Private Sewage System Design Example/Template

Mound

PREFACE

(Version April 1, 2011)

This is an example design document for a septic tank and treatment mound system. It reflects the information needed to demonstrate the design considerations for the particular site and system required by the Private Sewage Standard of Practice 2009 (Standard) have been made. Considerations needed for a particular site may go beyond those used as an example in this document.

This example document can be used as a template by editing or adding critical information to suit the particular site and system. This is an example only.

While it is preferable to use a consistent format to facilitate quick review, other formats of the design may be accepted by the Safety Codes Officer (SCO), if the design includes the required information that shows the necessary design considerations were made.

A design is required in support of a permit application. It includes drawings and supporting information as it applies to the specific design. This is the information a SCO will review to evaluate whether design considerations required by the Standard have been adequately made prior to issuing the permit.

Including the design in the operation and maintenance manual that must be provided to the owner, will simplify development of the operation and maintenance manual.

PRIVATE SEWAGE SYSTEM DESIGN CONSIDERATIONS AND DETAIL.

Joe Smith
Box 1,
Somewhere, Alberta

Legal Description of Property:	SE Sec 9, Twp 71, Rge. 5, W of 6 Mer. Lot 1; Blk 1; Plan 123450
Municipal Address:	19035 - Rge. Rd. 5

This private sewage system is for a 4-bedroom single family dwelling. The total peak wastewater flow per day used in this design is 461 imperial gallons. The average operating flow is expected to be 300 gallons per day.

The sewage system includes a septic tank and treatment mound system. This system is suitable for the site and soil conditions of your property. The design reflected in the following applies, and meets, the requirements of the current Alberta Private Sewage Systems Standard of Practice (Standard). The system will achieve effective treatment of the wastewater from this residence.

1 Wastewater Characteristics

1.1. Wastewater Peak Flow

The development served is a 4-bedroom single-family dwelling. Based on the characteristics of the home identified during the review the total plumbing fixture unit load in this residence is 21. This requires 11 Imp. gal/day be added to the peak daily flow. Fixture unit load is as follows:

- Main bath = 6 fixture units
- Bathroom with shower off master bedroom = 6 fixture units
- Kitchen sink = 1.5 fixture units
- Laundry stand pipe = 1.5 fixture units
- Bathroom in basement = 6 fixture units

Total peak daily flow used in the design is: **450 Imp. gal + 11 Imp. gal = 461 Imp. gal**	**461 Imp. gal/day**

1.2. Wastewater Strength

Characteristics of the development were considered to assess sewage strength. No garbage grinders or other characteristics were identified that would cause typical wastewater strength to be exceeded.

Projected wastewater strength for the design is:	**BOD 220 mg/L** **TSS 220 mg/L** **Oil and Grease 50 mg/L**

1.3. Wastewater Flow Variation Considerations

The characteristics of this development indicate wastewater flow volumes will not vary substantially during the day or from day to day. As a result, no flow variation management is needed.

2 Site Evaluation Findings

2.1 Site Evaluation

The lot is 3.88 acres (1.57 hectares). The dimensions of the property are shown in the drawing attached in Appendix A. The adjacent land use is country residential development, varying in size from approximately 1.5 to 3 hectares. There is a water well and a treatment mound on the neighbouring property to the north and south.

Blueberry Creek runs parallel to the southwest property line. The southwest portion of the property has a increased slope toward the creek. Seasonally saturated soils were found in the lower slope areas near the southwest property line. Line locates confirmed there are no existing utilities in the area selected for the system components. **The area selected for the system must be kept clear of any utilities to be installed.** No utility right-of-ways or easements were noted on the subject site based on a review of the survey plan attached to this design and as indicated by the owner.

The site evaluation assessed the area within in 330 ft (100 m) of all system design components. The slope at the selected treatment site is 2%. No significant setback constraints were noted. Pertinent features identified during the site review and the required setback distances are identified on the site plan in Appendix A.

2.2 Soils Evaluation

Three soil test pits were investigated on this site. Test Pit 1 was determined to be unsuitable. Test Pit 2 and 3 showed a restrictive layer at 3.5 feet. A treatment mound is selected to meet the vertical separation requirements.

Little variability was noted between test pits so they are adequate for design purposes. The location of the test pits are shown on the site plan in Appendix A. Soil profile descriptions of each test pit are attached in Appendix B.

3 Key Soil Characteristics and Effluent Loading Rates

3.1. Restrictive Layer Considerations

A restrictive layer exists at 3.5 feet below surface as indicated by:

- redoximorphic features - mottling at 3.5 to 4.5 ft; gleying below 4.5 ft,
- saturated soils at 4.5 feet (depth of groundwater).

3.2. Limiting Condition For Soil Loading Rate Selection

The key soil characteristic affecting effluent loading is**:**

- **loam textured soil having a blocky, grade 1 structure at the depth of 12 to 42 inches.**

3.3. In Situ Soil Effluent Loading Rate Selection

- **effluent loading rate for secondary treated effluent on this soil is 0.45 Imp. gal/day/ft^2.**

3.4. Effluent Linear Loading Rates and Design Considerations

There is a shallow restrictive soil layer at this site. The effluent must move laterally through the soil so linear loading rates must be applied.

- the dominant soil characteristic is a loam, blocky, grade 1 structure
- infiltration distance to the restrictive layer is 42 inches (3.5 feet)
- the slope at the site of the mound is 2%

Linear Loading Rate = 4.0 Imp. gal/day/ft

The mound is oriented at 90 degrees to the slope direction to address linear loading.

4 Initial Treatment Component Design Details

Details of the initial treatment components required for this design are attached in Appendix C.

4.1 Septic and Dose Tank Requirements

4.1.1 Septic Tank

The working capacity of the septic tank specified for this design is 1218 Imperial gallons. Appendix C includes specifications for septic tank Model ST 1218.

The minimum working capacity based on Table 4.2.2.2 of the 2009 SOP for this development is 951 Imp. gal [940 Imp. gal/day plus the additional flow of 11 Imp. gal].

Burial depth of the septic tank at finished grading above the top of the tank will be 5ft 9 inches. This tank is rated for a maximum burial depth of 5 ft 10 inches. Insulation of the tank is not required as the burial depth exceeds 4 feet.

4.1.2 Dose Tank

The dose tank (second chamber) has a total capacity of 670 Imp. gal. In addition to the single dose volume the tank provides approximately 300 Imp. gal emergency storage above the high effluent alarm setting. Specifications provided by the manufacturer are shown in Appendix C.

4.1.3 Effluent Filter

An inline 2-inch diameter Sim/Tech© model STF-100 effluent filter having an effective opening of less than 1/8-inch (3.2 mm) is used. When clean the filter is rated at a head loss of 0.5 feet at a flow of 80 Imp. gal/min. A one year service interval is expected with typical flow volumes and wastewater characteristics.

5 Soil Treatment Component Design Details

5.1 Selection of Soil Infiltration System Design

The system designed for this site is a septic tank and treatment mound.

5.2 Treatment Mound Size

Key design requirements:

Expected peak daily flow:	461 Imp. gal/day
Soil loading rate:	0.45 Imp.gal/day/ft^2
Linear loading rate:	4.0 Imp.gal/day/ft

Sand layer:

Sand layer length:	115 ft
Sand layer width:	4.8 ft
Sand layer area:	555.4 ft^2

Minimum in-situ soil infiltration area:

Soil infiltration surface area:	1024 ft^2
Minimum soil infiltration width:	8.9 ft [sand layer + downslope berm]

The location of the treatment mound on the property and layout of the laterals are shown in Appendix A and D. The treatment mound sizing worksheets are provided in Appendix E.

6 Effluent Distribution Design Detail

6.1 Effluent Pressure Distribution

Two 115 ft centre fed pressure effluent distribution laterals are used over the sand layer. The calculations are provided in Appendix E on the pressure distribution worksheets. The pressure distribution lateral layout drawing is included in Appendix D.

6.1.1 Effluent Pressure Distribution Lateral Design

The distribution laterals are center fed resulting in four 57.5 ft pressure distribution laterals.

- Each lateral is 1.25-inch schedule 40 PVC pipe.
- Each lateral has 26, 1/8-inch orifices drilled at 2.25 foot spacing.
- The laterals will be installed in the gravel above the sand layer.
- Orifices will be offset between the two laterals along its length.
- All orifices shall point down and be equipped with an orifice shield.

The design achieves a minimum 5 foot pressure head at each orifice, resulting in a design flow of 0.34 Imp. gal/min from each 1/8-inch orifice.

There are 104 orifices throughout the effluent pressure distribution system resulting in a **total flow** of **35.4 Imp gal/min**. An additional 3.2 Imp. gal/min is added for the ¼ inch drain back orifice drilled at the lowest elevation of the effluent piping in the dose tank to achieve drain back of the laterals and supply piping.

Total flow required for the effluent pressure distribution system is 38.6 Imp. gal/min (46.3 U.S. gal/min).

6.1.2 Pressure Head Requirements

The total length of supply piping from the pump to the start of the pressure distribution laterals is 205 feet. The supply piping is 2 inch Schedule 40 PVC pipe. The allowance for equivalent length of pipe due to fittings is 51 feet of pipe. Total equivalent length of pipe is 256 feet. This is detailed in appendix E.

Pressure head loss due to friction
The friction loss through the piping at the flow of 35.4 Imp. gal/min is 7.4 feet of head pressure.

Other friction loss considerations required include:
- Allowance for head loss through the effluent filter under partial plugging is 5.5 feet.
- Allowance for pressure head loss along the pressure distribution laterals is 1 foot.

Total pressure head required to overcome friction loss is 13.9 feet.

Pressure head to meet vertical lift requirements include:
- A pressure head at each orifice of 5 feet.
- Lift distance of effluent from the low effluent level in the tank to the pressure distribution laterals is 7.5 feet.

Vertical lift and friction loss results in a **total pressure head** requirement of **26.4 ft**.

Pump specifications:
Demands for this pressure distribution lateral system are **38.5 Imp. gal/min (46.2 U.S. gal/min)** at **26.4 feet** of pressure head.

The pump capacity must exceed these demands to allow for variations in the design and decreased pump performance over time. A Myers model ME 50 effluent pump (1/2 hp) is specified for this system. The pump specifications with the effluent distribution system demands plotted on the pump curve are included in Appendix C.

6.1.3 Effluent Dosing Volume
The volume of effluent applied to the sand layer in a single dose needs to be less than 20% of the daily flow, which is 92.2 Imp. gal. The volume of an individual dose must be at least 5 times the volume of the pressure distribution laterals, which is 73.8 Imp. gal. The individual dose volume selected is 74 Imp. gal.

The volume in the 205 ft of 2 inch PVC effluent supply line is 30 Imp. gal.
Total individual dose volume determining float settings is **104 Imp. gal [30 Imp. gal to fill the effluent supply line and deliver the 74 Imp. gal per dose]**.

7 Controls
All effluent level control floats will be attached to an independent PVC pipe float mast.

7.1 Effluent Dosing Float Setting
The dose tank dimensions result in 11.27 Imp. gallons per inch of depth. The float control elevations shall be set at:
- 9.25 inches between float off and on elevations (deliver 104 Imp. gal/dose).
- Off: 19 inches off floor of dose tank
- On: 28.25 inches off floor of dose tank

7.2 High Liquid Level Alarm
The high level alarm specified for this system is a JB Series 1000T (manufactured by Alarm Tech Inc.).
- Alarm control float is set at 1.5 inches above pump on elevation or at 29.75 inches above the floor of the dose tank/chamber.

8 Operation Monitoring Components

The following components are included in the system design. See detailed drawings in Appendix D for locations.

8.1 Monitoring Ports

Monitoring ports are provided at both ends of the sand layer to enable inspection of the effluent ponding depth that may result.

8.2 Pressure Distribution Lateral Clean Outs

Clean outs are provided at the end of each pressure distribution lateral with access to grade through an access box suitable for its purpose and anticipated traffic.

8.3 Sampling Effluent Quality

Samples of the effluent can be taken from the effluent dose chamber.

9 System Setup and Commissioning

- Clean the septic tank and effluent chamber of any construction debris.
- Flush effluent distribution laterals.
- Conduct a squirt test to assess that residual head pressure required by the design is achieved and that the volume from each orifice is within allowed tolerances.
- Confirm the correct float levels and ensure this delivers the dose volume required by this design.

10 Operation and Maintenance Manual

The Owner's Manual detailing the design, operation, and maintenance of the installed system will be provided to the owner in accordance with Article 2.1.2.8 of the Standard.

Signature and closing by the designer/Installer.

Attachments:

Appendix A – Site Information [Site Plan, Property Subdivision Plan]

Appendix B – Soil Information [Soil Profile Logs, Laboratory Analysis Results]

Appendix C – Manufacturer's and Design Specifications for System Components

Appendix D – Detailed System Schematics and Drawings

Appendix E – System Design Worksheets

This design has been developed by (name of certified person and company name). This design meets the requirements of the Alberta Private Sewage Systems Standard of Practice 2009 unless specifically noted otherwise and in such case special approval is to be obtained prior to proceeding with installation of this design. *(Carry on with any other qualifications or limitations that in your opinion as the designer/installer are needed.)*

Appendix A – Site Information

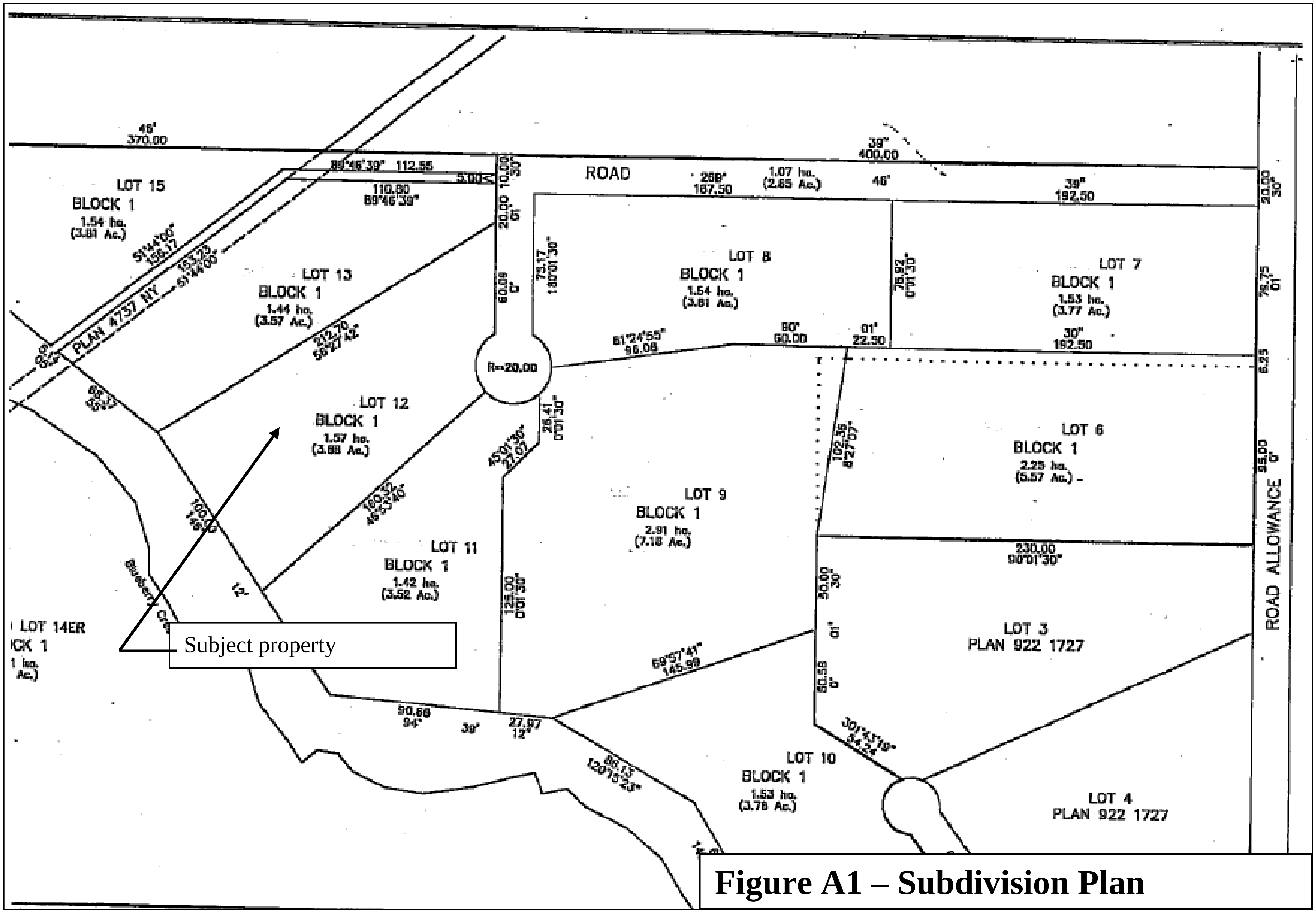


Figure A1 – Subdivision Plan

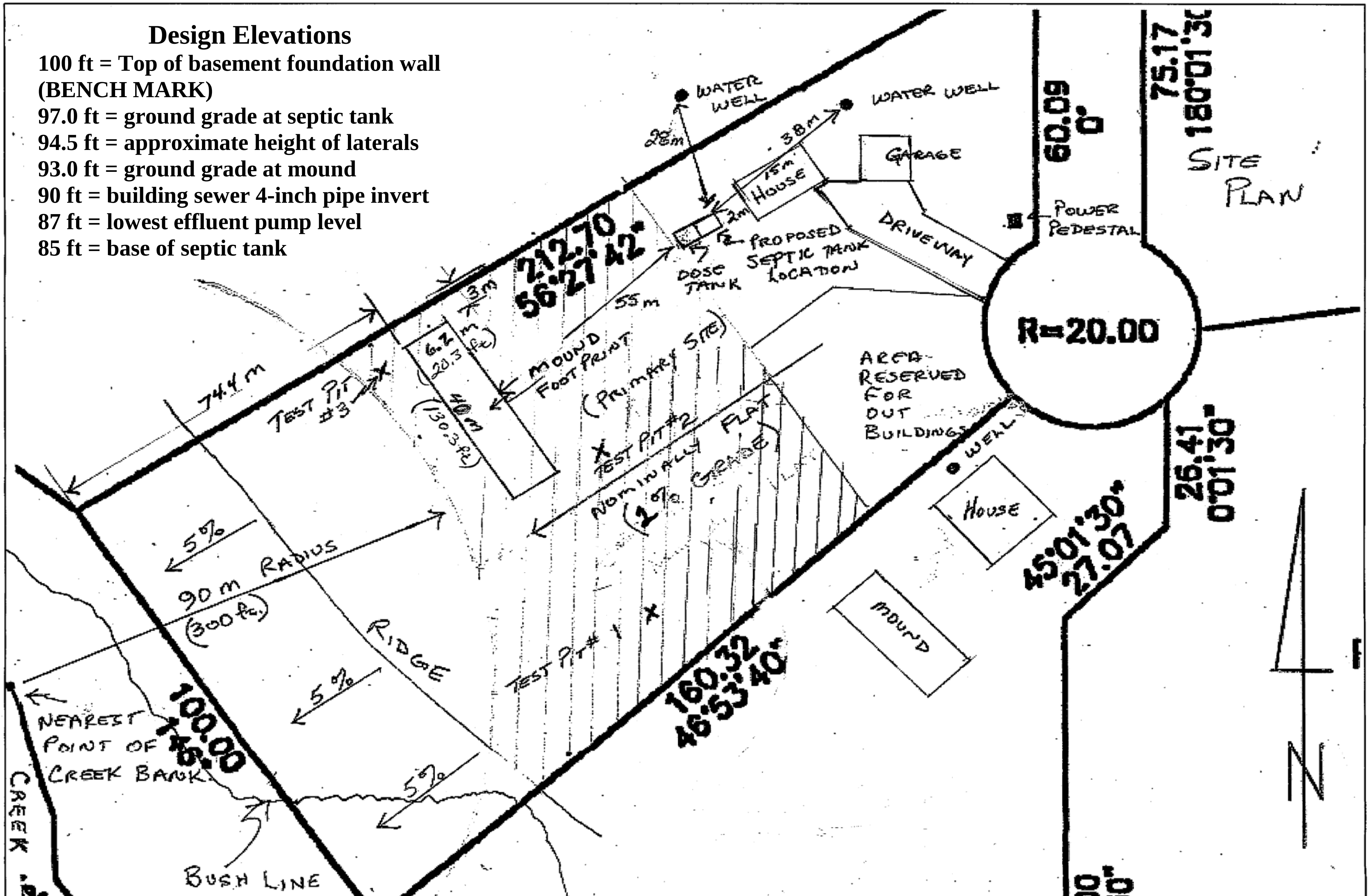


Figure A2 - Detailed Site Plan

Appendix B - Alberta Private Sewage Treatment System Soil Profile Log Form

Smith Residence Soil Assessment

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
SE	9	71	5	W6M	12	1	123450	65024	34535

Investigation Date: May 17th, 2011.	Vegetation notes: Prairie grasses.	Overall site slope %	Variable across site.
		Slope position of test pit:	2%

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Test Pit #2				30 – 36 in.	

Hori-zon	Depth (cm) (in)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
A	Surface to 8 in.	Very Fine Sandy Loam (VFSL)	HT	Dark brown.	None.	None.	Blocky	1		Moist	25%
B	8 to 12 in.	Fine Sandy Loam (FSL)	HT	Light brown.	None.	None.	Blocky	1	Friable	Moist to dry.	5%
B	12 to 42 in.	Loam (L)	HT and Lab	Light brownish grey.	None.	None.	Blocky	1	Friable to firm.	Moist.	<1%
C	42 to 60 in.	Sandy Clay (SC)	HT	Light to dark grey.	At 4.5 ft saturated and gleyed.	3.5 ft many prominent distinct mottles noted throughout.	Massive	0	Firm	Moist to wet.	<5%

Depth to Groundwater	4.5 feet.	Restricting Soil Layer Characteristic	Saturated conditions within the Loam restricts downward effluent movement.
Depth to Seasonally Saturated Soil	3.5 feet.	Depth to restrictive Soil Layer	3.5 feet.
Site Topography	Slightly undulating.	Depth to Highly Permeable Layer Limiting Design	Not encountered in this soils assessment and design.
Key Soil Characteristics applied to system design effluent loading			

Weather Condition notes: Slightly overcast with moderate wind – no rain or other conditions that would impact soils assessment were encountered.

Comments (such as root depth and abundance or other pertinent observations): As there is a restrictive layer at 3.5 feet below surface, only a treatment mound option can meet vertical separation requirements. Also linear loading must be considered in the design because the restrictive layer creates an infiltration distance of 42 inches.

Appendix B - Alberta Private Sewage Treatment System Soil Profile Log Form

Smith Residence Soil Assessment

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
SE	9	71	5	W6M	12	1	123450	64964	34557

Investigation Date: May 17th, 2011.	Vegetation notes: Prairie grasses.	Overall site slope %	Variable across site.
		Slope position of test pit:	2%.

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Test Pit #3				32 to 40 in.	

Hori-zon	Depth (cm) (in)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
A	Surface to 8 in.	Very Fine Sandy Loam (VFSL)	HT	Dark brown.	None.	None.	Blocky	1		Moist	15%
B1	8 to 12 in.	Fine Sandy Loam (FSL)	HT	Light brown.	None.	None.	Blocky	1	Friable	Moist to dry.	5%
B2	12 to 42 in.	Loam (L)	HT and Lab	Light brownish grey.	None.	None.	Blocky	1	Slightly friable.	Moist to wet.	4%
C	42 to 60 in.	Sandy Clay (SC)	HT	Light to dark grey.	At 4.5 ft saturated and gleyed.	3.5 ft many prominent distinct mottles noted throughout.	Massive	0	Firm	Wet.	<2%

Depth to Groundwater	4.5 feet.	Restricting Soil Layer Characteristic	Saturated conditions within the Loam restricts downward effluent movement.
Depth to Seasonally Saturated Soil	3.5 feet.	Depth to restrictive Soil Layer	3.5 feet.
Site Topography	Slightly undulating.	Depth to Highly Permeable Layer Limiting Design	Not encountered in this soils assessment and design.
Key Soil Characteristics applied to system design effluent loading			

Weather Condition notes: Slightly overcast with moderate wind – no rain or other conditions that would impact soils assessment were encountered.

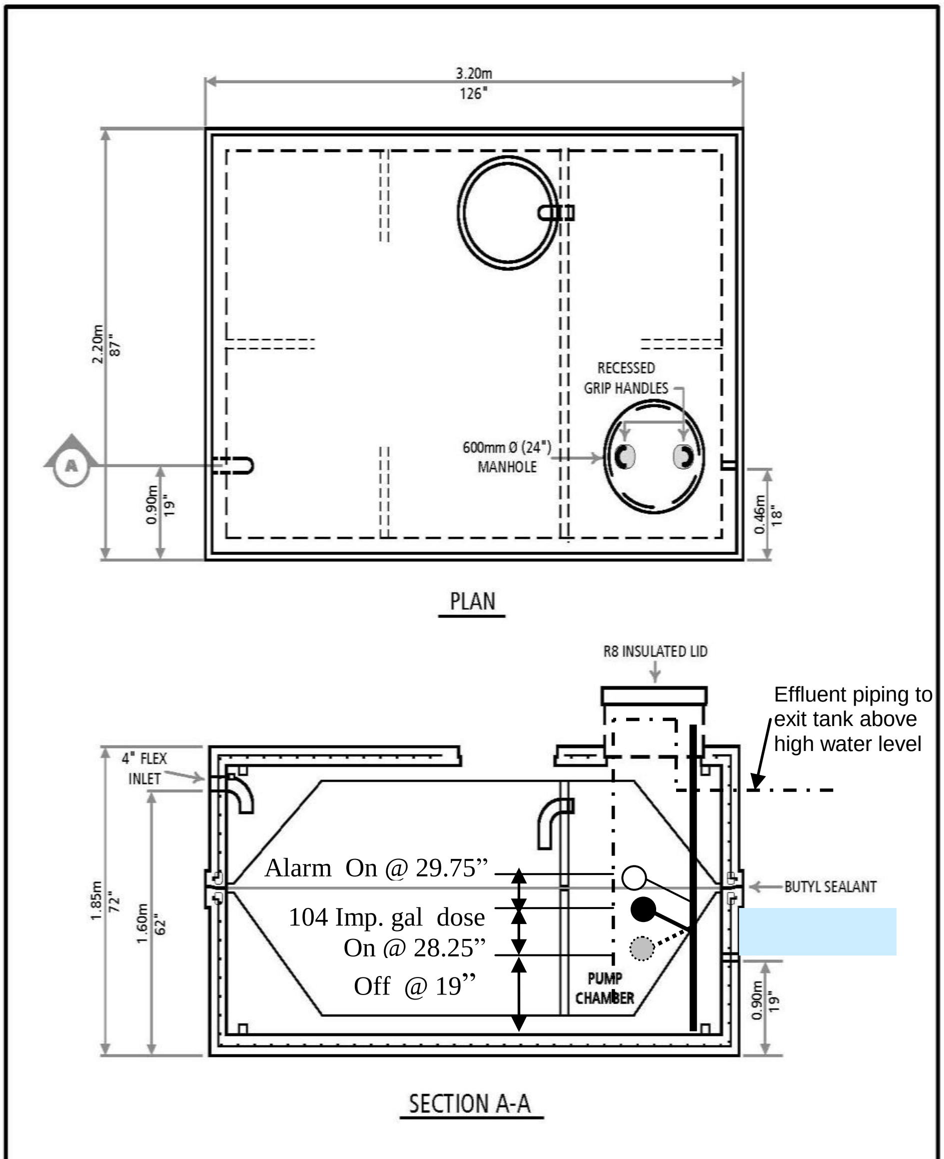
Comments (such as root depth and abundance or other pertinent observations): As there is a restrictive layer at 3.5 feet below surface, only a treatment mound option can meet vertical separation requirements. Also linear loading must be considered in the design because the restrictive layer creates an infiltration distance of 42 inches.

(APPENDIX B)

Insert lab analysis results of soil samples taken for determining soil texture!

Appendix C - Manufacturer's and Design Specifications for System Components

Septic Tank Specifications and Float Setting Details.



The Septic Tank Company
Mid Town,
Alberta

WEIGHT		GROSS/WORKING CAPACITY	EARTH COVER
T: 7,400 B: 7,400	(lbs)	2,000 / 1,218 (gal)	5'-10¾" (max)
T: 3,357 B: 3,357	(kg)	9,000 / 5,537 (l)	1.80m (max)
MODEL ST1218 2-PIECE SEPTIC TANK			CSA

LENGTH		WIDTH		HEIGHT		REVISION
10'-6"	3.20m	7'-6"	2.29m	6'-0"	1.85m	2.0

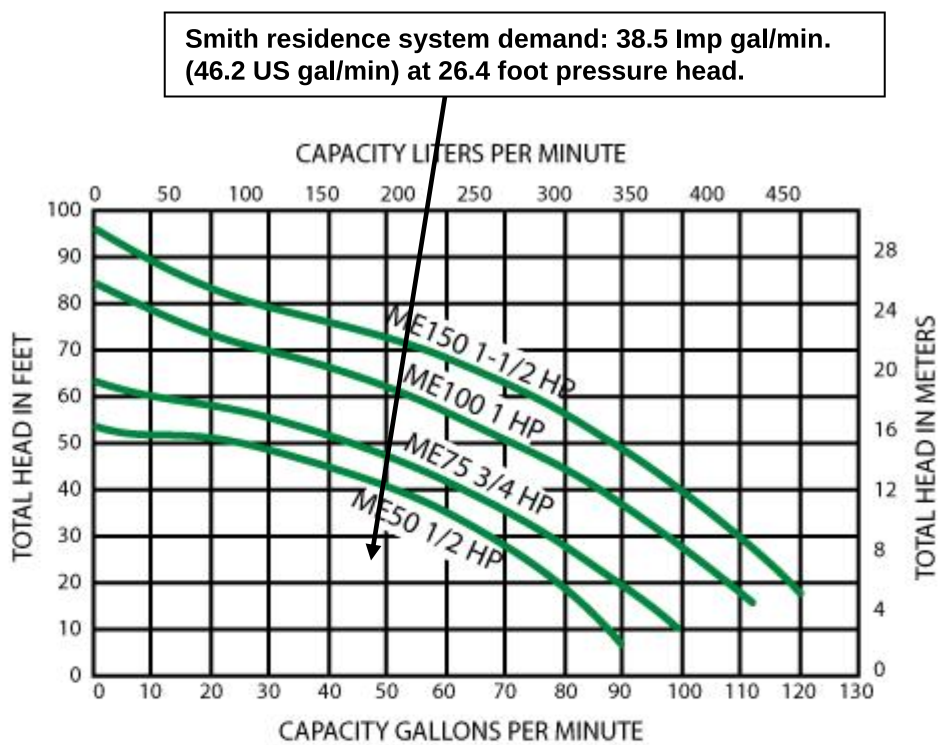
Appendix C - Pump Specifications

Myers Model ME50 (1/2 Hp) Selected

Product Capabilities

Capacities:	**120 GPM**	**454 LPM**
Shut-Off Head:	**95 ft.**	**28.9 m**
Max. Spherical Solids:	**3/4 in.**	**19 mm**
Liquids Handling:	**domestic effluent and drain water**	
Intermittent Liquid Temp.:	**up to 140°F**	**up to 60°C**
Motor Electrical Data:	**1/2 HP, 115V, 1Ø, 1/2 to 1-1/2 HP, 230V, 1Ø, 208/230/460/575V, 3Ø, oil-filled, permanent split capacitor type, 1Ø, 3450 RPM, 60Hz**	
Acceptable pH Range:	**6–9**	
Specific Gravity:	**.9–1.1**	
Viscosity:	**28–35 SSU**	
Discharge, NPT:	**2 in.**	**50.8 mm**
Housing:	**cast iron**	
Min. Sump Diameter: Simplex Duplex	**24 in. 36 in.**	**61.0 cm 91.4 cm**
Power Cord:	**10 ft.**	

Product Performance Chart



Appendix D- Detailed System Schematics and Drawings

- Width of sand layer = 4.8 ft
- Length of sand layer = 115.3 ft
- Effluent distribution lateral piping = 1.25 inch
- Orifice spacing = 2.25 feet (offset)
- Orifice diameter = 1/8 inch

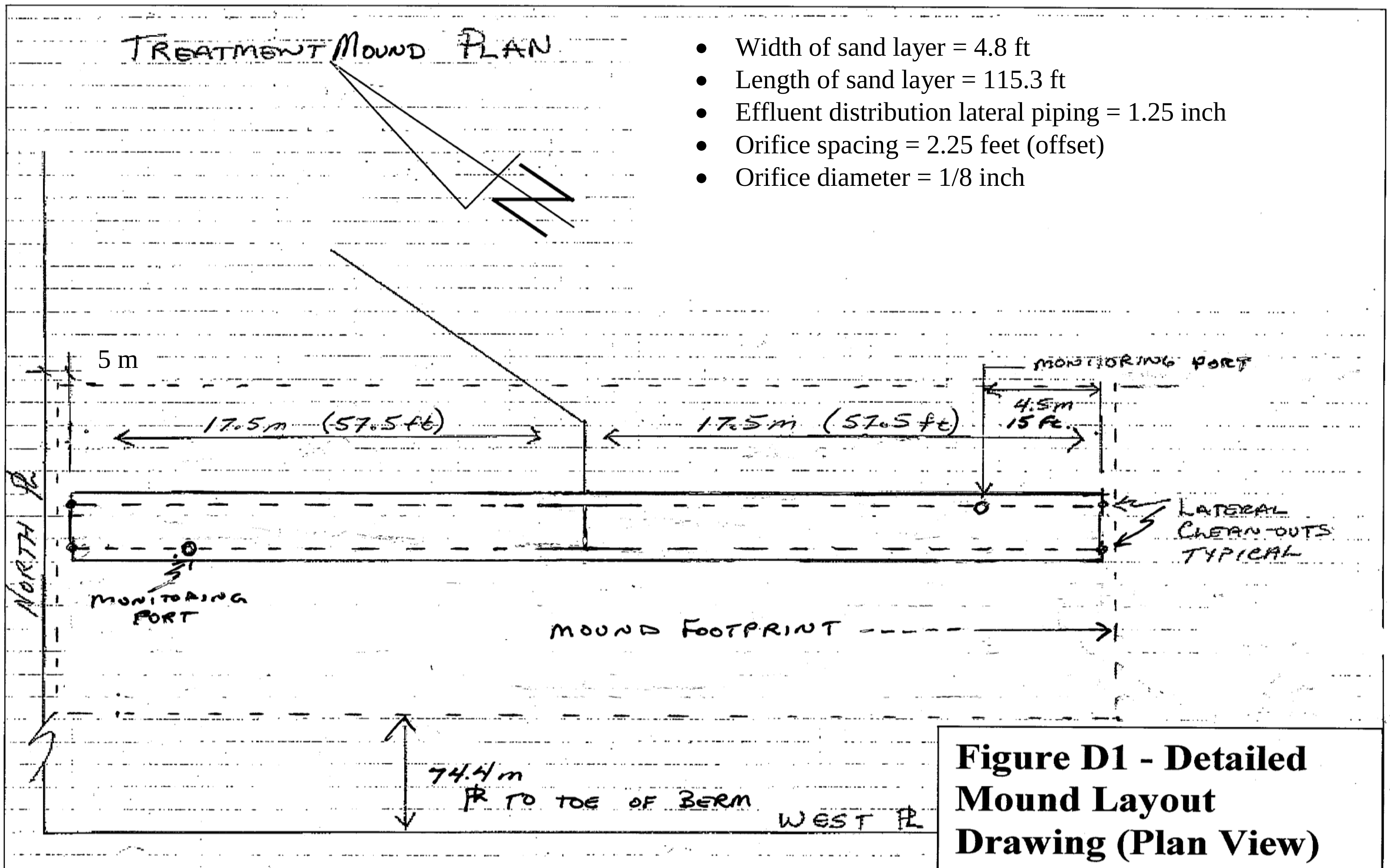


Figure D1 - Detailed Mound Layout Drawing (Plan View)

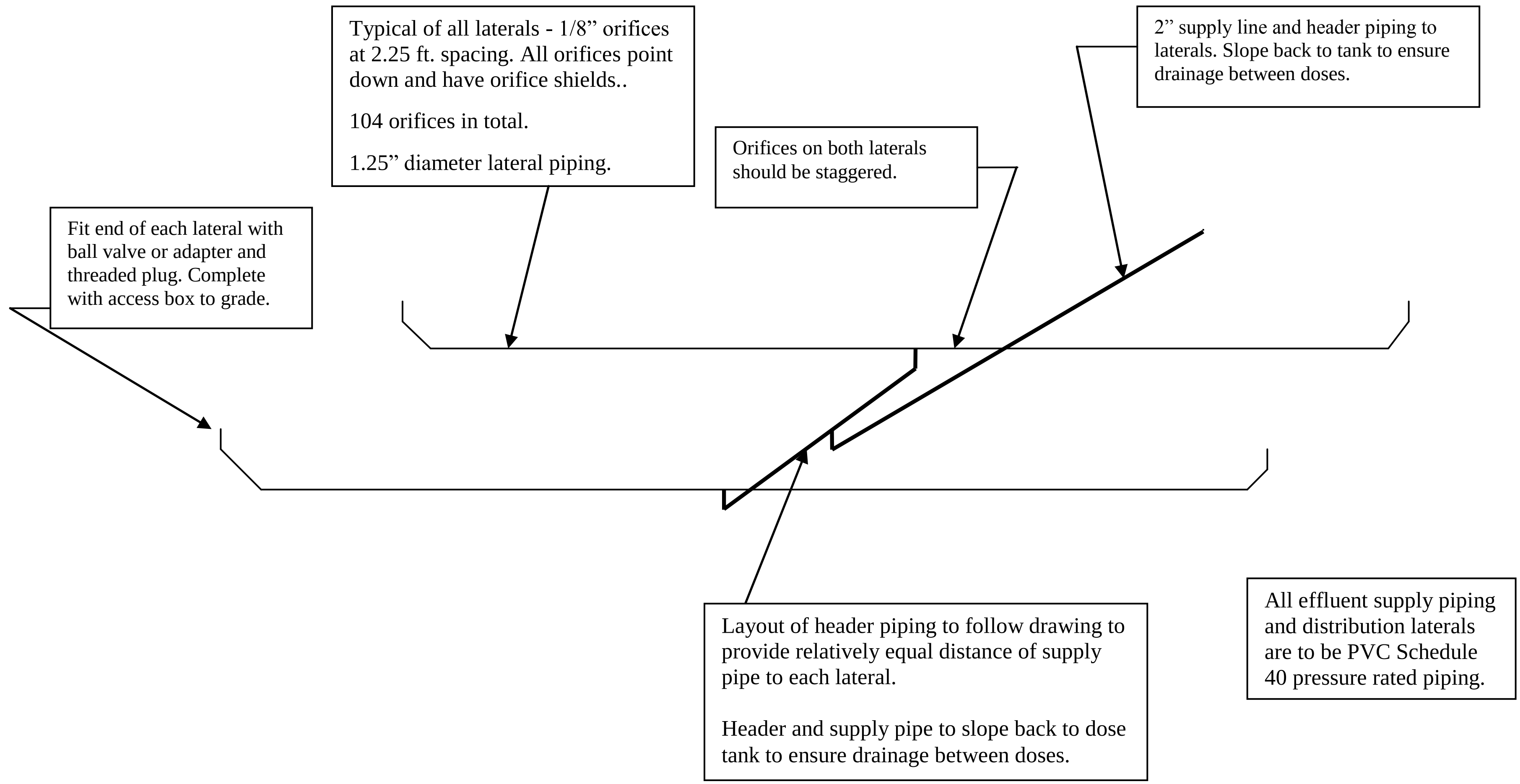
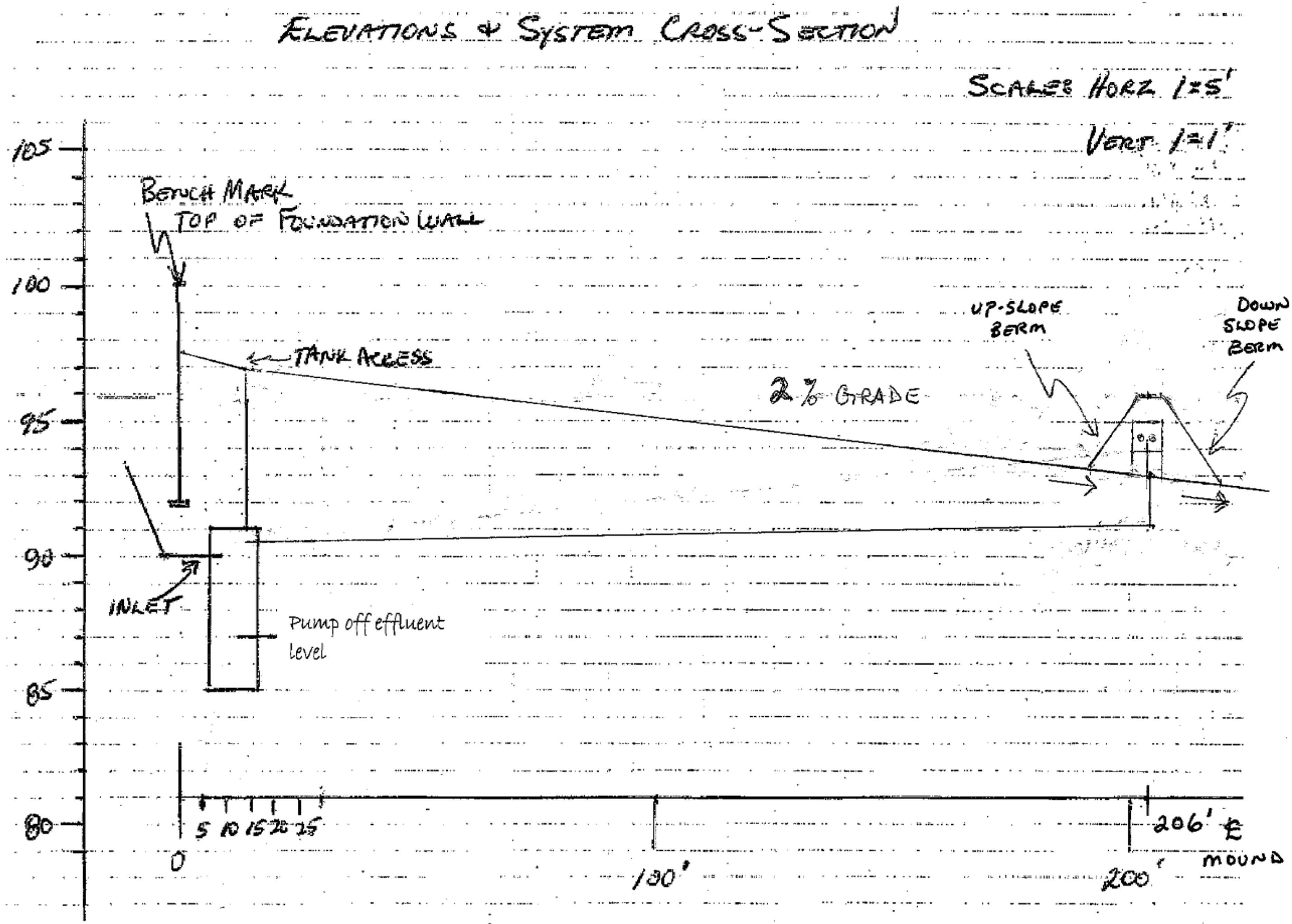


Figure D2: Pressure Distribution Lateral Layout Detail Drawing


ELEVATIONS & SYSTEM CROSS-SECTION
SCALE: HORZ 1=5'
VERT 1=1'
105
100
95
90
85
80
BENCH MARK
TOP OF FOUNDATION WALL
TANK ACCESS
2% GRADE
UP-SLOPE BERM
DOWN-SLOPE BERM
INLET
Pump off effluent level
5 10 15 20 25
0
100'
200'
206' ℄ MOUND

Appendix E – System Design Worksheets

SITE INFORMATION DETAILS

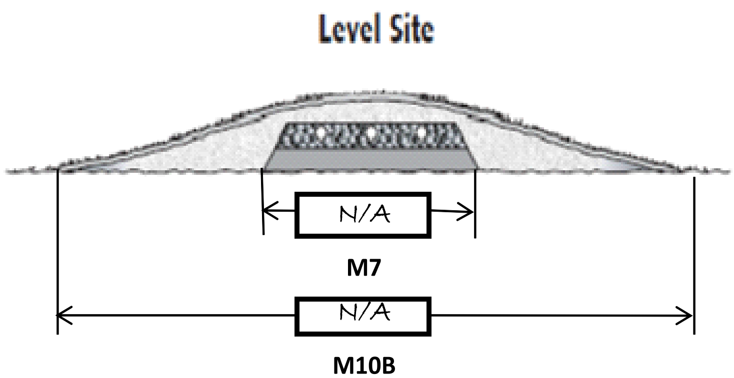
Landowner Name:	John Hancock	**Job Number:**	09-PS0032
Location:	Lot 1, Block 1, Plan 1111111	**Installer Name:**	John Smith
	NE-11-11-11-W5M	**Installing Company:**	JS Septic Systems

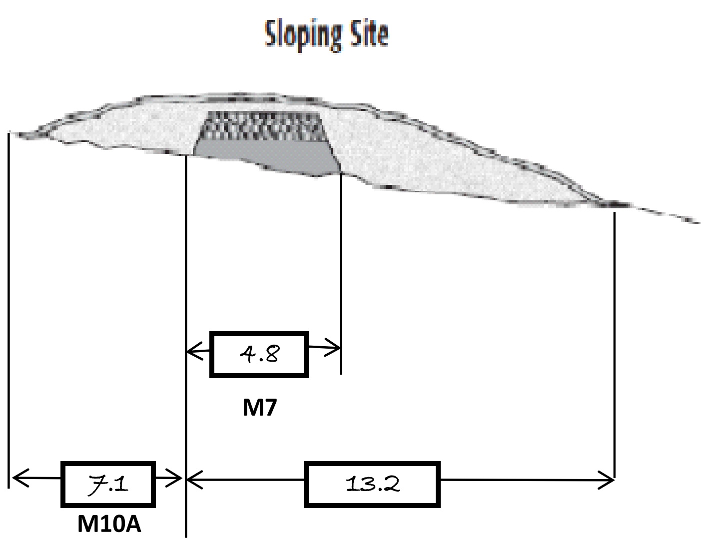
PSDS Design - Mound Worksheet

Treatment Mound: Sizing and Dimensions

Treatment Mound Dimensions Summary

This summary page is to be filled in with the noted dimensions once the worksheet has been completed.





Sand Layer Width (ft.)	4.8	M7
Sand Layer Length (ft.)	115.3	M6
Toe to Toe Width (ft.)	20.3	M11A or M11C
Upslope Mound Height (ft.)	2.5	M9B or M9C
Overall Length of Mound (ft.)	130.3	
Slope (%)	2	M5A

Note - All dimensions noted on summary drawings are in feet.

SITE INFORMATION DETAILS

Landowner Name:	John Hancock	**Job Number:**	09-PS0032
Location:	Lot 1, Block 1, Plan 1111111	**Installer Name:**	John Smith
	NE-11-11-11-W5M	**Installing Company:**	JS Septic Systems

Step 1) Determine the expected volume of sewage per day:

Facility Type (i.e., residential, commercial, etc.)	Residential	**Peak Wastewater Volumes (Imp. gal/day) Table 2.2.2.2.A and B. (p. 30 and 31)**	75 per bedroom	**Number of Occupants**	6.0

Effluent volume generated per day from development based on facility type and occupancy, as detailed in Table 2.2.2.2.A and Table 2.2.2.2.B. — 450.0 Imp. gal/day

Additional flow volumes in design - Provide allowance for additional loads factors as detailed in Table 2.2.2.2.A. (p. 30) and Table 2.2.2.3. (p. 32) — 11.0 Imp. gal/day

Total Expected Volume of Sewage per Day — 461.0 Imp. gal/day **M1**

Assure that the sewage strength does not exceed the requirements of 2.2.2.1 (1) - (p.27).

Step 2) Calculate the treatment area of the sand layer:

Expected Volume of Sewage per Day		**Sand Layer Loading Rate**		**Area Required for Sand Layer**	
461.0 Imp. gal/day	÷	0.83 Imp. gal. / sq. ft. / day	=	555.4 Square feet	**M2**
From **M1**		Max of 0.83 Imp. gal/ sq. ft. / day except for reduction for coarse textured soils [8.4.1.4 (1)(6) or 8.4.1.5 (1)(d)]			

Step 3) Determine the design soil effluent loading rate:

						Soil Effluent Loading Rate [From >30 - 150 mg/L column]	
L	&	Blocky	&	1	=	0.45 Imp. gal/ sq.ft./day	**M3**
Texture		Structure		Grade			

Note: Effluent loading rate MUST be determined from soil texture, structure, and grade classification according to Imperial Table A.1.E.1. (p.151).
Note: Ensure infiltration loading rate chosen does not exceed loading rates as set out in 8.1.2.2. (p. 101

Step 4) Calculate the in situ soil infiltration area required:

Expected Volume of Sewage per Day		**Soil Effluent Loading Rate**		**Required Soil Infiltration Area**	
461 Imp. gal/day	÷	0.45 Imp. gal. / sq. ft. / day	=	1024.4 Square feet	**M4**
From **M1**		From **M3**			

Step 5) Determine the site specific criteria of the installation site:

Slope of Installation Site

2 ft vertical elevation change in 100 horizontal ft

Ground Surface Slope = 2 % **M5A**

Depth to Restrictive Layer (if applicable in design)

42 **inches** **M5B**

SITE INFORMATION DETAILS

Landowner Name:	John Hancock	**Job Number:**	09-PS0032
Location:	Lot 1, Block 1, Plan 1111111	**Installer Name:**	John Smith
	NE-11-11-11-W5M	**Installing Company:**	JS Septic Systems

Step 6) Calculate the length of the sand layer:

Expected Volume of Sewage per Day		Hydraulic Linear Loading Rate (if restrictive layer < 48 inches) (see M5B to assess if applicable)		Length of Sand Layer	
461 Imp. gal/day	÷	4 Imp. gal/ day/lin.ft.	=	115.3 feet	M6
From **M1**		Table A.1.E.1 - (p. 151) Max linear loading rate of 8.3 Imp. gal/day/lineal foot so not to exceed the maximum sand layer width of 10 ft [8.4.1.4. 1) c)]			

Step 7) Calculate the minimum width of the sand layer:

Area of the Sand Layer		Length of the Sand Layer		Width of the Sand Layer	
555.4 Square feet	÷	115.3 feet	=	4.8 feet	M7
From **M2**		From **M6**			

Step 8) Calculate the required width of the soil infiltration area:

Required Infiltration Area		Length of Sand Layer		Width of Required Soil Infiltration Area	
1024.4 Square feet	÷	115.3 feet	=	8.9 feet	M8
From **M4**		From **M6**			

Step 9) Determine the side slope and height of the mound at edge of sand layer:

Selected Side Slope for Design [8.4.2.9. 1) requires that side slope not be steeper then 1 vertical:3 horizontal]:

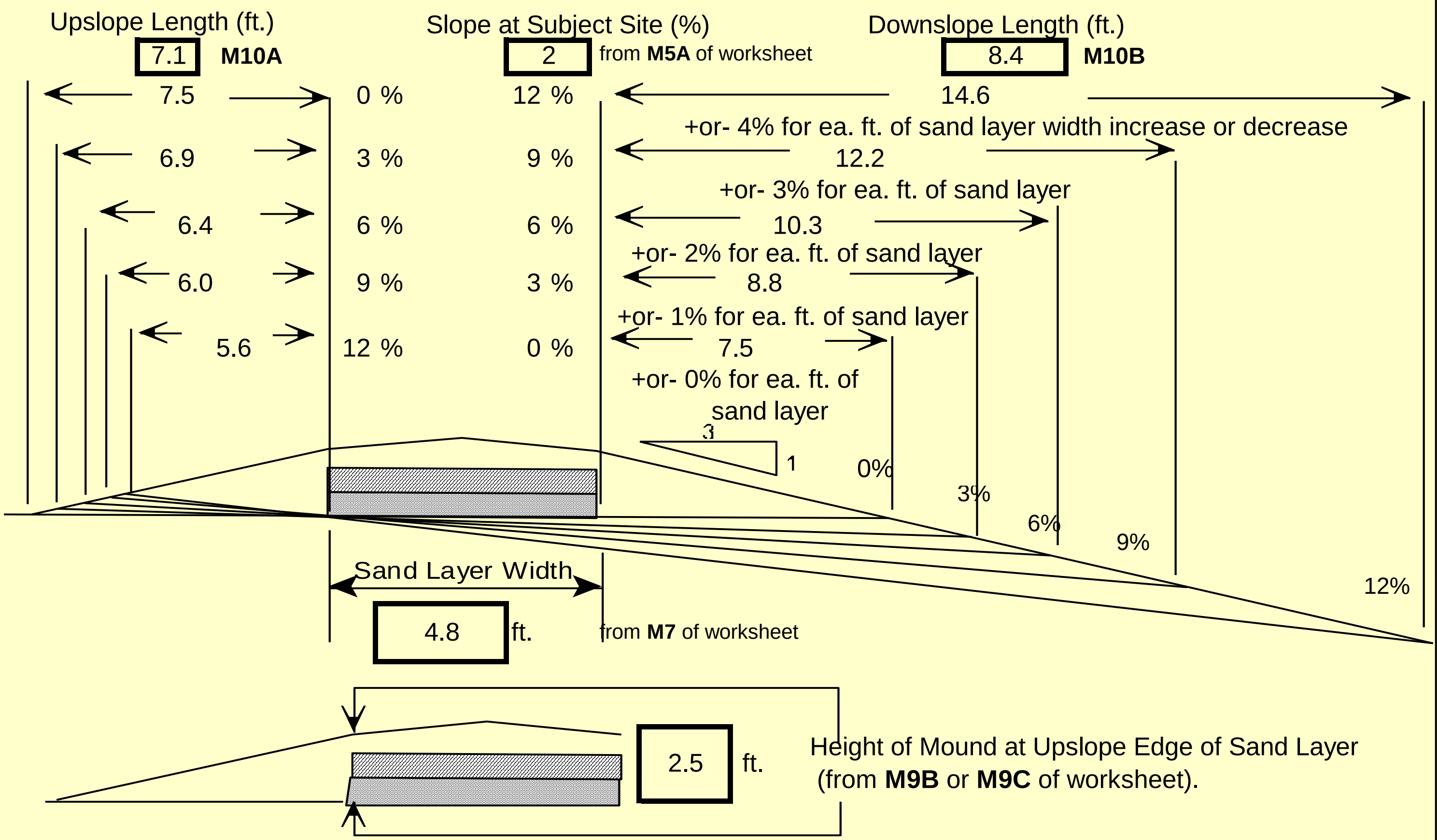
Vertical		Horizontal
1	:	3

Grade of Side Slope from Horizontal (Vertical Elevation Divided by Horizontal) 0.33 M9A

Calculate Height of Mound - if on a slope this should be the upslope edge of sand layer:

	Pipe in Gravel Design	Chamber System Design	
Top Soil Height	3 inches	0 inches	Min of 3 inches [8.4.2.7. 2)].
Fill Material Height	6 inches	0 inches	Min of 6 inches [8.4.2.7. 1)].
Chamber Height	Not Applicable	0 inches	
Gravel Layer Height	9 inches	0 inches	Min of 8 inches for pipe in gravel [8.4.2.5. 1)] or min of 2 inches when chambers used [8.4.1.9. 1) a)].
Sand Layer Height	12 inches	0 inches	Min of 12 inches for primary treated effluent [8.4.1.4. 1) e)] or min of 3 inches for secondary treated effluent [8.4.1.5. 1) a)].
Total Mound Height	30 inches	0 inches	
Height (in Feet)	2.5	0.0	
	M9B	M9C	

Treatment Mound Berm Slope Distances in Feet



Upslope Berm distance = Height of mound at edge of sand layer ÷ (0.33 + [slope% ÷ 100])

Downslope berm distance =

(Mound height at upslope edge of sand layer + [sand layer width X (slope% ÷ 100)]) ÷ (0.33 - [slope% ÷ 100])

SITE INFORMATION DETAILS

Landowner Name: John Hancock
Location: Lot 1, Block 1, Plan 1111111
NE-11-11-11-W5M
Job Number: 09-PS0032
Installer Name: John Smith
Installing Company: JS Septic Systems

Step 10) Determine the in-situ soil infiltration width under mound and the toe to toe width of the mound:

Insert slope % at subject site, sand layer width and upslope mound height into drawing calculator to determine upslope and downslope mound lengths.

For a mound on a site with no slope (0% grade), the in-situ soil infiltration width is the same as the toe to toe width for the mound:

Width of Sand Layer		Upslope Berm Width		Downslope Berm Width		In-Situ Soil Infiltraton Width and Toe to Toe Width of Mound	
N/A feet	+	N/A feet	+	N/A feet	=	N/A feet	M11A
From M7		From M10A		From M10B			

For a mound on a site with slope (>1% grade), the in-situ soil infiltration width is:

Width of Sand Layer		Downslope Berm Width		In-Situ Soil Infiltraton Width	
4.8 feet	+	8.4 feet	=	13.2 feet	M11B
From M7		From M10B			

Width of Sand Layer		Upslope Berm Width		Downslope Berm Width		Toe to Toe Width of Mound	
4.8 feet	+	7.1 feet	+	8.4 feet	=	20.3 feet	M11C
From M7		From M10A		From M10B			

Step 11) Confirm that mound width available for treatment provides the required soil infiltration area:

The width of the mound is based on the greater of:

- the width as determined by the 1:3 slope requirement, **or**
- the width required to provide adequate infiltration area

In-Situ Soil Infiltration Width Based on 1:3 Slope		Width of Soil Infiltration Required
13.2	Greater Than	8.9
From M11A or M11B		From M8

If the in-situ soil infiltration width (M11A or M11B) is not larger then the soil infiltration width required (M8) for the design, then the design width of the mound has to be adjusted to achieve the required soil infiltration width (M8).

Step 12) Confirm the design complies with the Standard of Practice:

This worksheet does NOT consider all the requirements of the mandatory Standard. Please work safely and follow safe practices near trenches and open excavations.

Pressure Distribution, Orifice, Pipe & Pump Sizing

This design worksheet was developed by Alberta Municipal Affairs and Alberta Onsite Wastewater Management Association.

The completed installation is to comply with Alberta Private Sewage Standard of Practice 2009.

This worksheet is for use in Alberta to: size the orifices in distribution lateral pipes, size effluent delivery piping, and to calculate the required capacity and pressure head capability of the effluent pump.

It can be used for: calculating delivery of effluent to laterals in disposal fields, mounds and sand filters.

This worksheet does NOT consider all of the mandatory requirements of the Standard.

It is intended for use by persons having training in the private sewage discipline.

Note: Page numbers refer to the Private Sewage Systems Standard of Practice 2009.

Use only Imperial units of measurement throughout (feet, inches, Imperial gallons, etc…).

Step 1) Select the pressure head to be maintained at the orifices:

Minimum pressure at the orifice:
3/16" or less orifice = 5 ft. Minimum - 2.6.2.5 (1), (p 48)
larger than 3/16" orifice = 2 ft. Minimum - 2.6.2.5 (1) (p 48)

Design pressure at lateral orifices | 5 | **ft.** **P1**

Note: *worksheet will not provide an adequate design if laterals are at different elevations. Differing elevations will result in a different pressure head and volume of discharge at the orifices in each lateral. Additional considerations must be made f*

Step 2) Select the size of orifice in the laterals:

Minimum size: 2.6.1.5. (1)(e) p. 46 **1/8"**

Orifice Diameter selected | 1/8 | **in.** **P2**

Note: larger sizes are less likely to plug.

Step. 3) Select the spacing of orifices and determine the number of orifices to be installed in distribution laterals:

Length of Distribution Lateral From system design drawings		**Spacing of Orifices selected for design**		**Resulting number of orifices per lateral**	
57.5 ft.	÷	2.25 ft.	=	26	**P3a**

Select a spacing of orifices to attain even distribution over the treatment area:
Maximum spacings are determined for :
* 5 ft. Primary treated effluent: 2.6.1.5 (e) (pp. 46 - 47)
* 3 ft. Secondary treated effluent: 8.1.1.8 & 2.6.2.2 (c) (pp 98 & 47 - 48)
* 3 ft. On sandy textured soils: 8.1.1.8 (p. 98)

26	X	4	=	104	**P3b**
From P3a		Number of Laterals		Total Number of Orifices All Laterals	

If laterals are of differing lengths, calculate each separately and add the number of orifices together.

Step 4) Determine the minumum pipe size of the distribution laterals:

Enter the system design information into the 3 boxes below. If distribution laterals are of differing lengths, each lateral must be considered separately.

Orifice Diameter		Length of Distribution Lateral		Total Orifices Each Lateral
1/8	in.	57.5	ft.	26
From P2		From System Design Drawings		From P3a

Use Table A.1.A. (pp 140 - 143) when applying the information entered in this step to determine the minimum size of the distribution lateral pipe.

Size of Distribution Lateral Pipe From Table A.1.A. 1.25 **in.** **P4**

Step 5) Determine the total flow from all orifices:

Total Number of Orifices in all laterals		Gal/min for each Orifice at Head Pressure Selected			Total flow from all lateral orifices		
104	X	0.34	Imp. gal /min.	=	35.4	Imp. gal /min.	P5
From P3b		From Table A.1.B. (pp 144 & 145)					

Step 6) Select the type and size of effluent delivery pipe:

Use Tables A.1.C.1 to A.1.C.4 (pp 146 - 149) to aid in decision. A larger pipe will reduce pressure loss.

Type of pipe used for effluent delivery line	Pipe size selected		
PVC	2	inch - NPS	P6

Choose a friction loss from Tables A.1.C.1 to A.1.C.4 in between the bolded lines to ensure a flow velocity between 2 to 5 feet per second. The pipe size selcted will affect the amount of friction loss the pump must overcome to deliver effluent.

Step 7) Calculate the equivalent length of pipe for pressure loss due to fittings:

Insert total from Worksheet "A" on last page (p.5) of this Pressure Distribution Worksheet

Equivalent Length of All Fittings 51.3 **ft.** **P7**

For Pressure Loss

Step 8) Calculate the equivalent length of pipe from pump to the farthest end of header of distribution laterals for pressure loss:

Length of Piping (ft)		Equivalent Length of Fittings (ft)		Length of Pipe for Friction Loss (ft)	
205	+	51.3	=	256.3	P8
Length from pump to farthest end of distribution header supplying laterals.		Equivalent fitting length from **P7.**		Used to determine total pressure head loss due to friction loss in piping.	

Step 9) Calculate the pressure head loss in delivery pipe including fittings:

Total Length of Pipe for Friction Loss		Friction Loss per 100 feet of pipe		Delivery Piping Pressure Head Loss	
256 **Divide by 100 ft.**	x	2.89 ft.	=	7.4 ft.	P9
From P8					
Don't forget to divide the length by 100 feet to match the factors in the tables.		Use Tables A.1.C. On pp 146 - 150 using flow volume from **P5.**			

Step 10) Calculate the total pressure head required at pump:

Delivery piping pressure loss	7.4	ft.	From **P9**
	+		
Lift distance of effluent from effluent level in tank to orifices	7.5	ft.	Measure from lowest effluent level in tank to elevation of orifices.
	+		
Design pressure at orifices	5.0	ft.	From **P1**
	+		
Head loss allowed if an inline filter is used in pressure piping	5.48	ft.	**Explain Pressure Loss Allowed if Applied** A pressure loss of 0.48 ft across filter and 5 ft until alarm goes off.
	+		
Add 1 ft to allow for pressure loss along the distribution lateral	1	ft.	
Total minimum pressure head pump must provide at Imp. gal/min required to supply orifices	26.4	ft.	**P10**

Step 11) Select the size of the drain back orifice if used and determine the flow from the drain back orifice. Then calculate total flow requirement for pump:

Size of Drain Back Orifice		Determine flow using Head Pressure at Drain Back Orifice			Flow from all lateral orifices			Total Imp. Gallons per Minute from the pump		
1/4	in.	3.1	Imp. gal /min	+	35.4	Imp. gal /min	=	38.5	Imp. gal /min	P11
		Use pressure head from P10 to find flow from Extended Table A.1.B.1			From P5					

Step 12) Details of the pump specifications required:

Required Flow Rate (Imp. gal/min)		Required Pressure Head (ft)
38.5	@	26.4
From P11		From P10

Select the appropriate pump by reviewing the pump curve of available pumps. Select a pump that exceeds the requirements set out in this step by approximately 10% considering both pressure head and volume.

Imp. gal (P11) multiplied by 1.2 = U.S. gallons

Required Flow Rate (US gal/min)
46.2

Step 13) Consider the pumping demands of the system. If they are considered excessive, redesign the pressure distribution system and recalculate the pump demands.

Worksheet "Appendix A" Determine Equivalent Length of Pipe due to fittings in piping system.

Determine the equivalent length of pipe to allow for friction loss due to fittings in the piping system:

	Number of Fittings		Friction loss as per Table A.1.C.5 or 6 (p. 150)		Total
90° Elbows	4	x	5.7	=	22.8
					+
45°Elbows		x		=	
					+
Gate and Ball Valves		x		=	
					+
Tee-on-Branch (TOB)	2	x	12.0	=	24.0
					+
Tee-on-Runs (TOR)		x		=	
					+
Male Iron pipe Adaptors (M/F Threaded Adaptors)	1	x	4.5	=	4.5
					=

Total Equivalent Length of pipe to allow for fittings in piping system **(Enter this total, Box P7)** 51.3