4. LOAD = 4.0 L/m²/DAY
5. IMPORTED SAND : T = 6 to 8 min/cm
6. MIN SEPTIC TANK CAPACITY = 5600 L. USE STANDARD
6800 L. CONCRETE TANK c/w POLYLOK PL-250 EFFL.
FILTER OR EQUIV. & ACCESS RISERS TO GRADE.

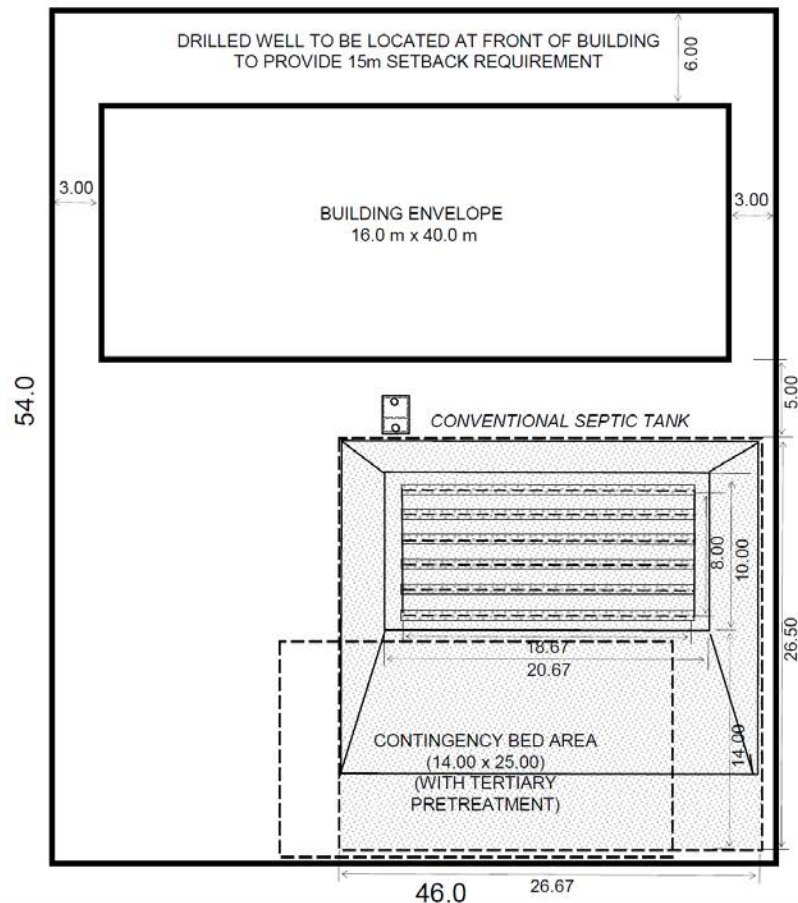
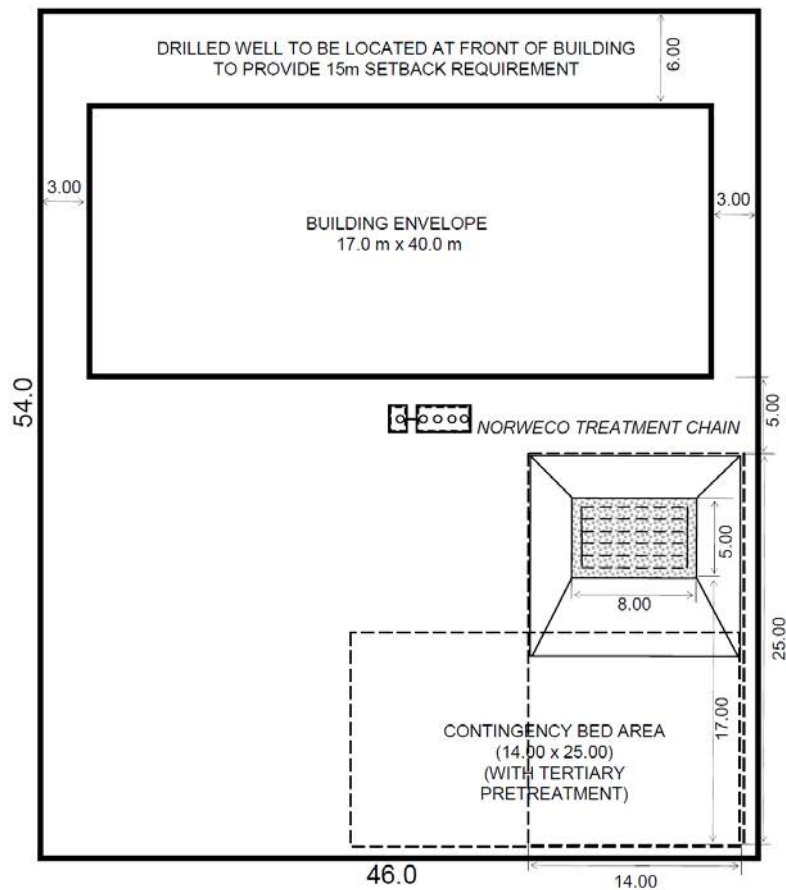


TABLE 2: TYPICAL TERTIARY WASTEWATER TREATMENT SYSTEM DESIGN CALCULATIONS & SPECIFICATIONS

(FOR DESIGN LOAD = 2800 L/d) (TERTIARY TREATMENT REQUIRES MAINTENANCE & MONITORING)

TERTIARY "TYPE A" RAISED BED DESIGN CALCULATIONS & DIMENSIONS

1. DESIGN LOAD = 2800 L/DAY (SEE "DESIGN CAPACITY")
2. USE NORWECO PRETREATMENT SYSTEM
3. MIN. STONE AREA = $2800 / 75 = 37.3 \text{ m}^2$
4. DISTRIBUTION PIPE: 4 RUNS EACH 6.0 m LONG @ 76cm ON CENTRES; ALL PIPES 60 cm FROM EDGES OF STONE.
5. MIN. TOTAL SAND CONTACT AREA = $QT/400 = 231 \text{ m}^2$
6. MANTLE LOAD = $7.9 \text{ L/m}^2/\text{DAY}$ (T = 6 to 8 min/cm)
7. SEPTIC TANK: INCLUDED IN TREATMENT UNIT CAPACITY.



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Summary

Based on the soil testing and analyses, lots that are 46m in width and 54m deep are more than adequate in size for a liberal building envelope, conventional raised septic bed with contingency area and well. There is also capacity for design loads greater than 2800 L/day, especially if tertiary pretreatment is employed.

Current topography of the site should be documented such that beds can be oriented to conform to the natural slopes.

Impact of septic systems on groundwater quality is not an issue at this site due to the native impermeable clay soils.

Sincerely,

BOS Engineering & Environmental Services Inc.

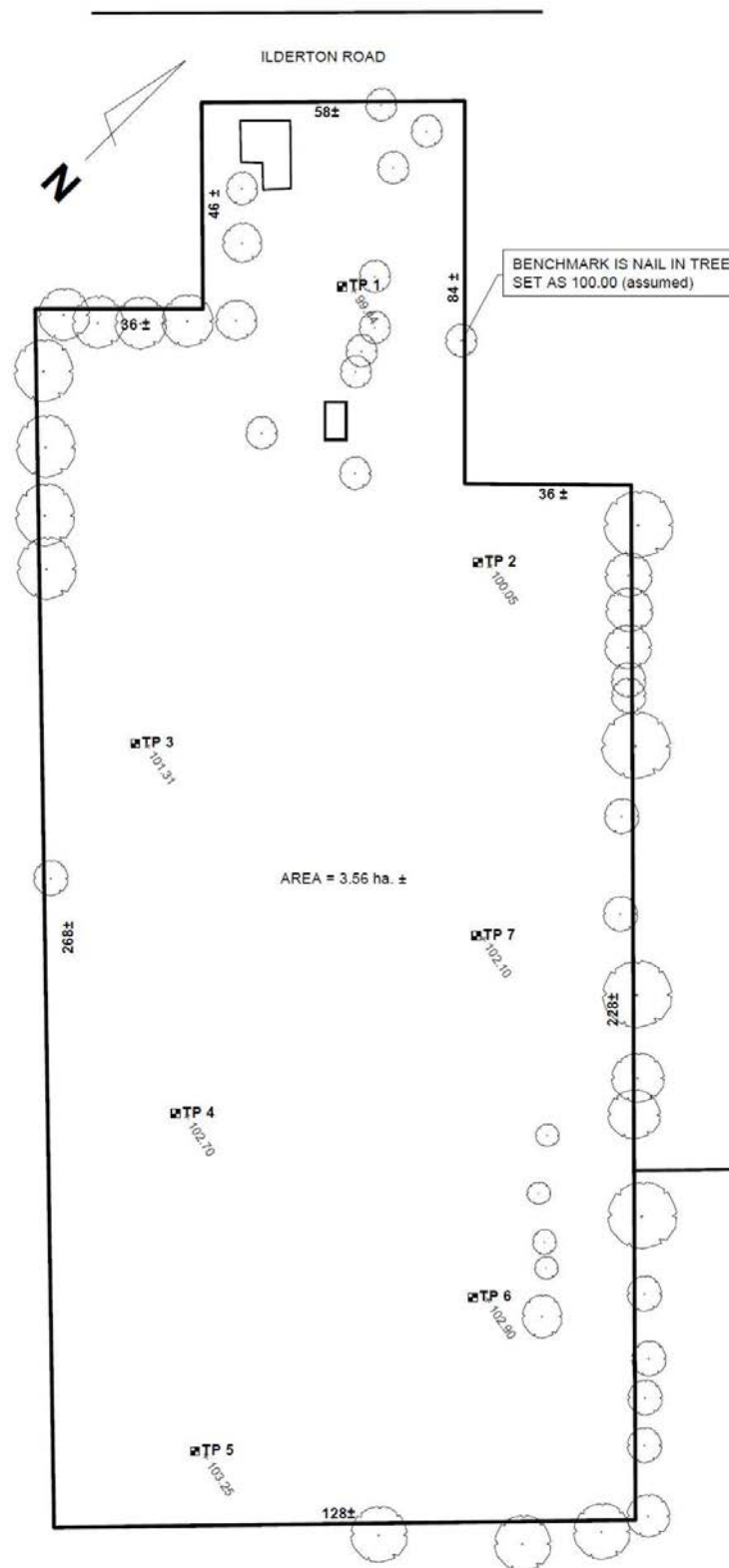


Art W. Bos P. Eng.

Appendices A, B & C/

APPENDIX "A"

TEST HOLE LOCATIONS



APPENDIX "B"

SOIL LOGS

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LOG OF TEST PIT 1													
Proj. No. : 1909-02		Excavation Date: SEPT 11 2019											
Client: ROB SANDERSON		Datum: On site Nail in Tree - assumed (100.00)											
RE: Soil Tests		Method: Backhoe											
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		99.44										
	Topsoil		0										
			98.98										
	Gravelly Sand		0.46	1									
1			98.22										
	Hard Clay		1.22										
	Bottom Of Testpit		97.61										
2			1.83										Groundwater not encountered
3													
4													

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Prepared by: R. B.
 Reviewed by: A. B.

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LOG OF TEST PIT 2													
Proj. No. : 1909-02		Excavation Date: SEPT 11 2019											
Client: ROB SANDERSON		Datum: On site Nail in Tree - assumed (100.00)											
RE: Soil Tests		Method: Backhoe											
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		100.05										Groundwater not encountered
	Topsoil		99.69										
	Br. Silty Clay		99.34										
1			97.61										
	Hard Clay		97.61										
2													Groundwater not encountered
	Bottom Of Testpit		2.44										
3													
4													

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Prepared by: R. B.
 Reviewed by: A. B.

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LOG OF TEST PIT 3													
Proj. No. :		1909-02				Excavation Date:		SEPT 11 2019					
Client:		ROB SANDERSON				Datum:		On site Nail in Tree - assumed (100.00)					
RE:		Soil Tests				Method:		Backhoe					
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		101.31										Groundwater not encountered
	Topsoil		0										
			99.69										
			0.41										
1	Clay												
			99.34										
			1.70										
2	Br. Silty Clay												
			99.18										
	Bottom Of Testpit		2.13										
3													
4													

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 Reviewed by: A. B.

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LOG OF TEST PIT 4													
Proj. No. : 1909-02		Excavation Date: SEPT 11 2019						Datum: On site Nail in Tree - assumed (100.00)					
Client: ROB SANDERSON		Method: Backhoe											
RE: Soil Tests													
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		102.70										Groundwater encountered @ 101.38
	Topsoil		102.29										
1	Clay		100.72										
2	Bottom Of Testpit		1.98										
3													
4													

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 Reviewed by: A. B.

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LOG OF TEST PIT 5													
Proj. No. : 1909-02		Excavation Date: SEPT 11 2019											
Client: ROB SANDERSON		Datum: On site Nail in Tree - assumed (100.00)											
RE: Soil Tests		Method: Backhoe											
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		103.25										Groundwater not encountered
	Topsoil		0										
			102.89										
	Gr. Clay		0.36										
1			102.34										
	Clay		0.91										
2													
			100.81										
	Bottom Of Testpit		2.44										
3													
4													

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Prepared by: R. B.
 Reviewed by: A. B.

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LOG OF TEST PIT 6													
Proj. No. : 1909-02		Excavation Date: SEPT 11 2019											
Client: ROB SANDERSON		Datum: On site Nail in Tree - assumed (100.00)											
RE: Soil Tests		Method: Backhoe											
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		102.90										Groundwater not encountered
	Topsoil		0										
			102.49										
1	Clay		0.41										
													Groundwater not encountered
	Bottom Of Testpit		101.20										
2			1.70										
3													
4													

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Prepared by: R. B.
 Reviewed by: A. B.

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LOG OF TEST PIT 7													
Proj. No. :		1909-02				Excavation Date:		SEPT 11 2019					
Client:		ROB SANDERSON				Datum:		On site Nail in Tree - assumed (100.00)					
RE:		Soil Tests				Method:		Backhoe					
Depth Scale (m)	SOIL PROFILE				PERCOLATION TIME (min/cm)				WATER CONTENT (%) (if applicable)				GROUNDWATER CONDITIONS INSTALL./NOTES
	DESCRIPTION	STRAT.	ELEV. DEPTH (m)	SAMPLE No.	0	20	40	>60	10	20	30	40	
0	GROUND SURFACE		102.10										Groundwater not encountered
	Topsoil		0										
			101.80										
	Silt		0.30										
			101.69										
			0.41										
1	Clay												Groundwater not encountered
2	Bottom Of Testpit		100.27										Groundwater not encountered
			1.83										
3													Groundwater not encountered
4													Groundwater not encountered

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Prepared by: R. B.
 Reviewed by: A. B.

APPENDIX "C"
SOIL GRAIN SIZE
DISTRIBUTION (TP1)

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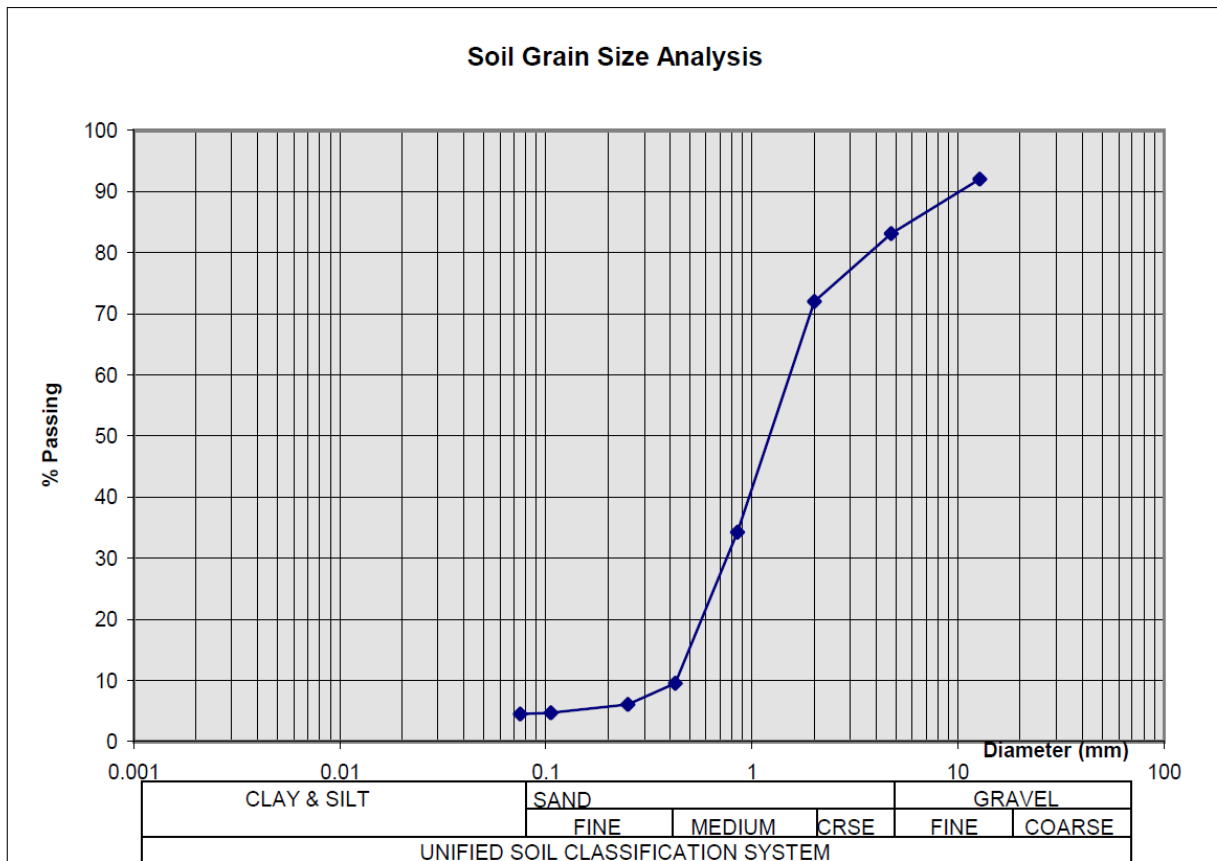
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Project : Native Soil
Test Pit : 10283 Ilderton Road
Depth : TP1
Dry Mass: 287.0 g

Client : Sanderson
RE: Waste Treatment System
Proj. No. : 1909-02
Date: Sep 20 2019

CHART DATA

Sieve No.	Mass	Cum. Mass	Diam. (d)	% Passing
	22.8	22.8	12.7	92
4	25.5	48.3	4.75	83
10	32.1	80.4	2	72
20	108.1	188.5	0.85	34
40	71.1	259.6	0.425	10
60	10.1	269.7	0.25	6
140	3.8	273.5	0.106	5
200	0.5	274	0.075	5



Unified System Classification:

SW Well Graded SAND (5% Finer than No. 200 sieve)

Est. Percolation Time: T = 2 to 8 min/cm