Darlow Excavating
48237 Lake Ave.
McGregor, MN 55760
Phone # (218) 426-4320
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Ernie Darlow
Septic Systems
Designs, Installation
& inspections

This Enclosed Individual Sewage Treatment System (ISTS)
Is Designed Specifically For:

Robert & Mary Herman
5933 195th Ave. NW
Anoka, MN 55303
(612) 703-0091

For Property Located At:
20389 – 640th Lane
Jacobson, MN 55752
Lot 2 / Tract D

Cornish Township
Section 5, Township 51, Range 23

Parcel # 06-0-007515

April 22nd 2016

A NEW ISTS SITE EVALUATION WILL BE REQUIRED IF THE SYSTEM IS NOT INSTALLED WITH IN 1 YEAR FROM THE ABOVE DATE.

2 Bedroom / 2' Sand Base Mound

FIELD EVALUATION SHEET

PRELIMINARY EVALUATION DATE 4-22-16, FIELD EVALUATION DATE 4-22-16
PROPERTY OWNER: Bob Herman PHONE 612-703-0091
ADDRESS: 20389 - 640th Lane CITY,STATE,ZIP: [redacted] Jacobson MN
LEGAL DESCRIPTION: Lot 2 / Tract D
PIN# 06-0-007515 SEC 5 T 51 R 23 TWP NAME Cornish
FIRE# LAKE/RIVER Ball Bluff Lake LAKE CLASS OHWL F

DESCRIPTION OF SOIL TREATMENT AREAS

	AREA #1	AREA #2
DISTURBED AREAS	YES NO X	YES NO X
COMPACTED AREAS	YES NO X	YES NO X
FLOODING	YES NO X	YES NO X
RUN ON POTENTIAL	YES NO X	YES NO X
SLOPE %	0	
DIRECTION OF SLOPE	South after hill	
LANDSCAPE POSITION	Summit	
VEGETATION TYPES	Grass -	

REFERENCE BM ELEV. F
REFERENCE BM DESCRIPTION

DEPTH TO STANDING WATER OR MOTTLED SOIL: BORING# 1 16", 1A 14", 2 15, 2A 14"

BOTTOM ELEVATION--FIRST TRENCH OR BOTTOM OF ROCK BED: #1 FT., #2 FT.

SOIL SIZING FACTOR: SITE # 1, SITE #2

CONSTRUCTION RELATED ISSUES:

LIC# 910 SITE EVALUATOR SIGNATURE: Ernie Darlow Jr
SITE EVALUATOR NAME: Ernie Darlow Jr. TELEPHONE# 218-426-4320
LUG REVIEW (KT) 4-27-16 DATE 4-22-16

Comments:

SOIL BORING LOGS ON REVERSE SIDE

APPROVED
___ ONSITE INSPECTION
___ NO ONSITE INSPECTION

SIGN (KT) DATE 4-27-16

Form des 2/20/98

SOILS CHARTS FOR BOTH PROPOSED AND ALTERNATE SITES

1 (PROPOSED) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSEEL COLOR
0-6"	Top Soil	10yr 3/1
6-18"	Sandy loam	10 yr 6/4
mottling at 16"		

2 (PROPOSED) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSEEL COLOR
0-6"	Top Soil	10 yr 3/1
6-24"	Sandy loam	10 yr 5/4
Mottling found at 14"		

1 (ALTERNATE) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSEEL COLOR
0-4"	Top Soil	10yr 3/1
4"-20"	Sandy loam	10yr 5/4
mottling found at 15"		

2 (ALTERNATE) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSEEL COLOR
0-4"	Top Soil	10yr 3/1
4"-18"	Sandy loam	10 yr 5/4
mottling found at 14"		

(KT) 4-27-16

ADDITIONAL SOIL BORINGS MAY BE REQUIRED

MOUND DESIGN WORK SHEET (For Flows up to 1200 gpd)

A. Average Design FLOW

Estimated 300 gpd *(see figure A-1)*
or measured _____ x 1.5 (safety *factor*) = _____ gpd

A-1: Estimated Sewage Flows in Gallons per Day

number of bedrooms	Class I	Class II	Class III	Class IV
2	300	225	180	60% of the values in the Class I, II, or III columns.
3	450	300	218	
4	600	375	256	
5	750	450	294	
6	900	525	332	
7	1050	600	370	
8	1200	675	408	

B. SEPTIC TANK Capacity

1650 gallons *(see figure C-1)*

C-1: Septic Tank Capacities (in gallons)

Number of Bedrooms	Minimum Liquid Capacity	Liquid capacity with garbage disposal	Liquid capacity with disposal & lift inside
2 or less	750	1125	1500
3 or 4	1000	1500	2000
5 or 6	1500	2250	3000
7, 8 or 9	2000	3000	4000

C. SOILS *(refer to site evaluation)*

1. Depth to restricting layer = 1 feet
2. Depth of percolation tests = — feet
3. Texture Sandy loam
   Percolation rate 6 to 15 mpi
4. Soil loading rate .79 gpd/sqft *(see figure D-33)*
5. Percent land slope 0 %

D. ROCK LAYER DIMENSIONS

1. Multiply average design flow (A) by 0.83 to obtain required rock layer area.
   300 gpd x 0.83 sqft/gpd = 250 sqft
2. Determine rock layer width = 0.83 sqft/gpd x linear Loading Rate (LLR)
   0.83 sqft/gpd x 12 gpd/sqft = 10 ft
3. Length of rock layer = area ÷ width =
   250 sqft (D1) ÷ 10 ft (D2) = 25 ft

Mound LLR	
< 120 MPI	≤12
≥ 120 MPI	≤6

E. ROCK VOLUME

1. Multiply rock area (D1) by rock depth of 1 ft to get cubic feet of rock
   250 sqft x 1 ft = 250 cuft
2. Divide cuft by 27 cuft/cuyd to get cubic yards
   250 cuft ÷ 27 cuyd/cuft = 10 cuyd
3. Multiply cubic yards by 1.4 to get weight of rock in tons
   10 cuyd x 1.4 ton/cuyd = 13 tons

F. SEWAGE ABSORPTION WIDTH

Absorption width equals absorption ratio (See Figure D-33) times rock layer width (D2)

1.50 x 10 ft = 15 ft

D-33: Absorption Width Sizing Table

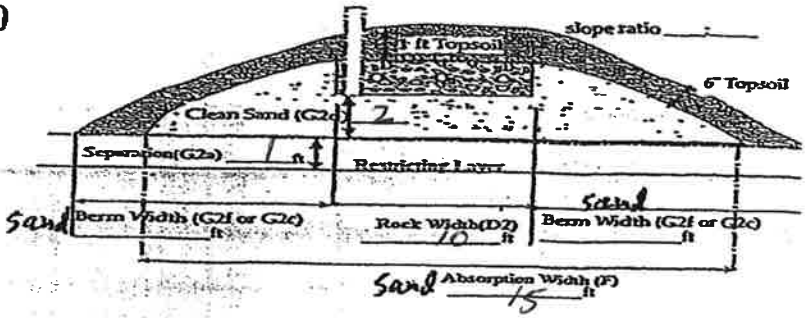
Percolation Rate in Minutes per Inch (MPI)	Soil Texture	Loading Rate Gallons per day per square foot	Absorption Ratio
Faster than 5	Coarse Sand Medium Sand Loamy Sand Fine Sand	1.20	1.00
6 to 15	Sandy Loam	0.79	1.50
16 to 30	Loam	0.60	2.00
31 to 45	Silt Loam Silt	0.50	2.40
46 to 60	Sandy Clay Loam Silty Clay Loam Clay Loam	0.45	2.67
61 to 120	Silty Clay Sandy Clay Clay	0.24	5.00
Slower than 120*			

*System designed for these soils must be other or performance

KT 4-27-16

<=1% land slope

G. **Mound Slope Width and Length (landslope less than or equal to 1%)**



1. Absorption width (F) 15 ft

2. Calculate mound size

a. Determine depth of clean sand fill

at upslope edge of rock layer = 3 ft

minus the distance to restricting layer (C1)

3 ft - 1 ft = 2 ft

b. Mound height at the upslope edge of rock layer = depth of clean sand for separation (G2a) at upslope edge plus depth of rock layer (1 ft) plus depth of cover (1 ft)

2 ft + 1ft + 1ft = 4 ft

c. Berm width = upslope mound height (G2b) times 4 *(4 is recommended, but could be 3-12)*

4 x 4 = 16 ft

d. The total landscape width is the sum of berm (G2c) width plus rock layer width (D2) plus berm (G2c): 16 ft + 10 ft + 16 ft = 42 ft

e. Additional width necessary for absorption = absorption width (F) minus the landscape width (G

_____ ft - _____ ft = _____ ft, *if number is negative (<0) skip to g*

f. Final berm width = additional width (G2e) plus the berm width (G2c)

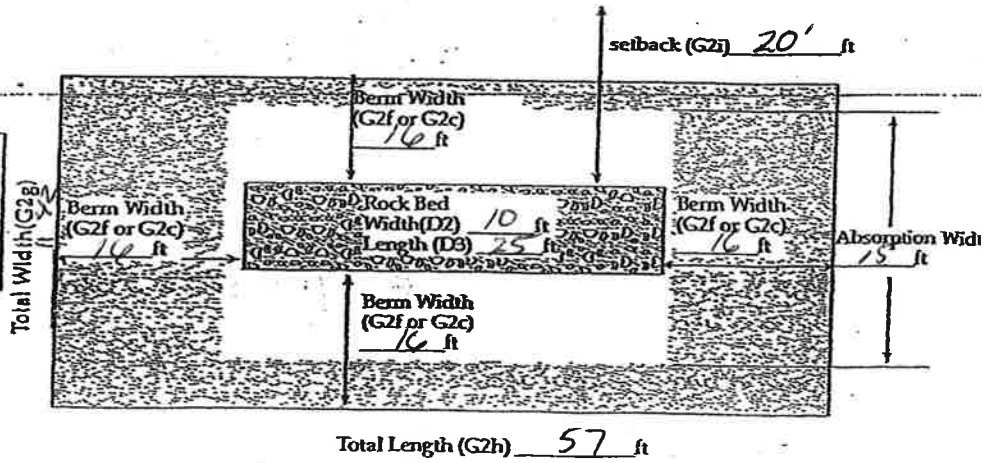
_____ ft + _____ ft = _____ ft

g. Total mound width is the sum of berm width (G2f or G2c) plus rock layer width (D2) plus berm width (G2f or G2c): 16 ft + 10 ft + 16 ft = 42 ft

h. Total mound length is the sum of berm (G2f or G2c) plus rock layer length (D3) plus berm (G2f G2c): 16 ft + 25 ft + 16 ft = 57 ft

i. Setbacks from the rockbed are calculated as follows: the absorption width (F) minus the rock bed (D2) divided by 2: (_____ ft - _____ ft) ÷ 2 = _____ ft

Final Dimensions:
42' x 57'

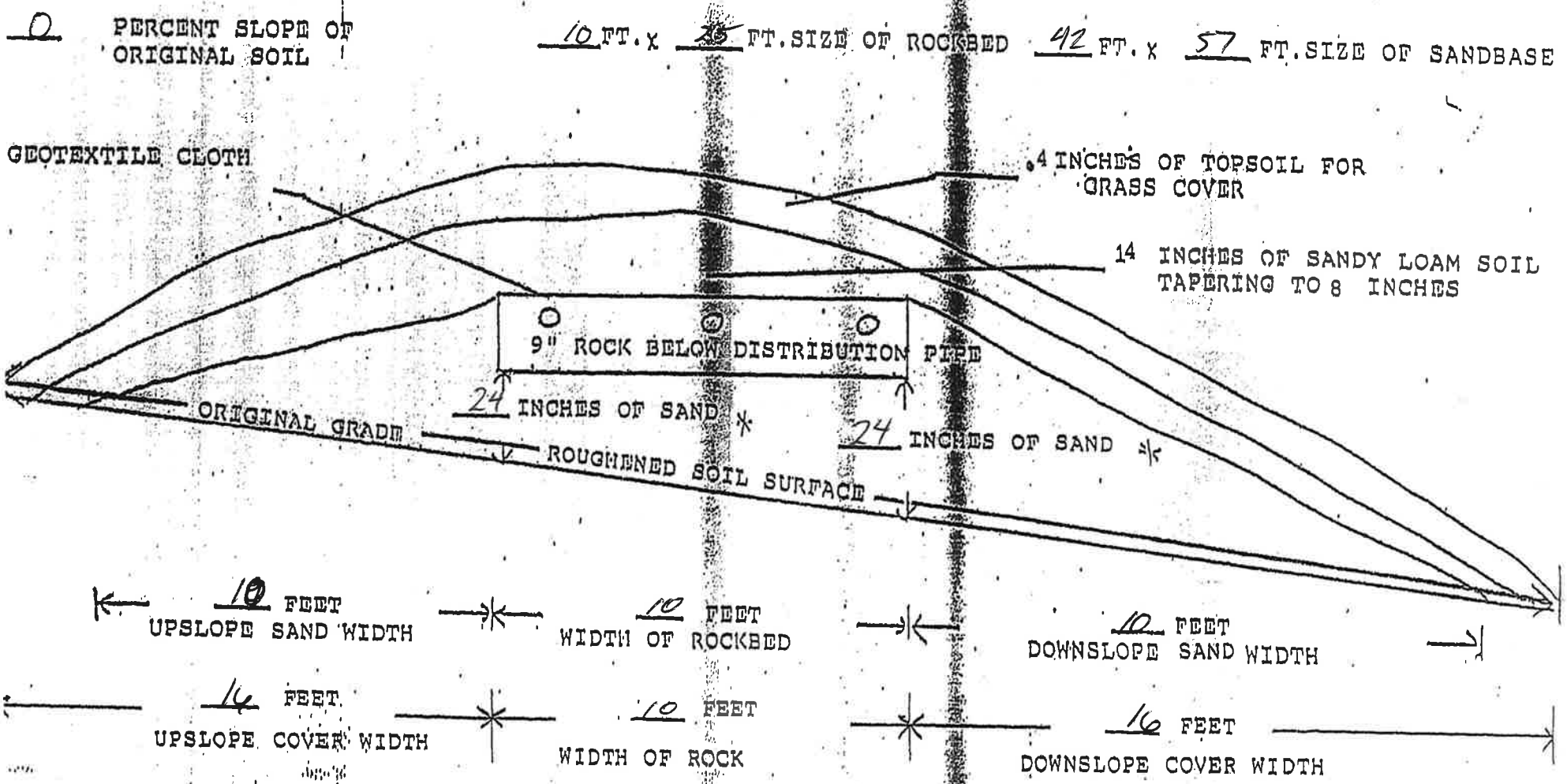


I hereby certify that I have completed this work in accordance with applicable ordinances, rules and laws.

Ernie Darlow Jr (signature) 910 (license #) 4-22-16 (date)

KT 4-27-16

MOUND CROSS-SECTION



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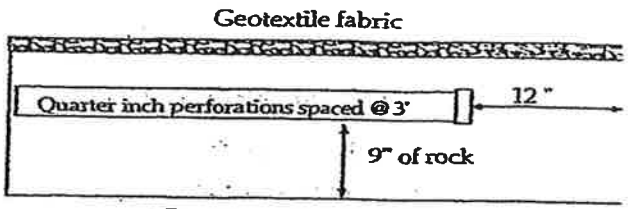
PRESSURE DISTRIBUTION SYSTEM



Perf Sizing 3/16" - 1/4"
Perf Spacing 1.5'- 5'

1. Select number of perforated laterals 3

2. Select perforation spacing = 3 ft

3. Since perforations should not be placed closer than 1 foot to the edge of the rock layer (see diagram), subtract 2 feet from the rock layer length.

$$\underset{\text{Rock layer length}}{25} - 2\text{ ft} = 23\text{ ft}$$

4. Determine the number of spaces between perforations. Divide the length (3) by perforation spacing (2) and round down to nearest whole number.

Perforation spacing = 25 ft ÷ 3 ft = 8 spaces

5. Number of perforations is equal to one plus the number of perforation spaces(4). *Check figure E-4 to assure the number of perforations per lateral guarantees <10% discharge variation.*

8 spaces + 1 = 9 perforations/lateral

6. A. Total number of perforations = perforations per lateral (5) times number of laterals (1)

9 perfs/lat x 3 lat = 27 perforations

B. Calculate the square footage per perforation.
Should be 6-10 sqft/perf. *Does not apply to at-grades.*
Rock bed area = rock width (ft) x rock length (ft)
10 ft x 25 ft = 250 sqft
Square foot per perforation = Rock bed area ÷ number of perfs (6)
250 sqft ÷ 27 perfs = 9.25 sqft/perf

7. Determine required flow rate by multiplying the total number of perforations (6A) by flow per perforation *(see figure E-6)*

27 perfs x .74 gpm/perfs = 20 gpm

8. If laterals are connected to header pipe as shown on upper example, to select minimum required lateral diameter; enter figure E-4 with perforation spacing (2) and number of perforations per lateral (5) Select minimum diameter for perforated lateral = 1.5 inches.

9. If perforated lateral system is attached to manifold pipe near the center, lower diagram, perforated lateral length (3) and number of perforations per lateral (5) will be approximately one half of that in step 8. Using these values, select minimum diameter for perforated lateral = 1.5 inches.

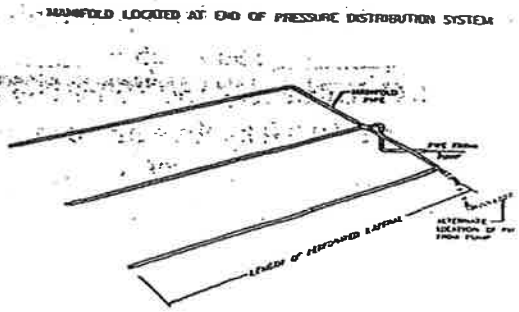
E-4: Maximum allowable number of 1/4-inch perforations per lateral to guarantee <10% discharge variation

perforation spacing (feet)	1 inch	1.25 inch	1.5 inch	2.0 inch
2.5	8	14	18	28
3.0	8	13	17	26
3.3	7	12	16	25
4.0	7	11	15	23
5.0	6	10	14	22

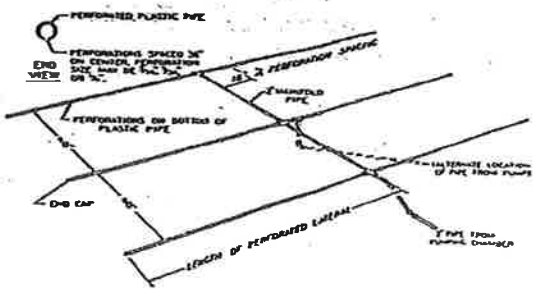
E-6: Perforation Discharge in gpm

head (feet)	perforation diameter (inches) 1/8	3/16	7/32	1/4
1.0[a]	0.18	0.42	0.56	0.7
2.0[b]	0.26	0.59	0.80	1.0
5.0	0.41	0.94	1.26	1.6

[a] Use 1.0 foot for single-family homes.
[b] Use 2.0 feet for anything else.



LAYOUT OF PERFORATED PIPE LATERALS FOR PRESSURE DISTRIBUTION IN MOUND



I hereby certify that I have completed this work in accordance with applicable ordinances, rules and laws.

Ernie Darbe Jr (signature) 910 (license #) 4-22-16 (date)

KT 4-27-16

PUMP SELECTION PROCEDURE

1. Determine pump capacity:

A. Gravity distribution

1. Minimum required discharge is 10 gpm
2. Maximum suggested discharge is 45 gpm. For other establishments at least 10% greater than the water supply rate, but no faster than the rate at which effluent will flow out of the distribution device.

B. Pressure distribution

See pressure distribution work sheet

From A or B Selected pump capacity: 20 gpm

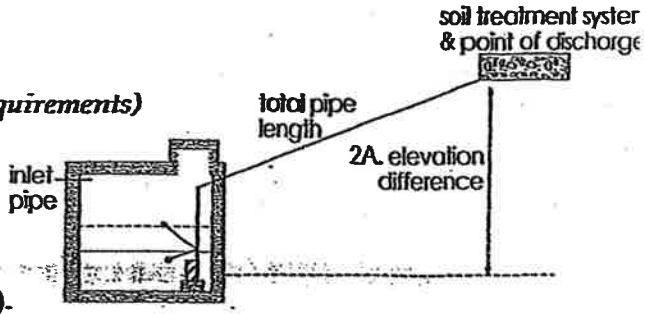
2. Determine pump head requirements:

A. Elevation difference between pump and point of discharge?

10 feet

B. Special head requirement? *(See Figure at right - Special Head Requirements)*

5 feet



Special Head Requirements	
Gravity Distribution	0 ft
Pressure Distribution	(5 ft)

C. Calculate Friction loss

1. Select pipe diameter 1.5 in
2. Enter *Figure E-9* with gpm (1A or B) and pipe diameter (C1).

   Read friction loss in feet per 100 feet from Figure E-9

   Friction Loss = 2.47 ft/100ft of pipe
3. Determine total pipe length from pump discharge to soil treatment discharge point. Estimate by adding 25 percent to pipe length for fitting loss. Total pipe length times 1.25 = equivalent pipe length

   40 feet x 1.25 = 50 feet
4. Calculate total friction loss by multiplying friction loss (C2) in ft/100 ft by the equivalent pipe length (C3) and divide by 100.

   = 2.47 ft/100ft x 50 ÷100 = 1.25 ft

D. Total head required is the sum of elevation difference (A), special head requirements (B), and total friction loss (C4)

10 ft + 5 ft+ 1.25 ft =

Total head: 16.25 feet

E-9: Friction Loss in Plastic Pipe Per 100 feet			
	nominal pipe diameter		
flow rate gpm	(1.5")	2"	3"
20	2.47	0.73	0.11
25	3.73	1.11	0.16
30	5.23	1.55	0.23
35	6.96	2.06	0.30
40	8.91	2.64	0.39
45	11.07	3.28	0.48
50	13.46	3.99	0.58
55		4.76	0.70
60		5.60	0.82
65		6.48	0.95
70		7.44	1.09

3. Pump selection

A pump must be selected to deliver at least 20 gpm (1A or B) with at least 16.25 feet of total head (2D)

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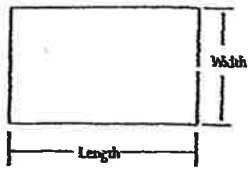
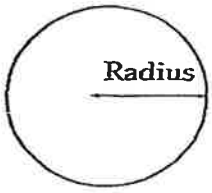
DOSING CHAMBER SIZING





1. Determine area
   A. Rectangle area = L x W
   _____ x _____ = _____ square feet
   B. Circle area = π (3.14) x radius in feet x radius in feet
   3.14 x _____ ft x _____ ft = _____ sqft
   C. Get area from manufacturer _____ sqft

2. Calculate gallons per inch
   There are 7.5 gallons per cubic foot of volume, therefore multiply the area (1A, B or C) times the conversion factor and divide by 12 inches per foot to calculate gallon per inch.
   Area x 7.5 ÷ 12 = _____ sqft x 7.5 ÷ 12 in/ft = 12.69 gallon per inch

3. Calculate total tank volume
   A. Depth from bottom of inlet pipe to tank bottom 48.5 in
   B. Total tank volume = depth from bottom of inlet pipe to tank bottom (3A) x gal/in (2)
   = 48.5 in x 12.69 gal/in = 615 gal

Legal Tank:
500 gallons or
100% the Daily flow
or
Alternating Pumps

4. Calculate gallons to cover pump (with 2-3 inches of water covering pump)
   (Pump and block height (inch) + 2 inch) x gallon/inch
   (14 in +2 in) x 12.69 gal/in = 203 gallon

5. Calculate total pumpout volume
   A. Select pump size for 4-5 does per day. Gallon per dose = gpd (see *figure A-1*)
   / doses per day = 300 gpd ÷ 5 doses/day = 60 gallons
   B. Calculate drainback
   1. Determine total pipe length, 40 feet
   2. Determine liquid volume of pipe, .11 gal per ft (*see figure E-20*)
   3. Drainback quantity = 40 ft (5B1) x .11 gal per ft (5B2) = 4.4 gal
   C. Total pump out volume = dose volume (5A) + drainback (5B3)
   60 gal + 4.5 gal = 64.5 Total gallon

A-1: Estimated Sewage Flows in Gallons per Day

number of bedrooms	Class I	Class II	Class III	Class IV
2	300	225	180	60%
3	450	300	218	of the
4	600	375	256	values
5	750	450	294	in the
6	900	525	332	Class I,
7	1050	600	370	II, or III
8	1200	675	408	columns.

E-20: Volume of Liquid in Pipe

Pipe Diameter inches	Gallons per foot
1	0.045
1.25	0.078
1.5	0.11
2	0.17
2.5	0.25
3	0.38
4	0.66

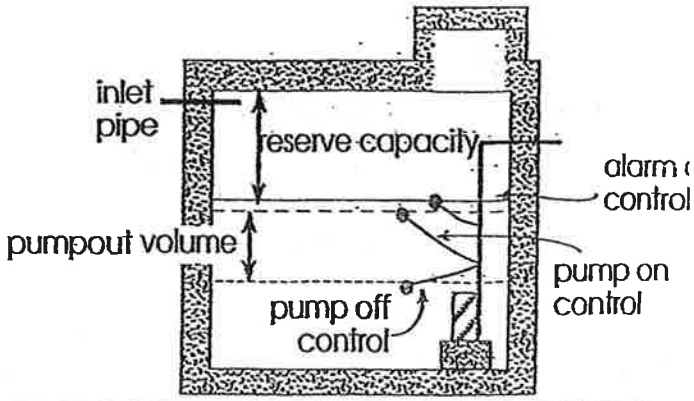
6. Float separation distance (using total pumpout volume)
   Total pumpout volume (5C) ÷ gal/inch (2)
   64.5 gal ÷ 12.69 gal/in = 5.1 inch

7. Calculate volume for alarm (typically 2 to 3 inches)
   Alarm depth (inch) x gallon/inch (2) = 2 in x 12.69 gal/in) = 25.5 gal

8. Calculate total gallon = gallons over pump (4) + gallons pumpout (5C) + gallons alarm (7)
   263 gal + 64.5 gal + 25.5 gal = 293 gallons

9. Total Tank Depth = total gallon (8) ÷ gallon/inch (2)
   293 gal ÷ 12.69 gal/in = 23 in

Recommended:
Calculate reserve capacity (75% the daily flow)
Daily flow x .75 = _____ x .75 = _____ gallons



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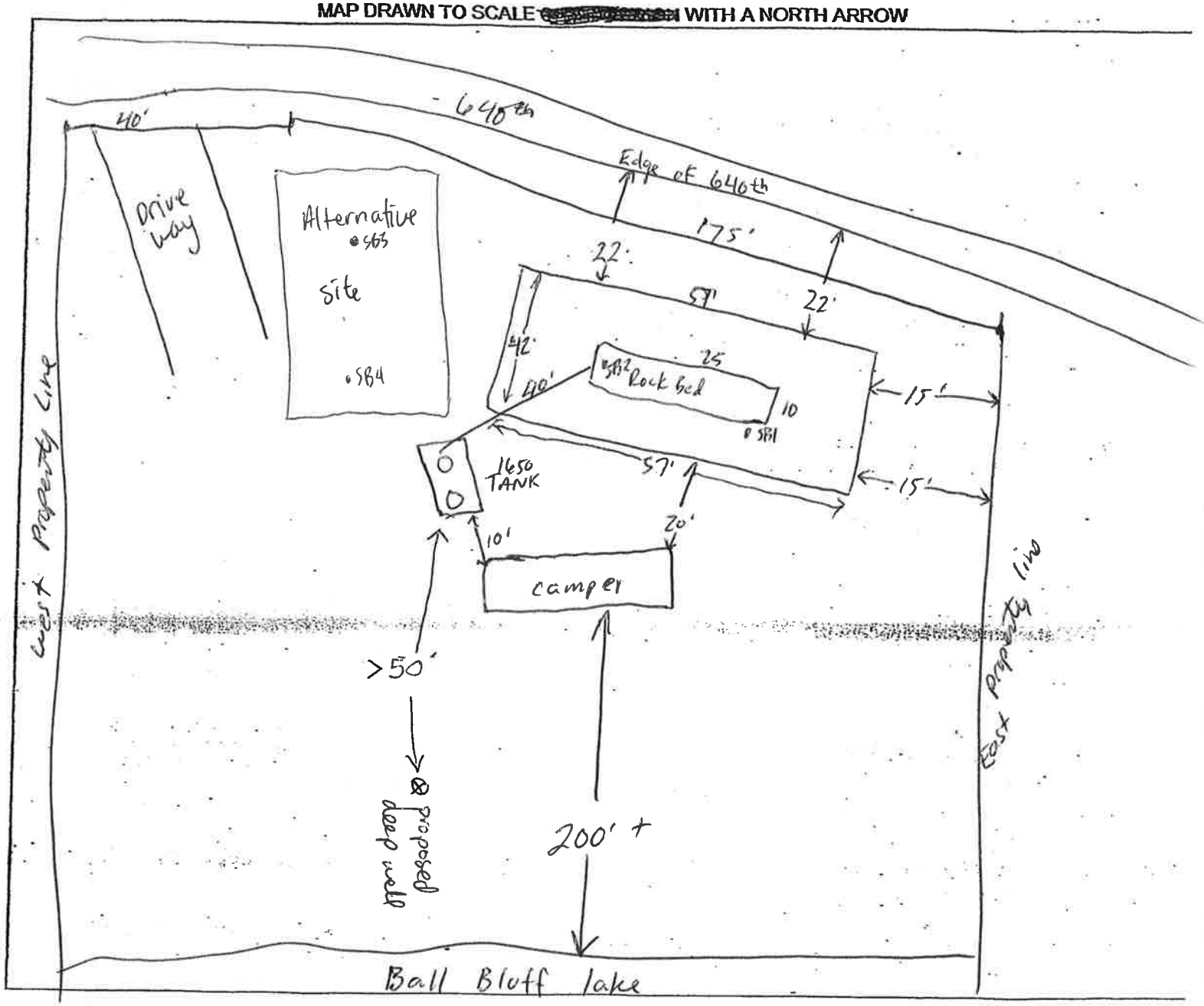
Ernie Dardaris (signature) 910 (license #) 4-22-16 (date)

KT 4-27-16

CLIENT: Bob Herman DATE: 4-22-16

MAP DRAWN TO SCALE [redacted] WITH A NORTH ARROW



CHECK OFF LIST--HAVE ALL OF THE FOLLOWING BEEN DRAWN ON THE MAP??

SHOW EXISTING OR PROPOSED

- ☐ WATER WELLS WITHIN 100 FT OF TREATMENT AREAS
- ☐ PRESSURE WATER LINES WITHIN 10 FT OF TREATMENT AREAS
- ☐ STRUCTURES
- ☐ LOT IMPROVEMENTS
- ☐ ALL SOIL TREATMENT AREAS
- ☐ ALL ISTS COMPONENTS
- ☐ HORIZONTAL AND VERTICAL REFERENCE
- ☐ POINT OF SOIL BORINGS
- ☐ DIRECTION OF SLOPE
- ☐ LOT EASEMENTS
- ☐ ALL LOT DIMENSIONS
- ☐ DISTURBED/ COMPACTED AREAS
- ☐ SITE PROTECTION--LATHE AND RIBBON EVERY 15 FT
- ☐ ACCESS ROUTE FOR TANK MAINTENANCE

REQUIRED SETBACKS

- ☐ STRUCTURES
- ☐ PROPERTY LINES
- ☐ OHWL

COMMENTS:

INDICATE ELEVATIONS

100.0	BENCHMARK Camper pad corner
101.0	ELEVATION OF SEWER LINE @ HOUSE
102.0	ELEVATION @ TANK INLET
98.0	ELEVATION @ BOTTOM OF ROCK LAYER
101.0	ELEVATION @ BOTTOM OF BORING OR RESTRICTIVE LAYER
106.0	ELEVATION OF PUMP
97.0	ELEVATION OF DISTRIBUTION DEVICE

DESIGNER SIGNATURE Ernie Darbo /s DATE 4-22-16

LICENSE# 910

4-27-16