CIVIL ENGINEERING ASSOCIATES, INC.
10 Mansfield View Lane
South Burlington, VT 05403
Phone: 802-864-2323
Fax: 802-864-2323
E-Mail: mail@cea-vt.com

January 4, 2018

Mr. Lee Krohn, Interim Town Zoning Administrator
Town of Charlotte
P.O. Box 119
Charlotte, Vermont 05445

**Re: Bean Farm 3-Lot Subdivision, Clarke W. Hinsdale, III
Wastewater Disposal and Potable Water Supply Permit Application
1712 Hinesburg Road, Charlotte**

Dear Lee:

Clark Hinsdale is proposing a 3-Lot subdivision of the existing undeveloped 96.84 acre parcel located on the south side of Hinesburg Road across from the Nordic Holstein (former Bean) farm located at 1711 Hinesburg Road.

The proposed subdivision will create two single family lots (Lot 2 – 17.35 acres and Lot 3 – 7.59 acres) with the remaining land being retained as an open space (agricultural) lot of 71.90 acres. A previous subdivision of a 5 acre lot from this parent parcel in 1986 (EC-4-0783) is depicted as Lot 4 but is not subject to any components of this application.

The two single family lots are proposed to be served by mound type wastewater disposal systems. Because of the variability of the slopes and soil conditions on these parcels, both of these lots have had hydrogeologic studies completed to demonstrate compliance with the standards set forth for performance based systems.

Lot 3 includes a mound based replacement area which also has had a hydrostudy completed to demonstrate conformance with the siting rules.

The test pitting for the property was completed in the spring of 2014 with oversight by Spencer Harris from Vermont Contours who at the time was the Town's technical wastewater consultant. He recently was made aware that an application would be submitted for this property and he indicated that he would share his background knowledge of the conditions if requested.

Each of the single family lots are proposed to be served by new drilled wells.

The proposed wastewater disposal systems and wells have been sited in a manner that avoids any overshadowing of the abutting properties.

There is no development of the proposed 71.90 acre agricultural lot 1. As such, no wastewater disposal or potable water supply designs have been offered.

The proposed well locations do fall just within one (1) mile of the Spear's Store gasoline station which is identified as a hazardous waste site at the intersection of Hinesburg Road and Spear Street. It Is our opinion that the proposed single family home wells are adequately isolated from this potential contamination source by the presence of low permeability unconsolidated soils and a hydraulic barrier in the form of the stream that runs between the store and this project site to the west.

This completes our summary of the proposed wastewater system and potable water supply components for the property at 1712 Hinesburg Road. If you should have any questions, please feel free to contact me at 864-2323 x310.

Respectfully,

David S. Marshall, P.E.
Project Engineer

\dsm

Enclosures
- Application Form
- Application Fee ($1,000 for two residential units)
- Act 145 Form 5 Abutter Notice Certification
- Two sets of full size plans, one set of 11x17
- Hydrostudy Reports w Attachments for Lots 2, 3 and Lot 3 replacement area
- Basis of Design Information for each Lot 2 and Lot 3
  - Pump Station
  - Mound System
  - Mound Distribution System
  - Pump Cut Sheets and System Curves
- CD of PDF's of application

cc: (all w enclosures, 11x17 plans) C. Hinsdale; E. Buttery, CEA File 17218..00

Drinking Water & Groundwater Protection Division - Permit Application

Wastewater System & Potable Water Supply

VERMONT
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

For Office Use Only:

Application#	PIN#	Date Complete Application Received

General Information:

IMPORTANT: This application form **IS NOT** intended to be printed and filled out by hand. Because of the dynamic nature of the form, it is required that the information be typed directly into the fields using a computer.

In most cases a licensed designer will be required for your project and to help complete this application form. There are also line-by-line instructions available to assist with completing this form: http://dec.vermont.gov/sites/dec/files/dwgwp/wastewater/pdf/WWApplnstructionsRules.pdf.

NOTE: ***We strongly suggest referring to the application instructions while completing this application form.***

A. Prior Permits

1 Please enter any prior or related WW permit or Act 250 permit number(s) (if applicable)

EC-4-0873 existing prior subdivided 5 acre parcel to the south

B. Project Name

1 Please enter a name that can be used as a reference for the project

Bean Farm Subdivision

C. Landowner Information

Landowner Name

1 Legal Entity/Organization Name (if the Landowner is a legal entity or organization rather than a person)

2 Landowner First Name (and Middle Initial if appropriate)	3 Landowner Last Name
Clark W.	Hinsdale, III

Landowner Contact Information

4 Mailing Address Line 1	5 Mailing Address Line 2
1211 Ethan Allen Highway	

6 City	7 State/Province	8 Country	9 Zip/Postal Code
Charlotte	VT	United States	05445

10 Email Address	11 Telephone
cshinsdale@gmavt.net	802-425-3004

Landowner Certifying Official Information (if applicable)

12 First Name (and MI if appropriate)	13 Last Name

14 Title	15 Email Address	16 Telephone

Add Another Landowner

D. Primary Contact Information (if other than Landowner)

1 First Name (and Middle Initial if appropriate)	2 Last Name
David S.	Marshall

3 Company/Organization Name

Civil engineering Associates, Inc.

4 Mailing Address Line 1	5 Mailing Address Line 2
10 Mansfield View Lane	

6 City	7 State/Province	8 Country	9 Zip/Postal Code
South Burlington	VT	United States	05403

10 Email Address	11 Telephone
dmarshall@cea-vt.com	802-864-2323 x310

E. Lot(s) Affected by this Project

1 Please list any and all proposed lots or existing parcels that are directly affected by this project. If this application is an amendment to a previous project, please use consistent lot numbers.

(a) Existing or Proposed Lot	(b) Lot Number	(c) SPAN	(d) Parcel ID	(e) Acres
Existing	Parent Parcel		00003-1711	96.84

(f) Book Number (ref. 1)	(g) Page Number(s) (ref. 1)	(h) Book Number (ref. 2)	(i) Page Number(s) (ref. 2)	(j) Book Number (ref. 3)	(k) Page Number(s) (ref. 3)
151	168	192	677		

(l) Comments

Existing Parent Parcel after 5 acre subdivision in 1986.

(a) Existing or Proposed Lot	(b) Lot Number	(c) SPAN	(d) Parcel ID	(e) Acres
Proposed	1		00003-1711	71.9

(f) Book Number (ref. 1)	(g) Page Number(s) (ref. 1)	(h) Book Number (ref. 2)	(i) Page Number(s) (ref. 2)	(j) Book Number (ref. 3)	(k) Page Number(s) (ref. 3)
151	168	192	677		

(l) Comments

Proposed open space (agricultural) parcel with deferral.

(a) Existing or Proposed Lot	(b) Lot Number	(c) SPAN	(d) Parcel ID	(e) Acres
Proposed	2		00003-1711	17.35

(f) Book Number (ref. 1)	(g) Page Number(s) (ref. 1)	(h) Book Number (ref. 2)	(i) Page Number(s) (ref. 2)	(j) Book Number (ref. 3)	(k) Page Number(s) (ref. 3)
151	168	192	677		

(l) Comments

Proposed single family residential lot.

(a) Existing or Proposed Lot	(b) Lot Number	(c) SPAN	(d) Parcel ID	(e) Acres
Proposed	3		00003-1711	7.59

(f) Book Number (ref. 1)	(g) Page Number(s) (ref. 1)	(h) Book Number (ref. 2)	(i) Page Number(s) (ref. 2)	(j) Book Number (ref. 3)	(k) Page Number(s) (ref. 3)
151	168	192	677		

(l) Comments

Proposed single family residential lot.

Add Another Lot

F. Project Information

1 Project Description

Three lot subdivision of 96.84 acre parcel into two single family lots (lot 2 - 17.35 acres and Lot 3 - 7.59 acres) with retained 71.90 acre open space (agricultural) parcel with deferral.

2 Total Acreage of Property	3 Town (primary)	4 Town (secondary - if located in more than one town)
96.84	Charlotte	

5 Street Address (911 address if available, otherwise a brief description of the location)

1712

6 Center of property GPS coordinates - Enter the approximate center of the project coordinates using GPS set for NAD83 or as derived from a map (map must be based on NAD83).

(a) Latitude *(in decimal degrees to five decimal places, ex. 44.38181°)*	(b) Longitude *(in decimal degrees to five decimal places, ex. -72.31392 °)*
44.31516	-73.20058

7 If someone from the Drinking Water & Groundwater Protection Division's Regional Office has been to the property for a site visit, please indicate who visited the property and the date of the visit.

(a) Name of Staff Person	(b) Date of Visit (m/d/yyyy)
Spencer Harris	3/31/2014

G. Application Fee

Please refer to the Application Fee Schedule prior to selecting the Application Fee Code for your project below.

1 Select Application Fee Code	2 Fee Amount Due

H. Wastewater System and Water Supply Component Details

Component Information:

PLEASE READ: The purpose of this section is to provide supplementary information for system components when there are proposed changes to existing conditions or previous permits. In the case that the application includes site plans, the component names on this worksheet must match those on the site plans. If there is a prior permit, the component names must be labeled consistent with plans from the prior permit(s). It is *__required__* that, at a minimum, the following component types must be included for each application: final disposal; pre-treatment (if applicable); building unit(s); water treatment (if applicable); and water source. To add components after the third entry, click the green button labeled "Add Another Component". You may also insert components between components you've already added by clicking the "Insert Component Between" button. For large projects with many components, you may consider using the "Show/Hide Component Set Separator" button to separate sets (or groups) of connected components by naming each set. For additional instructions, please review the appendix to the application instructions: http://dec.vermont.gov/sites/dec/files/dwgwp/wastewater/pdf/WWAppInstructionsRules.pdf.

Component 1 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type: (WW) Final Disposal

Component Type: Mound

--Component 1 Details--

Component Name: Lot 2 Mound

Lot # Physical Location: 2

Change Type: New System

WW Design Flow: 630

Changes: Construction of new 630 GPD mound system

I/A Dispersal Type:

Variance Requested: ☐

Comments:

Design Approach (select all that apply, press Ctrl and Click to select multiple):
- Alternative Toilets
- Constructed Wetlands
- Existing - Unknown
- Filtrate
- Flow equalization
- No discharge (other than holding tank)
- Performance based
- Prescriptive
- Store and dose
- Subsurface drip distribution
- Time dosing
- Wastewater strength

Manufacturer:

Model Name:

Model Number:

As-Built Latitude:

As-Built Longitude:

Insert Component Between

Component 2 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type: (WW) Conveyance

Component Type: Pump Station

--Component 2 Details--

Component Name	Pump station and force main		
Lot # Physical Location	2	Change Type	New System
Municipal WW System		Changes	New simplex pump station in 1,500 gallon tank with 650 gallons of emergency storage for 6-BR home.
		Comments	

Insert Component Between

Component 3 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WW) Tanks	Component Type	Septic Tank

--Component 3 Details--

Component Name	New 1000 gallon septic tank		
Lot # Physical Location	2	Change Type	
		Changes	
		Comments	

Insert Component Between

Component 4 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	Building	Component Type	Building-Unit

--Component 4 Details--

Component Name	6 Bedroom Home		
Lot # Physical Location	2	Change Type	Connection to New System
WW Permitted Flow	630	Changes	6 BR Home design flow = 630 GPD
WS Permitted Flow	630		
Flow Basis	Rule	Comments	

Insert Component Between

Component 5 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WS) Source	Component Type	Potable

--Component 5 Details--

Component Name	Lot 2 Well		
Lot # Physical Location	2	Change Type	New System
Source Type	Drilled/Driven Well	Changes	6 BR Home design flow = 630 GPD
WS Design Flow	630		
Allocation Approval	☐	Comments	
Construction Approval	☐		
Variance Requested	☐		
As-Built Latitude			
As-Built Longitude			

Insert Component Between

Component 6 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WW) Final Disposal	Component Type	Mound

--Component 6 Details--

Component Name	Lot 3 Mound		
Lot # Physical Location	3	Change Type	New System
WW Design Flow	490	Changes	Mound for 4 BR Home design flow = 490 GPD
I/A Dispersal Type			
Variance Requested	☐	Comments	
Design Approach (select all that apply, press Ctrl and Click to select multiple)	Alternative Toilets Constructed Wetlands Existing - Unknown Filtrate Flow equalization No discharge (other than holding tank) Performance based Prescriptive Store and dose Subsurface drip distribution Time dosing Wastewater strength		
Manufacturer			
Model Name			
Model Number			
As-Built Latitude			
As-Built Longitude			

Insert Component Between

Component 7 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WW) Conveyance	Component Type	Pump Station

--Component 7 Details--

Component Name	Lot 3 Pump Station and force main
Lot # Physical Location	3
Municipal WW System	
Change Type	New System
Changes	New simplex pump station for 4-BR home in 1000 gallon tank with 500 gallons of emergency storage.
Comments	

Insert Component Between

Component 8 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WW) Tanks
Component Type	Septic Tank

--Component 8 Details--

Component Name	New 1000 gallon septic tank
Lot # Physical Location	3
Change Type	New System
Changes	
Comments	

Insert Component Between

Component 9 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	Building
Component Type	Building-Unit

--Component 9 Details--

Component Name	4-BR Home
Lot # Physical Location	3
WW Permitted Flow	490
WS Permitted Flow	490
Flow Basis	Rule
Change Type	Connection to New System
Changes	
Comments	

Insert Component Between

Component 10 Information

Show/Hide Component Set Separator | Remove This Component

Component Group Type	(WS) Source
Component Type	Potable

--Component 10 Details--

Component Name	New Drilled well for Lot 3		
Lot # Physical Location	3	Change Type	New System
Source Type	Drilled/Driven Well	Changes	Design flow of 490 GPD fr 4-BR home
WS Design Flow	490		
Allocation Approval	☐	Comments	
Construction Approval	☐		
Variance Requested	☐		
As-Built Latitude			
As-Built Longitude			

Insert Component Between

Add Another Component

I. Project Plan Reference

1 Please provide the following information for all water supply and wastewater system plans being submitted.

(a) Sheet#	(b) Title	(c) Plan Date	(d) Last Revision Date	
C1.1	Proposed Conditions Overall Site Plan	1/1/2018		X
C3.0	Wastewater System Site Plan - Lot 2	1/1/2018		X
C3.1	Wastewater System Site Plan - Lot 2	1/1/2018		X
C3.2	Lot 3 Wastewater System Replacement Area	1/1/2018		X
C4.0	Wastewater Details	1/1/2018		X
C4.1	Wastewater Details	1/1/2018		X

Add Another Plan Reference

J. Project Scoping Questions

	Question	Answer
1	Does this project involve the replacement of a failed wastewater system?	○ Yes ◉ No
2	Does this project involve the replacement of a failed water supply?	○ Yes ◉ No
3	Does this project involve construction within the buffer for a Class 2 Wetland?	○ Yes ◉ No
4	Does this project involve construction within a river corridor?	○ Yes ◉ No
5	Is the property within 250 feet of the mean water level of lakes greater than 10 acres in size?	○ Yes ◉ No
6	Will the project require a public water supply permit?	○ Yes ◉ No
7	Is any portion of the proposed wastewater system located in a Water Source Protection Area (SPA) as designated by the Drinking Water & Groundwater Protection Division?	○ Yes ◉ No
8	Does this project require an Underground Injection Control Permit?	○ Yes ◉ No
9	Is this project located in a Class A Watershed?	○ Yes ◉ No
10	If this project is in a Class A Watershed, does the design flow for the project exceed 1,000 gpd or is the project located on the same lot as other buildings, structures, or campgrounds where the total design flow for the lot is greater than 1,000 gpd?	○ Yes ○ No ◉ NA
11	Are any of the proposed water sources located within 1 mile of a hazardous waste site as designated by the Waste Management & Prevention Division and identified on the Agency mapping website (if Yes, please submit additional information on the site)?	◉ Yes ○ No
12	Does any building(s) on the property or the proposed project include any floor drains?	○ Yes ◉ No
13	If there are existing floor drains, where do they discharge?	
14	Does this project involve only a single family residence with no in-home business?	○ Yes ◉ No
15	Does this project include a discharge of wastewater to a soil-based wastewater treatment system?	◉ Yes ○ No

16 Select any of the following activities that are part of the project, regardless of discharges. If none of the activities listed apply to the project, select "Not Applicable". If more than one item in the list applies to your project, click the "Add Another Activity" button to add another activity.

Not Applicable

Add Another Activity

17 Is there a wastewater discharge from the activities selected in the previous question? ○ Yes ◉ No

K. Consultant/Designer Certification

Consultant/Designer Certification & Copyright License

"I hereby certify that in the exercise of my reasonable professional judgment, the design-related information submitted with this application is true and correct, and that the design included in this application for a permit complies with the Vermont Wastewater System and Potable Water Supply Rules and the Vermont Water Supply Rules.

As the individual who prepared this application, including all documents that are marked as copyrighted, I hereby grant a non-exclusive, limited license to the State to allow the documents to be made available for public review and copying in order to properly implement and operate the permitting programs for Wastewater Systems and Potable Water Supplies, and for no other purposes. As a condition to this license, the State agrees that it will not make any changes to such documents, nor will the State delete any copyright notices on such documents."

Consultant/Designer Role	Print Consultant/Designer Name	Consultant/Designer Signature	Signature Date
WW Designer	David S. Marshall, P.E.	[signature]	1-8-18

Add Second Consultant/Designer

L. Signatures & Acknowledgements of Landowner(s)

This application must be signed by each Landowner listed on the property deed or by individuals with legal authority to sign on behalf of each Landowner. In order to insure compliance with the requirements of the regulations administered by the Department of Environmental Conservation, Drinking Water and Groundwater Protection Division, it may be necessary to visit the property. As this would involve a Department employee entering private property, we request your approval to do so.

If we do visit your property, do you have any special instructions?

"By signing this application, I certify that I am a landowner listed on the property deed or that I have the legal authority to sign on behalf of the landowner. I understand that by signing this application I am granting permission for the Department employees to enter the property, during normal business hours, to insure compliance of the property with the applicable rules of the Department.

I also understand that I am not allowed to commence any site work or construction on this project without written approval from the Department of Environmental Conservation.

If my project utilizes an Innovative/Alternative System or Product, I have received a copy of the Drinking Water & Groundwater Protection Division's approval letter and agree to abide by the conditions of the approval.

I also certify that to the best of my knowledge and belief the information submitted above is true, accurate and complete."

Print Landowner Name	Landowner Signature	Signature Date
Clark W. Hinsdale, III	Clark W. Hinsdale III	1-8-18

Add Landowner Signature Block

Department of Environmental Conservation

Wastewater System & Potable Water Supply Permit Application

ANR Form 5: Certification Statement for Wastewater System & Potable Water Supply Permits when there is no Required Notification of Overshadowed Property Owner(s)

A person submitting an application to the Secretary for a Wastewater System and Potable Water Supply Permit shall use this statement whenever overshadowing notification of affected landowners is not required (see guidance and instructions for examples).

Note: When the property subject to the permit application is owned by more than one person, only one of the landowners must sign this certification statement even though all landowners must sign the permit application itself.

Landowner Certification
I hereby certify that "overshadowing" notification is not required either because there is an exemption to the notification requirement or there are no landowners whose property may be affected by the proposed water and wastewater systems.
Clark W. Hinsdale III (Landowner Signature) · Clark W. Hinsdale, III (Print Landowner Name) · 1-8-18 (Certification Date)
00003-1711 96.84 acre open land at 1712 Hinesburg Road. (Property Address or Property Tax ID#)

CIVIL ENGINEERING ASSOCIATES, INC.
10 Mansfield View Lane | Phone: 802-864-2323
South Burlington, VT 05403 | Fax: 802-864-2271
Email: dmarshall@cea-vt.com

STATE OF VERMONT
DAVID S. MARSHALL
No. 6010
CIVIL
REGISTERED
PROFESSIONAL ENGINEER

Hydrogeologic Study
Hinsdale Lot 2 Wastewater Disposal System

December 27, 2017

The proposed mound type wastewater disposal system has a design disposal capacity of 630 gallons per day in support of a 6-bedroom single family home. As the applicant has proposed to recognize the varying slopes and soil types within the vertical profile in the design area, a Hydrogeologic study is required to be completed.

Existing Conditions

The existing site is generally comprised of a fine to very fine sandy loam over a silt loam, silty clay or bedrock substratum. Test pitting information is depicted on Sheet C3.0 and is based on the work completed Civil Engineering Associates in March and May, 2014 and overseen by Spencer Harris on behalf of the Town of Charlotte.

The depth to seasonal high groundwater was interpolated between these points to determine the existing seasonal high groundwater contours and project specific points.

Depths to seasonal high groundwater vary within the site and are generally summarized below.

Under Trench	14" to 18"
Toe of Fill	16" to 20"
25' below Toe	20"

The hydraulic gradients, based upon the SHGWT elevations generally are summarized as follows:

Under Trench	7.2%
From Trench to Toe	14.6% (shallowest slope at north end)
From Toe to 25-ft	16.1%

The existing surface grade and interpreted SHGHT elevation (red hatch) have been added to the attached site plan mark-up of the system area (one over the other). The estimate SGWT elevation contours are shown in red solid line. The calculated slopes are also shown on the plan as red highlighted arrows with the noted gradient over the length of the arrow (red hatch). The estimated spread of the effluent plume is shown with the brown long dashed lines.

Design Requirements
The proposed disposal trench will receive standard settled effluent from a 1,500 gallon septic tank.

The proposed layout of the system calls for the construction of one 10 foot wide x 63-foot long disposal bed. Based on a standard loading rate of 1.0 gallons per day per square foot for settled effluent, this equates into a maximum linear loading rate of 10.0 GPD/LF.

The minimum required separation distance to the seasonal high groundwater table from the bottom of the disposal trench stone to the mounded groundwater table is 3.0 feet. The Performance Based standards call for an unsaturated thickness of 6" below at the toe of the mound fill and at a point 25-feet downgradient of the toe.

Due to the characteristics of the site and the variability of the topography (combination of convex and concave groundwater contours), the effluent plume spreads out from the 63-foot bed to a width of 65 feet at the lower point of analysis 25-feet downgradiant of the toe of the system. The varying hydraulic gradients and depths to SHGWT and varying flow characteristics are addressed in the subsequent analysis.

Analysis
The Darcy based table top analysis of the site utilized a hydraulic permeability of 20 feet per day for the non-platy very fine sandy loam and 15 feet per day for the non-platy loam. This is consistent with the conservative values utilized in the Performance Based approach (see attached soil permeability design table).

The wastewater disposal system was analyzed for compliance at the south center of the system where the convex shape of the groundwater contours represented the worst case scenario of vertical separation to seasonal high groundwater. Groundwater.

The distribution bed was analyzed to demonstrate compliance with the 3-foot separation distance to the induced groundwater level. The attached site plan shows the estimated seasonal high groundwater elevations assigned for the study area (red lines).

The application of the effluent across the bed is presumed to be linear and the resulting loading of the mounded effluent is calculated in the analysis accordingly where the linear loading begins at 0.0 GPD/LF at the east edge and increases to 10.0 GPD/LF at the west end of the bed.

The existing SHGWT elevations are assigned at both the east and west ends of the bed while the reported interior elevation are interpreted.

Based upon the assigned bottom of bed elevation of 416.2 feet (invert = 416.96), the resulting unsaturated thickness due to the effluent mounding is reported. During the design, the bottom of trench elevation is adjusted up to produce the minimum 3.0 foot separation distance or down to minimize the amount of sand required while still satisfying the 3.0 minimum separation distance from the bottom of the trench to the mounded SHGWT.

In determining the compliance at the toe of the system, the additional spread of the effluent plume was taken into account. This created a linear loading rate of (63 ft /65 ft =) 9.7 GPD/LF. For conservative simplicity, the 10.0 GPD/LF linear loading rate was carried forward for this analysis. Here, the depth to the SHGWT was 7.5" which meets the 6" minimum unsaturated standard.

At the point 25-feet downgradient of the system, both ends of the system benefitted from a deeper depth to SHGWT (20") and a steeper hydraulic gradient than the rest of the site. The north end of the site is handicapped by the presence of loam in in the portion of the unsaturated profile at Test Pit 7. For conservative simplicity, the permeability for loam was used throughout the vertical profile at the north end. Additional spread of the effluent plume was not taken into account. For the foregoing reasons, the north end of the system was found to be the controlling location with the calculated unsaturated depth being 13.5" which is greater than the 6" minimum unsaturated standard.

A review of the separation distance to ledge shows that there is a minimum of 43" of unconsolidated materials at the three test pits on the east side of the bed, coupled with the minimum mound sand depth of 22", this mound system readily exceeds the requisite 48" of vertical separation between the trench and ledge.

Summary

The analysis indicates that the proposed mound type system can be placed on this site with the use of a minimum of 22" of mound sand under the bed.

The depth of unsaturated soil at the toe of the system ranges from 7 to 8" which complies with the minimum required 6" depth. The depth of unsaturated soils at the point 25-feet downgradient of the toe ranges from 13.5 to 15" which exceeds the 6" minimum standard on both the east and west ends of the system.

Attachments:

- Hydrogeologic Analysis
- Site Plan of Mound System
- Soil Permeability Table

End of Study

Hinsdale Bean Farm Lot 2 Wastewater System
Hinesburg Road, Charlotte, Vermont

Site: Mound Disposal Site - North End

Calculation Method: Darcy's Law

Q = KiA x 7.48

where Q = Design Flow, or Hydrogeologic Site Capacity
or Q/ft = Design Flow per Linear Foot
i = Hydraulic Gradient
A = L x h = Cross Sectional Area, Sq. Ft.
7.48 = Conversion from Cu. Ft. to Gallons

Parameter	Assigned Value	Units	Notes:
K	20	ft/day	Value for Very Fine Sandy Loam
i	0.072	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.93 Ft

Trench 1 Calculate Trench Bottom Elevations to Provide 3.0 feet of Unsaturated Thickness Below Trench Bottoms.

Trench No.	Gallons per Day Q/ft	Highest Lim. Cond. Elev. Ft	Add Induced GW Mound, Ft.	Elev. SHGWT Plus IGWM, Ft.	Trench Bottom Elev. Calcs. Inv. Elev.	Below Inv.	Bottom Elev.	Unsat. Thickness Below Trench including Induced Mound, Ft.	Comment
East Edge	0	413.2	0.00	413.2	416.96	0.75	416.21	3.01	Okay,3.0' or Greater
	2.50	412.95	0.23	413.2	416.96	0.75	416.21	3.03	Okay,3.0' or Greater
Middle	5.00	412.70	0.46	413.2	416.96	0.75	416.21	3.05	Okay,3.0' or Greater
	7.50	412.45	0.70	413.1	416.96	0.75	416.21	3.06	Okay,3.0' or Greater
West Edge	10.00	412.20	0.93	413.1	416.96	0.75	416.21	3.08	Okay,3.0' or Greater

Check on Predicted Freeboard at Toe of Mound Below Trench

K	20	ft/day	Value for Very Fine Sandy Loam
i	0.146	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.46 Ft

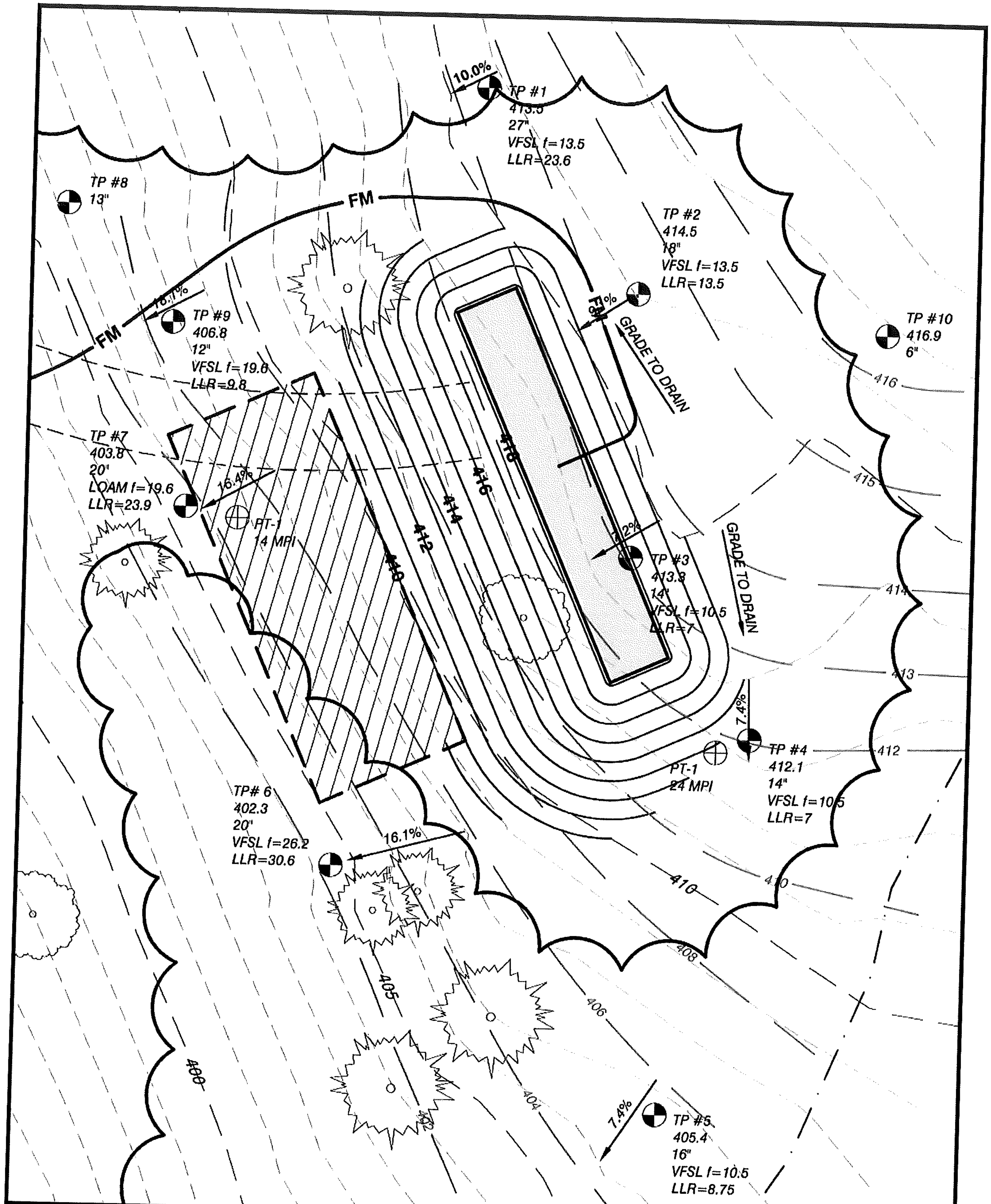
Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
409.8	1.08	408.72	0.46	409.2	0.62	Okay, 0.5' or Greater

Check on Predicted Freeboard 25' downgradient of Toe of Mound

K	15	ft/day	Value for Very Fine Sandy Loam
i	0.161	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 8' wide bed at 1 GPD/SF

Solve for: 25 height of induced groundwater mound (IGWM)
h = 0.55 Ft

Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
405.7	1.67	404.03	0.55	404.6	1.12	Okay, 0.5' or Greater



CIVIL ENGINEERING ASSOCIATES, INC.
10 MANSFIELD VIEW LN., SO. BURLINGTON, VT 05403
802-864-2323 FAX: 802-864-2271

Scale:	1" = 20'	Drawn by	SAL
Date	1/5/18	Checked by	DSM

BEAN FARM
LOT 2 - HYDROSTUDY

CHARLOTTE VERMONT

Project No. 17218

DRAWING

Table 1. Hydraulic Loading Method for Detailed Soil Descriptions in Vermont (2003)

				Hydraulic Loading Rate (gpd/square foot)							
				(Sorted by hydraulic gradient and % ground surface slope range as noted) based on midpoint of slope range							
Soil Texture[1]	Soil Structure[2]		K[3]	0.01	0.03	0.05	0.07	0.09	0.125	0.175	0.25
	Shape	Grade	(ft/day)	0-2%	2.1-4%	4.1-6%	6.1-8%	8.1-10%	10.1-15%	15.1-20%	20.1-30%
(1) Coarse Sand, Sand,		0SG	100	7.5	22.4	37.4	52.4	67.3	93.5	130.9	187.0
Loamy Coarse Sand, Loamy Sand											
(2) Fine Sand, Very Fine Sand,	--	0SG	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
Loamy Fine Sand, Loamy Very Fine Sand											
Coarse Sandy Loam, Loamy Sand											
	--	0M	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
	PL	1	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PL	2,3	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PR/BK/GR	1	40	3.0	9.0	15.0	20.9	26.9	37.4	52.4	74.8
	PR/BK/GR	2,3	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
(3) Fine Sandy Loam, Very Fine Sandy Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
	PR/BK/GR	2,3	30	2.2	6.7	11.2	15.7	20.2	28.1	39.3	56.1
(4) Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	15	1.1	3.4	5.6	7.9	10.1	14.0	19.6	28.1
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(5) Silt Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(6) Sandy Clay Loam, Clay Loam, Silty Clay Loam	--	0M	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	8	0.6	1.8	3.0	4.2	5.4	7.5	10.5	15.0
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
(7) Sandy Clay, Clay, Silty Clay	--	0M	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PL	1,2,3	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PR/BK/GR	1	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7

Note: 1. Soil texture and structure columns are based on Tyler and Kuns (2000).

2. Structure Abbreviations: Shapes: PL = platy; BK = blocky; PR = prismatic; GR = granular

Grade: 0 = structureless; SG = single grain; M = massive; 1 = weak; 2 = moderate; 3 = strong

3. K = hydraulic conductivity (estimated)

VT DEC, 2003.

CIVIL ENGINEERING ASSOCIATES, INC.
10 Mansfield View Lane
South Burlington, VT 05403
Phone: 802-864-2323
Fax: 802-864-2271
Email: dmarshall@cea-vt.com

STATE OF VERMONT
DAVID S. MARSHALL
No. 6019
CIVIL
REGISTERED
PROFESSIONAL ENGINEER

Hydrogeologic Study
Hinsdale Lot 3 Wastewater Disposal System

December 28, 2017

The proposed mound type wastewater disposal system has a design disposal capacity of 490 gallons per day in support of a 4-bedroom single family home. As the applicant has proposed to recognize the varying slopes and soil types within the vertical profile in the design area, a Hydrogeologic study is required to be completed.

Existing Conditions

The existing site is generally comprised of a fine to very fine sandy loam over a loam and silt loam or bedrock substratum. Test pitting information is depicted on Sheet C3.1 and is based on the work completed Civil Engineering Associates in March and May, 2014 and overseen by Spencer Harris on behalf of the Town of Charlotte.

The depth to seasonal high groundwater was interpolated between these points to determine the existing seasonal high groundwater contours and project specific points.

Depths to seasonal high groundwater vary within the site and are generally summarized below.

Under Trench	12" to 13"
Toe of Fill	14" to 22"
25' below Toe	13" (north end) to 24" (south end)

The hydraulic gradients, based upon the SHGWT elevations generally are summarized as follows:

Under Trench	12.5% (shallowest slope at north end)
From Trench to Toe	15.6% (shallowest slope at north end)
From Toe to 25-ft	8.5% (shallowest slope at south end)

The existing surface grade and interpreted SHGHT elevation (red hatch) have been added to the attached site plan mark-up of the system area (one over the other). The estimate SGWT elevation contours are shown in red solid line. The calculated slopes are also shown on the plan as red highlighted arrows with the noted gradient over the length of the arrow (red hatch). The estimated spread of the effluent plume is shown with the brown long dashed lines.

Design Requirements
The proposed disposal trench will receive standard settled effluent from a 1,000 gallon septic tank.

The proposed layout of the system calls for the construction of one 7.7 foot wide x 59-foot long disposal bed. Based on a standard loading rate of 1.0 gallons per day per square foot for settled effluent, this equates into a maximum linear loading rate of 10.0 GPD/LF.

The minimum required separation distance to the seasonal high groundwater table from the bottom of the disposal trench stone to the mounded groundwater table is 3.0 feet. The Performance Based standards call for an unsaturated thickness of 6" below at the toe of the mound fill and at a point 25-feet downgradient of the toe.

Due to the characteristics of the site and the variability of the topography (slightly concave groundwater contours), the effluent plume concentrates from the 64-foot bed to a width of 54 feet at the lower point of analysis 25-feet downgradiant of the toe of the system. The varying hydraulic gradients and depths to SHGWT and varying flow characteristics are addressed in the subsequent analysis.

Analysis
The Darcy based table top analysis of the site utilized a hydraulic permeability of 20 feet per day for the non-platy fine or very fine sandy loam. This is consistent with the conservative values utilized in the Performance Based approach (see attached soil permeability design table).

The wastewater disposal system was analyzed for compliance on both the west and east ends of the system. This was undertaken as a factor of safety to address the variation in the topography from one side to the other.

The distribution bed was analyzed to demonstrate compliance with the 3-foot separation distance to the induced groundwater level. The attached site plan shows the estimated seasonal high groundwater elevations assigned for the study area (red lines).

The application of the effluent across the bed is presumed to be linear and the resulting loading of the mounded effluent is calculated in the analysis accordingly where the linear loading begins at 0.0 GPD/LF at the east edge and increases to 10.0 GPD/LF at the west end of the bed.

The existing SHGWT elevations are assigned at both the east and west ends of the bed while the reported interior elevation are interpreted.
Based upon the assigned bottom of bed elevation of 401.2 feet (invert = 401.96), the resulting unsaturated thickness due to the effluent mounding is reported. During the

design, the bottom of trench elevation is adjusted up to produce the minimum 3.0 foot separation distance or down to minimize the amount of sand required while still satisfying the 3.0 minimum separation distance from the bottom of the trench to the mounded SHGWT.

This exercise is repeated for both the south and north analysis points until all of the separation distance conditions are met.

In determining the compliance at the toe of the system, the additional spread of the effluent plume was taken into account. This created a linear loading rate of 490 GPD/ 62 ft 7.9 GPD/LF. In this case, the north end was found to be the controlling location due to the shallower depth to SHGWT. Here, the depth to the mounded SHGWT was 9" which readily met the 6" minimum unsaturated standard.

At the point 25-feet downgradient of the system, the north end was hampered by a shallower depth to SHGWT (13") while the south end had a shallower hydraulic gradient than the remaining portions of the toe. The consolidated spread of the effluent plume was taken into account. At this location the linear loading rate was 490 GPD/ 55 ft = 8.9 GPD/LF. The north end of the system was found to be the controlling location with the calculated unsaturated depth being 0.50' which meets the 6" minimum unsaturated standard.

A review of the separation distance to ledge shows that there is 18" of unconsolidated soils over bedrock beyond the south end of the bed. This was the worst case situation and was carried forward in the design. Based on this information, a minimum mound sand depth of 30" is required for this mound system in order to meet the requisite 48" of vertical separation between the bed and ledge.

Summary

The analysis indicates that the proposed mound type system can be placed on this site with the use of a minimum of 30" of mound sand under the bed.

The depth of unsaturated soil at the toe of the system ranges from 9" to 17" which complies with the minimum required 6" depth. The depth of unsaturated soils at the point 25-feet downgradient of the toe ranges from 6" to 17" which meets the 6" minimum standard on both the east and west ends of the system.

Attachments:

- North End Hydrogeologic Analysis
- South End Hydrogeologic Analysis
- Site Plan of Mound System
- Soil Permeability Table

End of Study

Hinsdale Bean Farm Lot 3 Wastewater System
Hinesburg Road, Charlotte, Vermont

Site: Mound Disposal Site - North End

Calculation Method: Darcy's Law

Q = KiA x 7.48

where Q = Design Flow, or Hydrogeologic Site Capacity
or Q/ft = Design Flow per Linear Foot
i = Hydraulic Gradient
A = L x h = Cross Sectional Area, Sq. Ft.
7.48 = Conversion from Cu. Ft. to Gallons

Parameter	Assigned Value	Units	Notes:
K	20	ft/day	Value for Very Fine Sandy Loam
i	0.125	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	7.66	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.41 Ft

Trench 1 Calculate Trench Bottom Elevations to Provide 3.0 feet of Unsaturated Thickness Below Trench Bottoms.

Trench No.	Gallons per Day Q/ft	Highest Lim. Cond. Elev. Ft	Add Induced GW Mound, Ft.	Elev. SHGWT Plus IGWM, Ft.	Trench Bottom Elev. Calcs.			Unsat. Thickness Below Trench including Induced Mound, Ft.	Comment
					Inv. Elev.	Below Inv.	Bottom Elev.		
East Edge	0	397.7	0.00	397.7	401.96	0.75	401.21	3.51	Okay,3.0' or Greater
	1.91	397.40	0.10	397.5	401.96	0.75	401.21	3.71	Okay,3.0' or Greater
Middle	3.83	397.10	0.20	397.3	401.96	0.75	401.21	3.91	Okay,3.0' or Greater
	5.74	396.80	0.31	397.1	401.96	0.75	401.21	4.10	Okay,3.0' or Greater
West Edge	7.66	396.50	0.41	396.9	401.96	0.75	401.21	4.30	Okay,3.0' or Greater

Check on Predicted Freeboard at Toe of Mound Below Trench

K	20	ft/day	Value for Very Fine Sandy Loam
i	0.156	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	7.90	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.34 Ft

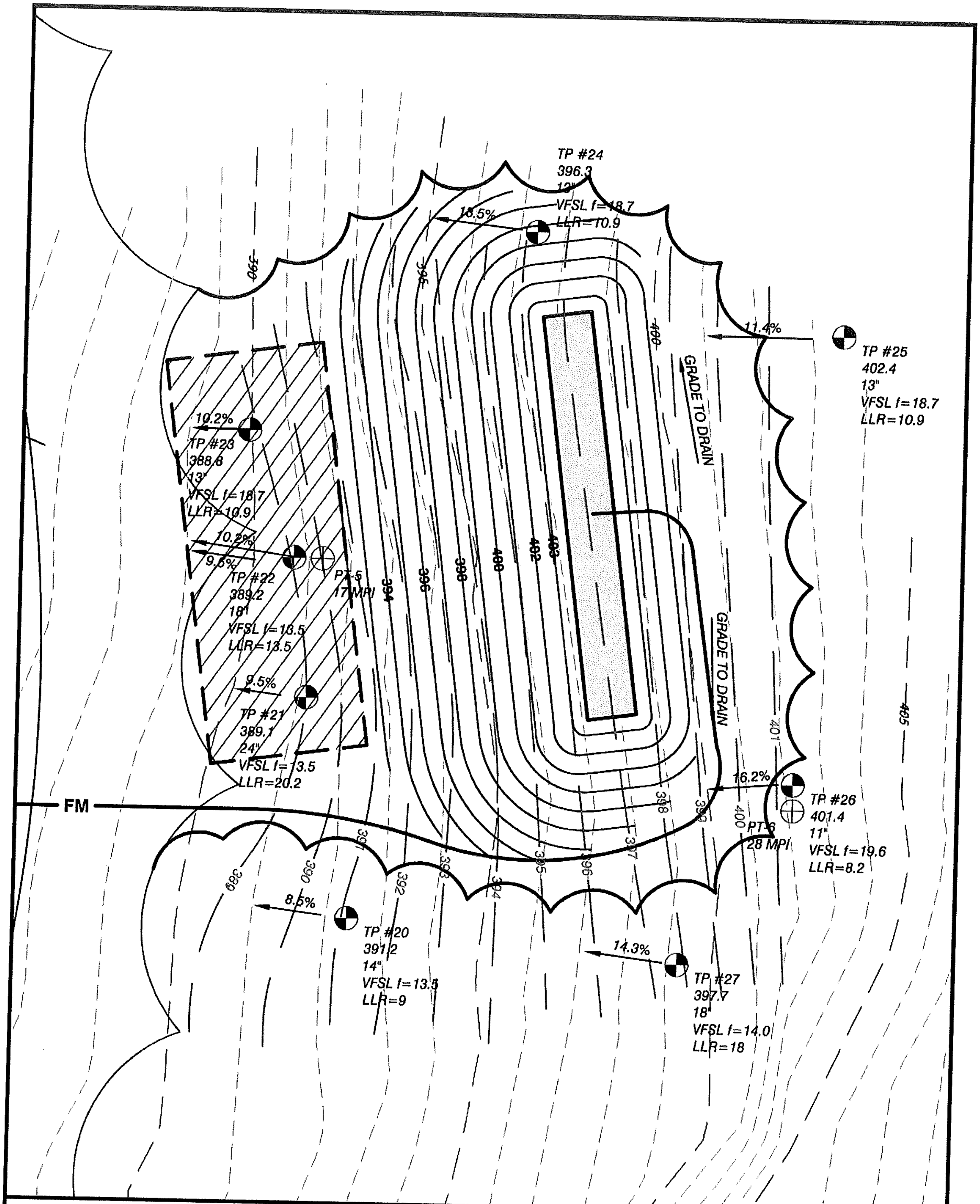
Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
391.5	1.08	390.42	0.34	390.8	0.74	Okay, 0.5' or Greater

Check on Predicted Freeboard 25' downgradient of Toe of Mound

K	20	ft/day	Value for Very Fine Sandy Loam
i	0.102	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	8.91	gpd/lf	Design Flow - One 8' wide bed at 1 GPD/SF

Solve for: 25 height of induced groundwater mound (IGWM)
h = 0.58 Ft

Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
388.8	1.08	387.72	0.58	388.3	0.50	Okay, 0.5' or Greater



CIVIL ENGINEERING ASSOCIATES, INC.
10 MANSFIELD VIEW LN., SO. BURLINGTON, VT 05403
802-864-2323 FAX: 802-864-2271

BEAN FARM

LOT 3 - HYDROSTUDY

CHARLOTTE VERMONT

Scale:	1" = 20'	Drawn by	SAL
Date	1/5/18	Checked by	DSM

Project No. 17218

DRAWING

Table 1. Hydraulic Loading Method for Detailed Soil Descriptions in Vermont (2003)

Soil Texture[1]	Soil Structure[2] Shape	Soil Structure[2] Grade	K[3] (ft/day)	Hydraulic Loading Rate (gpd/square foot) (Sorted by hydraulic gradient and % ground surface slope range as noted) based on midpoint of slope range: 0.01, 0-2%	0.03, 2.1-4%	0.05, 4.1-6%	0.07, 6.1-8%	0.09, 8.1-10%	0.125, 10.1-15%	0.175, 15.1-20%	0.25, 20.1-30%
(1) Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand		0SG	100	7.5	22.4	37.4	52.4	67.3	93.5	130.9	187.0
(2) Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	--	0SG	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
Coarse Sandy Loam, Loamy Sand											
	--	0M	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
	PL	1	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PL	2,3	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PR/BK/GR	1	40	3.0	9.0	15.0	20.9	26.9	37.4	52.4	74.8
	PR/BK/GR	2,3	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
(3) Fine Sandy Loam, Very Fine Sandy Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
	PR/BK/GR	2,3	30	2.2	6.7	11.2	15.7	20.2	28.1	39.3	56.1
(4) Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	15	1.1	3.4	5.6	7.9	10.1	14.0	19.6	28.1
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(5) Silt Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(6) Sandy Clay Loam, Clay Loam, Silty Clay Loam	--	0M	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	8	0.6	1.8	3.0	4.2	5.4	7.5	10.5	15.0
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
(7) Sandy Clay, Clay, Silty Clay	--	0M	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PL	1,2,3	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PR/BK/GR	1	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7

Note: 1. Soil texture and structure columns are based on Tyler and Kuns (2000).

2. Structure Abbreviations: Shapes: PL = platy; BK = blocky; PR = prismatic; GR = granular
Grade: 0 = structureless; SG = single grain; M = massive; 1 = weak; 2 = moderate; 3 = strong

3. K = hydraulic conductivity (estimated)

VT DEC, 2003.

CIVIL ENGINEERING ASSOCIATES, INC.
10 Mansfield View Lane
South Burlington, VT 05403
Phone: 802-864-2323
Fax: 802-864-2271
Email: dmarshall@cea-vt.com

STATE OF VERMONT
DAVID S. MARSHALL
No. 6019
CIVIL
REGISTERED
PROFESSIONAL ENGINEER

Hydrogeologic Study
Hinsdale Lot 2-3 Replacement Wastewater Disposal System

December 29, 2017

The proposed mound type wastewater disposal system has a design disposal capacity of 490 gallons per day in support of a 4-bedroom single family home. As the applicant has proposed to recognize the varying slopes and soil types within the vertical profile in the design area, a Hydrogeologic study is required to be completed.

Existing Conditions

The existing site is generally comprised of a fine to very fine sandy loam over a loam and silt loam or bedrock substratum. Test pitting information is depicted on Sheet C3.2 and is based on the work completed Civil Engineering Associates in March and May, 2014 and overseen by Spencer Harris on behalf of the Town of Charlotte.

The depth to seasonal high groundwater was interpolated between these points to determine the existing seasonal high groundwater contours and project specific points.

Depths to seasonal high groundwater vary within the site and are generally summarized below.

Under Trench	13"
Toe of Fill	16"
25' below Toe	16"

The hydraulic gradients, based upon the SHGWT elevations generally are summarized as follows:

Under Trench	15.4% (shallowest slope at north end)
From Trench to Toe	13.3% (shallowest slope at north end)
From Toe to 25-ft	13.3% (shallowest slope at north end)

The existing surface grade and interpreted SHGHT elevation (red hatch) have been added to the attached site plan mark-up of the system area (one over the other). The estimate SGWT elevation contours are shown in red solid line. The calculated slopes are also shown on the plan as red highlighted arrows with the noted gradient over the length of the arrow (red hatch). The estimated spread of the effluent plume is shown with the brown long dashed lines.

Design Requirements
The proposed disposal trench will receive standard settled effluent from a 1,000 gallon septic tank.

The proposed layout of the system calls for the construction of one 10 foot wide x 49-foot long disposal bed. Based on a standard loading rate of 1.0 gallons per day per square foot for settled effluent, this equates into a maximum linear loading rate of 10.0 GPD/LF.

The minimum required separation distance to the seasonal high groundwater table from the bottom of the disposal trench stone to the mounded groundwater table is 3.0 feet. The Performance Based standards call for an unsaturated thickness of 6" below at the toe of the mound fill and at a point 25-feet downgradient of the toe.

Due to the characteristics of the site (consistent topography), the effluent plume width does not vary appreciably from the 49-foot wide distribution bed. The varying hydraulic gradients and depths to SHGWT and varying flow characteristics are addressed in the subsequent analysis.

Analysis
The Darcy based table top analysis of the site utilized a hydraulic permeability of 20 feet per day for the non-platy fine or very fine sandy loam. The presence of loam in Test Pit 34 does not impact the hydraulic performance of the system as it is located outside of the travel path of the effluent plume. This K values are consistent with the conservative values utilized in the Performance Based approach (see attached soil permeability design table).

Based on the generally consistent site soil and depth to SHGWT characteristics, the wastewater disposal system was analyzed for compliance along the center portions of the system.

The distribution bed was analyzed to demonstrate compliance with the 3-foot separation distance to the induced groundwater level. The attached site plan shows the estimated seasonal high groundwater elevations assigned for the study area (red lines).

The application of the effluent across the bed is presumed to be linear and the resulting loading of the mounded effluent is calculated in the analysis accordingly where the linear loading begins at 0.0 GPD/LF at the east edge and increases to 10.0 GPD/LF at the west end of the bed.

The existing SHGWT elevations are assigned at both the east and west ends of the bed while the reported interior elevation are interpreted.

Based upon the assigned bottom of bed elevation of 410.2 feet (invert = 410.96), the resulting unsaturated thickness due to the effluent mounding is reported. During the design, the bottom of trench elevation is adjusted up to produce the minimum 3.0 foot separation distance or down to minimize the amount of sand required while still satisfying the 3.0 minimum separation distance from the bottom of the trench to the mounded SHGWT.

This exercise is repeated for both the south and north analysis points until all of the separation distance conditions are met.

In determining the compliance at the toe of the system, with the understanding that the plume width remained consistent with the width the bed, the slopes and depths to the SHGWT were reviewed. In this case, the north end was found to be the controlling location due to the shallower slope. Here, the depth to the mounded SHGWT was 10" which exceeds the 6" minimum unsaturated standard.

At the point 25-feet downgradient of the system, the north end was hampered by a slightly shallower hydraulic gradient. As such, the north end of the system was found to be the controlling location with the calculated unsaturated depth being 0.82' which is greater than the 6" minimum unsaturated standard.

A review of the separation distance to ledge shows that there is 23" of unconsolidated soils over bedrock at Test Pit 31. Based on this information, a minimum mound sand depth of 25" is required for this mound system in order to meet the requisite 48" of vertical separation between the bed and ledge.

Summary

The analysis indicates that the proposed mound type system can be placed on this site with the use of a minimum of 25" of mound sand under the bed.

The depth of unsaturated soil at the toe of the system is 10" which complies with the minimum required 6" depth. The depth of unsaturated soils at the point 25-feet downgradient of the toe is also 10" which exceeds the 6" minimum standard on both the east and west ends of the system.

Attachments:

- Hydrogeologic Analysis
- Site Plan of Mound System
- Soil Permeability Table

End of Study

Hinsdale Bean Farm Lot 3 Replacement Area Wastewater System
Hinesburg Road, Charlotte, Vermont

Site: Mound Disposal Site - Center

Calculation Method: Darcy's Law

Q = KiA x 7.48

where Q = Design Flow, or Hydrogeologic Site Capacity
or Q/ft = Design Flow per Linear Foot
i = Hydraulic Gradient
A = L x h = Cross Sectional Area, Sq. Ft.
7.48 = Conversion from Cu. Ft. to Gallons

Parameter	Assigned Value	Units	Notes:
K	20	ft/day	Value for Very Fine Sandy Loam
i	0.154	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.43 Ft

Trench 1 Calculate Trench Bottom Elevations to Provide 3.0 feet of Unsaturated Thickness Below Trench Bottoms.

Trench No.	Gallons per Day Q/ft	Highest Lim. Cond. Elev. Ft	Add Induced GW Mound, Ft.	Elev. SHGWT Plus IGWM, Ft.	Trench Bottom Elev. Calcs. Inv. Elev.	Below Inv.	Bottom Elev.	Unsat. Thickness Below Trench Including Induced Mound, Ft.	Comment
East Edge	0	405.2	0.00	405.2	409.05	0.75	408.3	3.10	Okay,3.0' or Greater
	2.50	404.70	0.11	404.8	409.05	0.75	408.3	3.49	Okay,3.0' or Greater
Middle	5.00	404.20	0.22	404.4	409.05	0.75	408.3	3.88	Okay,3.0' or Greater
	7.50	403.70	0.33	404.0	409.05	0.75	408.3	4.27	Okay,3.0' or Greater
West Edge	10.00	403.20	0.43	403.6	409.05	0.75	408.3	4.67	Okay,3.0' or Greater

Check on Predicted Freeboard at Toe of Mound Below Trench

K	20	ft/day	Value for Very Fine Sandy Loam
i	0.133	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 10' wide bed at 2 GPD/SF

Solve for: h = height of induced groundwater mound (IGWM)
h = 0.50 Ft

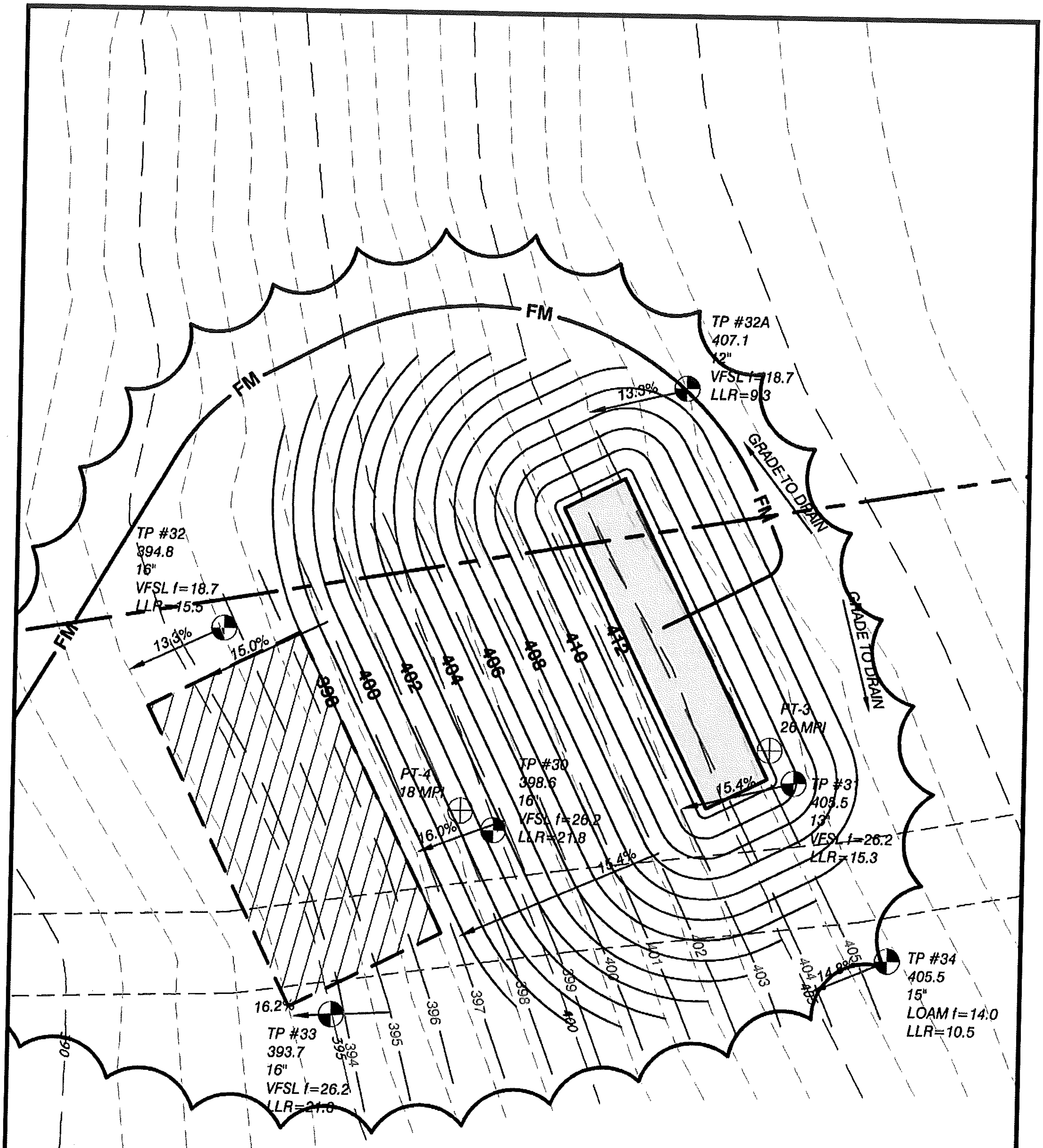
Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
398	1.33	396.67	0.50	397.2	0.83	Okay, 0.5' or Greater

Check on Predicted Freeboard 25' downgradient of Toe of Mound

K	20	ft/day	Value for Very Fine Sandy Loam
i	0.133	ft/ft	Hydraulic Gradient (Slope of Limiting Conditions)
A	1	Ft	Calculate using Linear Loading Rate
Des Q	10.00	gpd/lf	Design Flow - One 8' wide bed at 1 GPD/SF

Solve for: 25 height of induced groundwater mound (IGWM)
h = 0.50 Ft

Elev. Toe., Ft.	(B) Depth to SHGWT, Ft.	Lim. Cond. at Toe. Elev., Ft.	(D) Add Induced GW Mound, (ft.)	Elev. SHGWT Plus IGWM, Ft.	Predicted Freeboard (Col B- Col D), Ft.	Comment
393.7	1.33	392.37	0.50	392.9	0.83	Okay, 0.5' or Greater



CIVIL ENGINEERING ASSOCIATES, INC. 10 MANSFIELD VIEW LN., SO. BURLINGTON, VT 05403 802-864-2323 FAX: 802-864-2271 Scale: 1" = 20' Drawn by SAL Date 1/5/18 Checked by DSM	BEAN FARM LOT 3 - REPLACEMENT - HYDROSTUDY CHARLOTTE VERMONT	Project No. 17218 DRAWING

Table 1. Hydraulic Loading Method for Detailed Soil Descriptions in Vermont (2003)

Soil Texture[1]	Soil Structure[2] Shape	Soil Structure[2] Grade	K[3] (ft/day)	Hydraulic Loading Rate (gpd/square foot) (Sorted by hydraulic gradient and % ground surface slope range as noted) based on midpoint of slope range: 0.01 0-2%	0.03 2.1-4%	0.05 4.1-6%	0.07 6.1-8%	0.09 8.1-10%	0.125 10.1-15%	0.175 15.1-20%	0.25 20.1-30%
(1) Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand		0SG	100	7.5	22.4	37.4	52.4	67.3	93.5	130.9	187.0
(2) Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	--	0SG	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
Coarse Sandy Loam, Loamy Sand											
	--	0M	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
	PL	1	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PL	2,3	25	1.9	5.6	9.4	13.1	16.8	23.4	32.7	46.8
	PR/BK/GR	1	40	3.0	9.0	15.0	20.9	26.9	37.4	52.4	74.8
	PR/BK/GR	2,3	50	3.7	11.2	18.7	26.2	33.7	46.8	65.5	93.5
(3) Fine Sandy Loam, Very Fine Sandy Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
	PR/BK/GR	2,3	30	2.2	6.7	11.2	15.7	20.2	28.1	39.3	56.1
(4) Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	1	15	1.1	3.4	5.6	7.9	10.1	14.0	19.6	28.1
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(5) Silt Loam	--	0M	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
	PR/BK/GR	2,3	20	1.5	4.5	7.5	10.5	13.5	18.7	26.2	37.4
(6) Sandy Clay Loam, Clay Loam, Silty Clay Loam	--	0M	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PL	1,2,3	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	1	8	0.6	1.8	3.0	4.2	5.4	7.5	10.5	15.0
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7
(7) Sandy Clay, Clay, Silty Clay	--	0M	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PL	1,2,3	3	0.2	0.7	1.1	1.6	2.0	2.8	3.9	5.6
	PR/BK/GR	1	5	0.4	1.1	1.9	2.6	3.4	4.7	6.5	9.4
	PR/BK/GR	2,3	10	0.7	2.2	3.7	5.2	6.7	9.4	13.1	18.7

Note: 1. Soil texture and structure columns are based on Tyler and Kuns (2000).
2. Structure Abbreviations: Shapes: PL = platy; BK = blocky; PR = prismatic; GR = granular
Grade: 0 = structureless; SG = single grain; M = massive; 1 = weak; 2 = moderate; 3 = strong
3. K = hydraulic conductivity (estimated)

VT DEC, 2003.

Hinsdale Bean Farm Lot 2
Charlotte, Vermont

Pump Station Basis of Design

Design Flow	630 GPD
Infiltration	0 GPD
20% Municipal Credit	0
Total Design Flow	630 GPD
Average Daily Flow	0.66 GPM
Peaking Factor	5.00
Peak Flow	3.28 GPM
Required Storage	630 gallons
Storage Provided	650 gallons
Force Main Dia.	1.50 Inches
Min. Cleansing Velocity	2.00 FPS
Min. Pumping Rate	11.01 GPM
Chosen Pumping rate	33.00 GPM
Length of FM to Mound	165.00 feet
Friction Losses to Mound	14.64 feet
High Point of FM in Mound	416.96 feet
Low Elevation in PS	390.60 feet
Elevation Change	26.36 feet
Minor headlosses	3.00 feet
Residual	3.00 feet
TDH	47.00 feet
Pump Cycle Storage	100 Gallons
Run Cycle	4.52 Minutes
Wet Well Detention Time	152.38 Minutes

System Curve

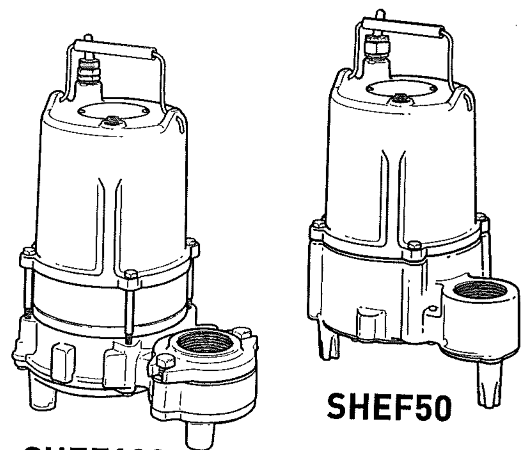
GPM	TDH
25.0	41.10
30.0	44.60
35.0	48.70
40.0	53.30
45.0	58.40
50	64.00

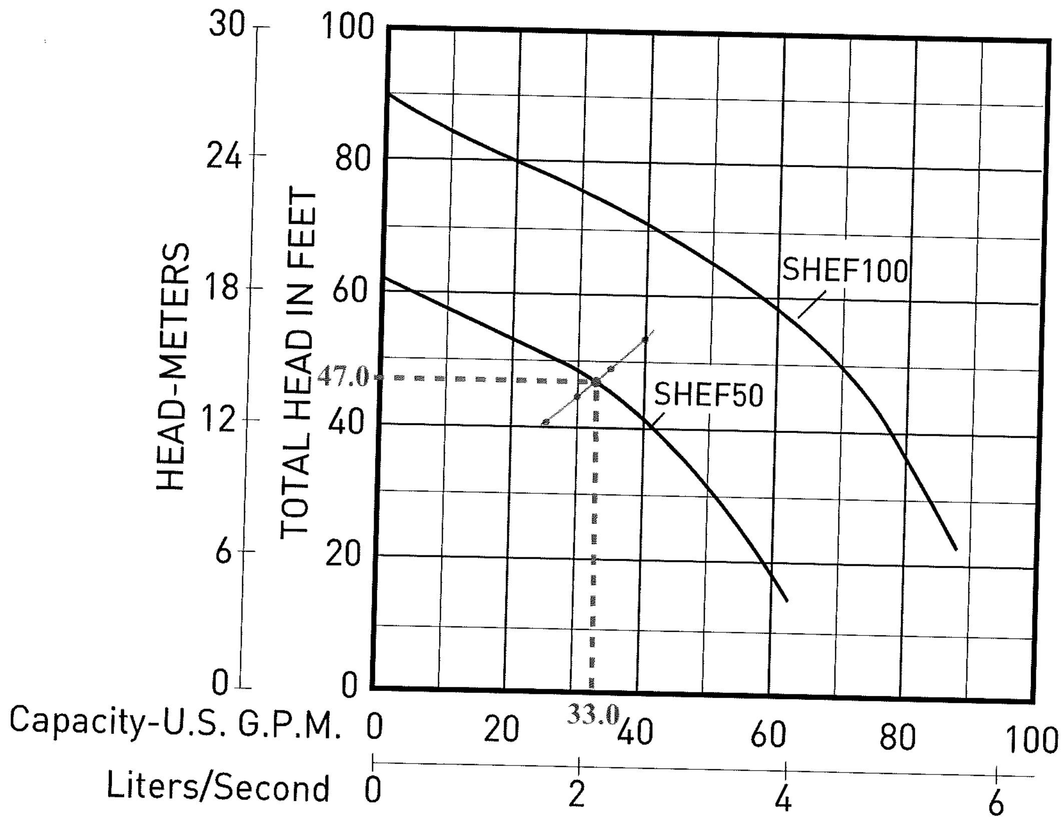
Pump Selection Hydromatic, SHEF 50, 230 v, 60 Hz, 5/10 HP

HYDROMATIC®
SHEF50/100
SUBMERSIBLE HIGH HEAD EFFLUENT

PERFORMANCE DATA

Wholesale Products **Page:** 6370-1
Dated: January 2001
RPM: **3450** Discharge: **2"** Solids: ¾"





The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

PENTAIR

Conditions of Service:

GPM:______ **TDH:**______

Wastewater Disposal System Design
Hinsdale Bean Farm Lot 2 Mound Site
26-Dec-17

630 GPD Bedrooms = 6
0 GPD 1-BR Apartment
630 Design Flow (GPD)
0.66 Average Daily Flow (GPM)

10.0 Allowable application per linear foot (GPD/LF)
63 Linear feet of Trench Required (FT)
63 Equivalent Linear feet of Trench Proposed (FT)

Dosing Requirements

1.5 Diameter of Distribution Pipe (Inches)
3 Number of Distribution Pipes
59 Length of Distribution Pipe (FT)
5 Distribution System Volume (Gallons)
5.00 Required Dose Volume Factor
27 Required Minimum Dose Volume (Gallons)
4.00 Minimum Required Doses per Day
158 Maximum Dose Allowed (Gallons)
100.00 Chosen Dose Volume (Gallons)
5.00 Recommended Pumping Duration per Dose (Minutes)
20.00 Recommended Pumping Rate w/o Inflow (GPM)
20.66 Recommended Pumping Rate with Inflow (GPM)
33.00 Chosen Flow Rate (GPM)

Distribution Requirements

10 Trench width (FT)
630 Total Trench Area (SF)
25 Maximum Area per orifice Hole (SF)
25 Required Number of Orifice Holes
27 Number of Orifice Holes Proposed
0.74 Avg. Flow per Orifice (GPM)

419.96 Effluent Elevation Head

TRENCH 1

27 Total # of orifices
630 Total Design Flow (GPD)
63 Total Length of Trench (FT)

33.0 Chosen Design Flow (GPM)
34.45 Total Actual Design Flow (GPM)
4.22% Percent Delta from Design

Hinsdale Bean Farm Lot 2
Mound Distribution System Design
26-Dec-17

1	Maximum Allowable application Rate per Square Foot (GPD/SF)
33.0	Design Pumping Rate to Entire Field (GPM)
630	Total Design Flow to Site (GPD)
1	Number of Trenches/Beds
416.96	Invert Elevation
Trench 1 (Bed)	
9	Depth of Stone (inches)
1	Application Rate per Square Foot
63	Length of Section
630	Design Flow (GPD)
33.00	Design Flow (GPM)
25	Required Number of Orifices
Orifice Design	
0.125	Diameter of orifice (Inches)
0	Number of orifices
3	Residual pressure (FT)
0.32	Design Flow per head (GPM)
0.00	Subtotal flow (GPM)
0.1875	Diameter of orifice (Inches)
0	Number of orifices
3	Residual pressure (FT)
0.72	Design Flow per head (GPM)
0.00	Subtotal flow (GPM)
0.25	Diameter of orifice (Inches)
27	Number of orifices
3	Residual pressure (FT)
1.28	Design Flow per head (GPM)
34.45	Subtotal flow (GPM)
27	Total # of orifices
25	Required Number of Orifice Holes
34.45	Total Flow
33.00	Total Rec. Design Flow This Trench (GPM)
4.41%	Percent Delta from Design
61	Length of Distribution Pipe (FT)
7.25	Spacing of orifice holes (FT)

PENTAIR

SHEF100 Shown

HYDROMATIC® SHEF50/100
SUBMERSIBLE HIGH HEAD EFFLUENT PUMPS

WWW.HYDROMATIC.COM

SHEF50/100

Submersible High Head Effluent Pumps

Applications:

- Septic Tank Effluent
- High Head Sump
- Dewatering

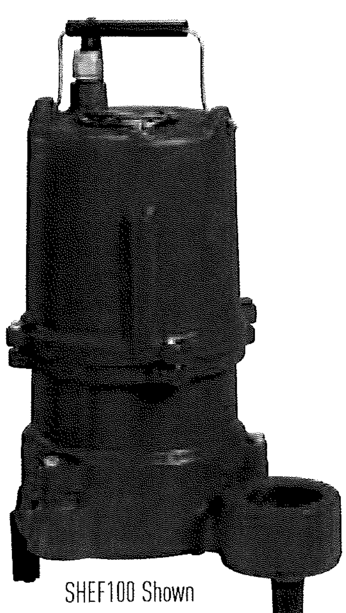
SHEF100 Features:

- 1 HP
- 208-230 voltage (1ø) 208-230/460, 575 voltage (3ø)
- 2" discharge
- 3/4" solids handling
- Capacities to 87 GPM
- Heads to 90 feet
- Automatic or manual models

SHEF50 Features:

- 1/2 HP
- 115/208-230 dual voltage (1ø) 208-230/460, 575 voltage (3ø)
- 2" discharge
- 3/4" solids handling
- Capacities to 63 GPM
- Heads to 63 feet
- Automatic or manual models

SHEF50 Shown



SHEF100 Shown

The HYDROMATIC® SHEF50/100 submersible pumps are specifically designed to meet the demands of residential high head septic tank effluent or sump applications. The 2 inch NPT discharge pumps feature an energy-efficient 1/2 or 1 horsepower motor, automatic and manual versions, and a wide variety of voltages including dual voltage 208-230 volt single and three phase. The SHEF50 can handle capacities up to 63 gallons per minute and heads to 63 feet. The SHEF100 can handle capacities up to 87 gallons per minute and heads to 90 feet.

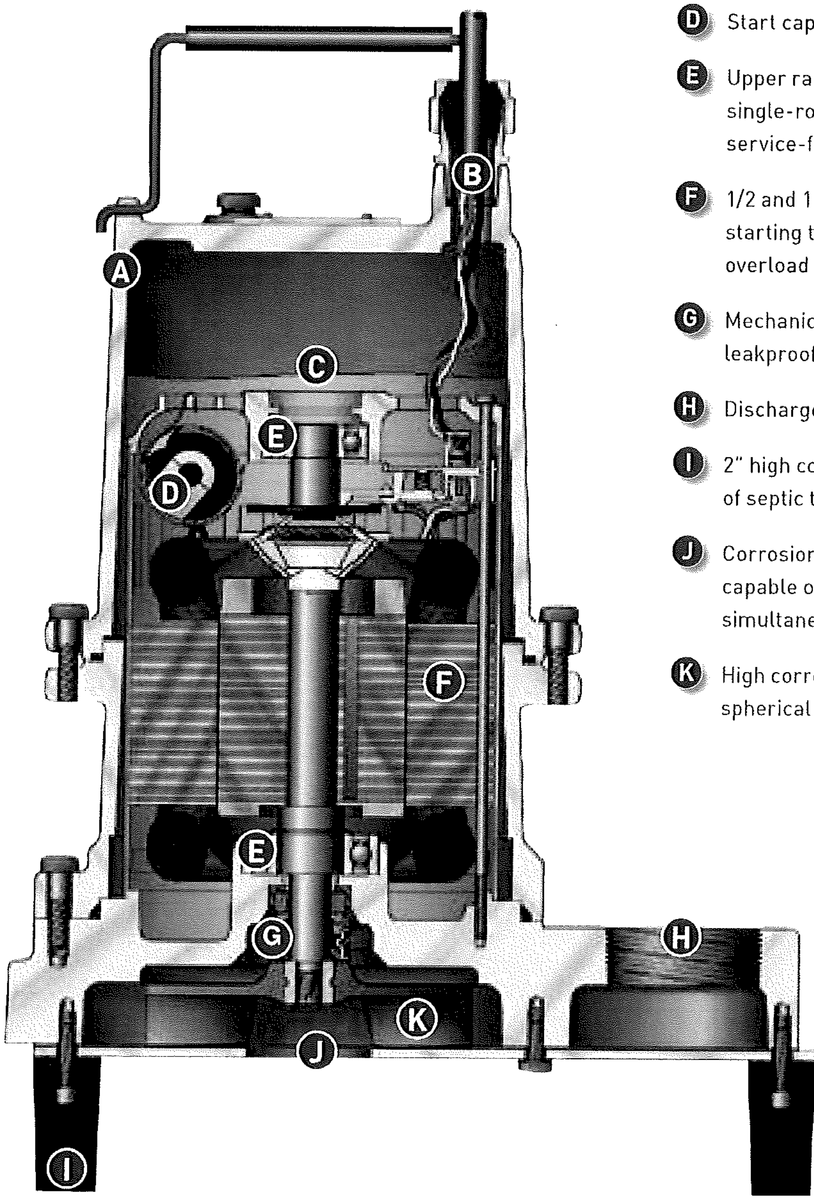
The SHEF50/100 features a heavy-duty cast iron construction that provides durability for a long service life, as well as dissipating heat from the motor for cooler operation. All fasteners are stainless steel for corrosion resistance. The pump's semiopen, nonclog design impeller passes 3/4" (spherical) solids and is made from a super tough engineered plastic that provides the highest level of corrosion resistance and the toughness to withstand the impact of solid materials. The impeller, molded to a bronze insert, also features pump-out vanes to preclude material from building up around the shaft and seal. The pump's unique (patent pending) nonclog design baseplate has an electrostatically applied polyester coating for corrosion resistance and provides a strainer-free inlet capable of passing two (2), 3/4" (spherical) solids simultaneously. The inlet area is raised off the bottom of the septic tank or sump basin by the pump's 2" high legs constructed of engineered thermoplastic material for maximum corrosion resistance.

The SHEF50/100's oil-filled motor provides superior cooling characteristics, allowing the motor to run cool and quiet. The oil-filled design also provides permanent lubrication of the shaft bearings, minimizing maintenance and extending the service life of the pump. The oil-filled motor design allows for even heat dissipation. On single phase models the windings feature a built-in thermal overload that resets automatically.

Automatic models feature an easily adjustable wide-angle float switch, incorporating a unique piggyback plug arrangement. This plug allows for simple conversion to manual operation by simply removing the switch plug and inserting the pump's motor plug into the electrical outlet. This feature provides an easy way of periodically cycling the pump to ensure it is operating properly.

SHEF50/100

The SHEF50/100 are completely submersible "high head" pumps for use in residential septic tank effluent pumping applications and are available in automatic and manual configuration. Automatic models feature a wide-angle float switch with piggyback plug-in arrangements. Switch is adjustable, easy to service and allows for simple conversion to manual operations.



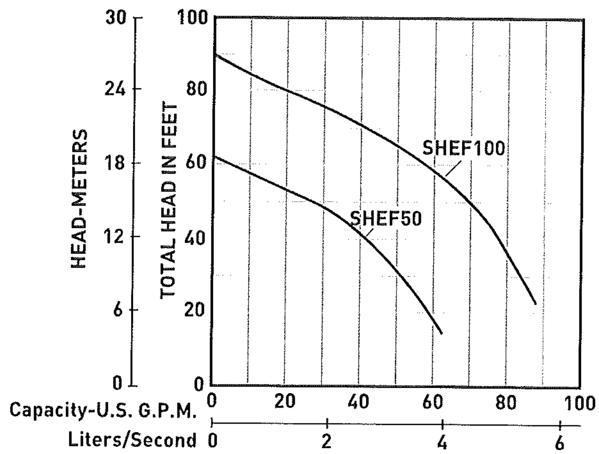
- **A** High quality cast iron construction of pump volute, motor housing and seal housing provides long life.
- **B** Water resistant power cord has a compression fit connection and an epoxy potting for double protection against water entry. Lengths of 20 and 30 feet are available with molded plugs, depending on model variations.
- **C** Oil-filled motor provides superior cooling and permanent lubrication of bearings, minimizing maintenance and extending service life.
- **D** Start capacitor 1ø models only.
- **E** Upper radial- and lower thrust bearings are heavy-duty, single-row ball bearings that are permanently lubricated for service-free life.
- **F** 1/2 and 1 HP capacitor-start (1ø) motors provide maximum starting torque. Motor windings contain automatic thermal overload protection (1ø).
- **G** Mechanical shaft seal is carbon and ceramic-faced for long leakproof life.
- **H** Discharge is standard 2" NPT.
- **I** 2" high corrosion-resistant legs raise pump's inlet from bottom of septic tank pump chamber.
- **J** Corrosion-resistant, nonclog base with strainer-free inlet capable of passing two (2), 3/4" diameter spherical solids simultaneously.
- **K** High corrosion-resistant, nonclog impeller passes two (2), 3/4" spherical solids.

SHEF50/100

PUMP CHARACTERISTICS

Pump/Motor Unit	Submersible				
Manual Models (50)	M1	M2	M3	M4	M5
Automatic Models	A1	A2	-	-	-
Horsepower	1/2				
Full Load Amps	14.5	7.6/7.1	3.2/3.1	1.6	1.2
Motor Type	Capacitor Start				
R.P.M.	3450				
Phase Ø	1 Ø		3 Ø		
Voltage	115	208-230	208-230	460	575
Manual Models (100)		M2	M3	M4	M5
Automatic Models		A2	-	-	-
Horsepower	1				
Full Load Amps	13.6/12.1		6.0/5.8	2.8	1.9
Motor Type	Capacitor Start		3 Ø		
R.P.M.	3450				
Phase Ø	1 Ø		3 Ø		
Voltage	208-230		208-230	460	575
Hertz	60				
Temperature	140°F Max Fluid Temp.				
NEMA Design	L		B		
Insulation	Class B				
Discharge Size	2" NPT std.				
Solids Handling	3/4"				
Unit Weight	58 lbs. (50)		65 lbs. (100)		
Power Cord	115V, 14/3, SJTW-A; 230V, 1ø, 16/3 SWT-A; 3ø, 16/4, STW-A, All cords 20' std. with 30' opt.				

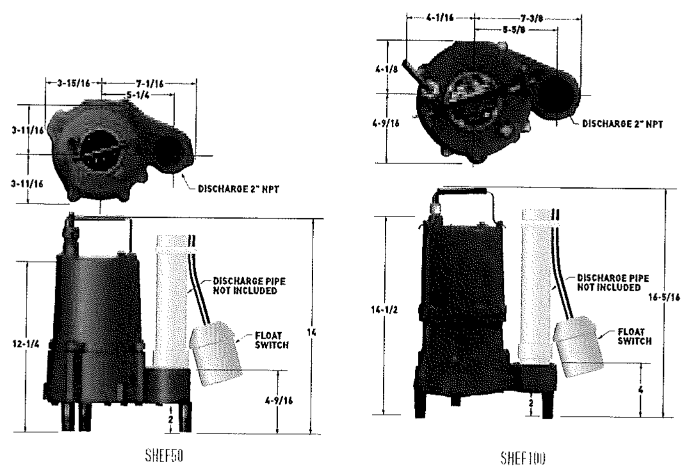
PERFORMANCE DATA



MATERIALS OF CONSTRUCTION

Handle	Stainless Steel
Lubricating Oil	Dielectric Oil
Motor Housing	Cast Iron
Pump Casing	Cast Iron
Shaft	Stainless Steel
Mechanical Shaft Seal	Seal Faces: Carbon/Ceramic Seal Body: Brass Spring: Stainless Steel Bellows: Buna-N
Impeller	Engineered Thermoplastic
Upper Bearing	Single Row Ball Bearing
Lower Bearing	Single Row Ball Bearing
Bottom Plate	Single Row Ball Bearing
Fasteners	Stainless Steel
Legs	Engineered Thermoplastic

DIMENSIONAL DATA



All dimensions in inches. Metric for international use. Component dimensions may vary ± 1/8 inch. Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate. On/Off level adjustable.

PENTAIR

USA
293 WRIGHT STREET, DELAVAN, WI 53115 WWW.HYDROMATIC.COM
PH: 888-957-8677 ORDERS FAX: 800-426-9446

CANADA
269 TRILLIUM DRIVE, KITCHENER, ONTARIO, CANADA N2G 4W5
PH: 519-896-2163 ORDERS FAX: 519-896-6337

Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

Hinsdale Bean Farm Lot 3
Charlotte, Vermont

Pump Station Basis of Design

Design Flow	490	GPD
Infiltration	0	GPD
20% Municipal Credit	0	
Total Design Flow	490	GPD
Average Daily Flow	0.51	GPM
Peaking Factor	5.00	
Peak Flow	2.55	GPM
Required Storage	490	gallons
Storage Provided	600	gallons
Force Main Dia.	2.00	Inches
Min. Cleansing Velocity	2.00	FPS
Min. Pumping Rate	19.57	GPM
Chosen Pumping rate	27.00	GPM
Length of FM to Mound	390.00	feet
Friction Losses to Mound	5.89	feet
High Point of FM in Mound	409.05	feet
Low Elevation in PS	364.40	feet
Elevation Change	44.65	feet
Minor headlosses	3.00	feet
Residual	3.00	feet
TDH	56.54	feet
Pump Cycle Storage	100	Gallons
Run Cycle	5.53	Minutes
Wet Well Detention Time	195.92	Minutes

System Curve

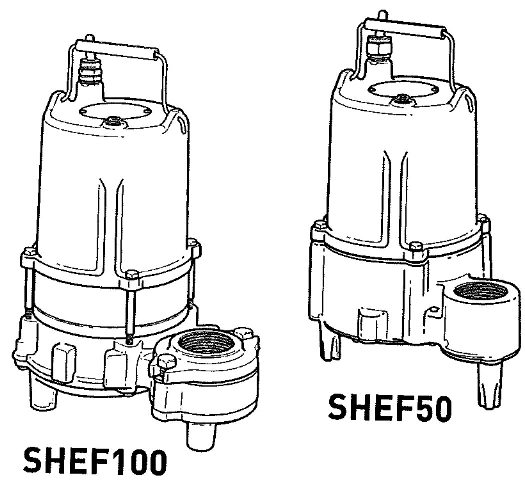
GPM	TDH
15.0	52.60
20.0	54.00
25.0	55.80
30.0	57.80
35.0	60.20
40	62.80

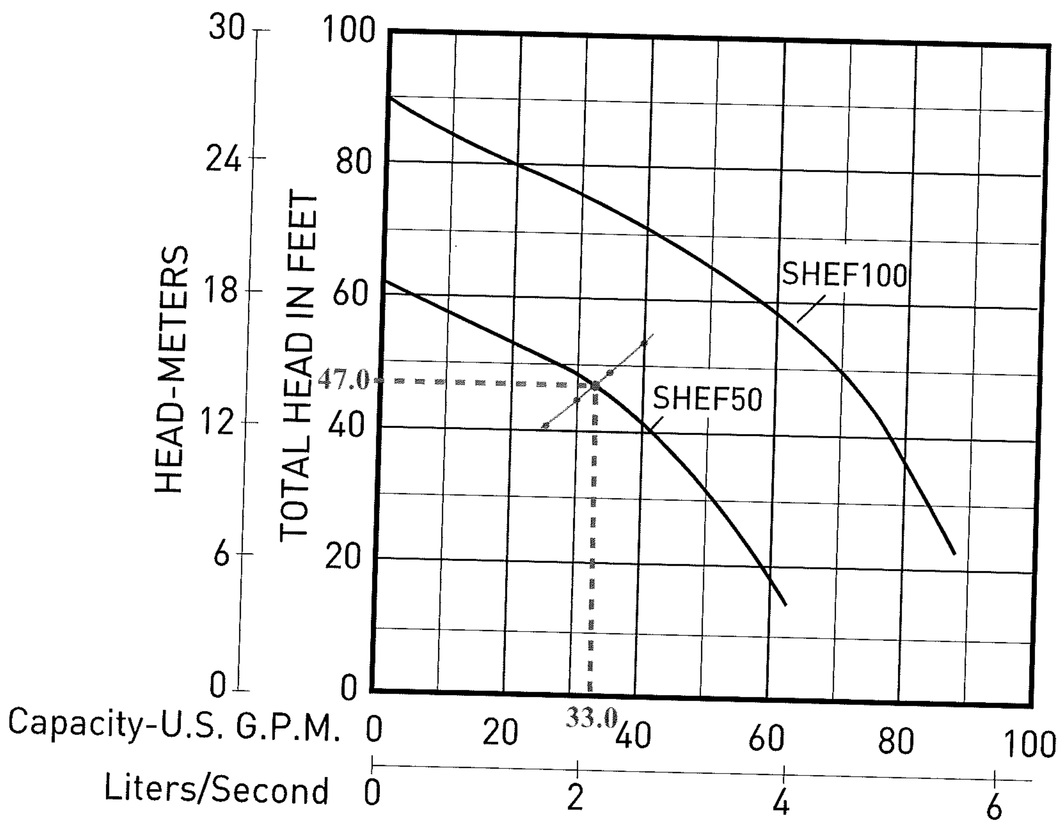
Pump Selection Hydromatic SHEF 50, 230 v, 60 Hz, 5/10 HP

HYDROMATIC®
SHEF50/100
SUBMERSIBLE HIGH HEAD EFFLUENT

PERFORMANCE DATA

Wholesale Products Page: 6370-1
Dated: January 2001
RPM: **3450** Discharge: **2"** Solids: **¾"**





The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

PENTAIR

Conditions of Service:

GPM:______ **TDH:**______

Wastewater Disposal System Design
Hinsdale Bean Farm Lot 2 Mound Site
26-Dec-17

630 GPD Bedrooms = 6
0 GPD 1-BR Apartment
630 Design Flow (GPD)
0.66 Average Daily Flow (GPM)

10.0 Allowable application per linear foot (GPD/LF)
63 Linear feet of Trench Required (FT)
63 Equivalent Linear feet of Trench Proposed (FT)

Dosing Requirements

1.5 Diameter of Distribution Pipe (Inches)
3 Number of Distribution Pipes
59 Length of Distribution Pipe (FT)
5 Distribution System Volume (Gallons)
5.00 Required Dose Volume Factor
27 Required Minimum Dose Volume (Gallons)
4.00 Minimum Required Doses per Day
158 Maximum Dose Allowed (Gallons)
100.00 Chosen Dose Volume (Gallons)
5.00 Recommended Pumping Duration per Dose (Minutes)
20.00 Recommended Pumping Rate w/o Inflow (GPM)
20.66 Recommended Pumping Rate with Inflow (GPM)
33.00 Chosen Flow Rate (GPM)

Distribution Requirements

10 Trench width (FT)
630 Total Trench Area (SF)
25 Maximum Area per orifice Hole (SF)
25 Required Number of Orifice Holes
27 Number of Orifice Holes Proposed
0.74 Avg. Flow per Orifice (GPM)

419.96 Effluent Elevation Head

TRENCH 1

27 Total # of orifices
630 Total Design Flow (GPD)
63 Total Length of Trench (FT)

33.0 Chosen Design Flow (GPM)
34.45 Total Actual Design Flow (GPM)
4.22% Percent Delta from Design

Hinsdale Bean Farm Lot 2
Mound Distribution System Design
26-Dec-17

1	Maximum Allowable application Rate per Square Foot (GPD/SF)
33.0	Design Pumping Rate to Entire Field (GPM)
630	Total Design Flow to Site (GPD)
1	Number of Trenches/Beds
416.96	Invert Elevation

Trench 1 (Bed)

9	Depth of Stone (inches)
1	Application Rate per Square Foot
63	Length of Section
630	Design Flow (GPD)
33.00	Design Flow (GPM)
25	Required Number of Orifices

Orifice Design

0.125	Diameter of orifice (Inches)
0	Number of orifices
3	Residual pressure (FT)
0.32	Design Flow per head (GPM)
0.00	Subtotal flow (GPM)
0.1875	Diameter of orifice (Inches)
0	Number of orifices
3	Residual pressure (FT)
0.72	Design Flow per head (GPM)
0.00	Subtotal flow (GPM)
0.25	Diameter of orifice (Inches)
27	Number of orifices
3	Residual pressure (FT)
1.28	Design Flow per head (GPM)
34.45	Subtotal flow (GPM)
27	Total # of orifices
25	Required Number of Orifice Holes
34.45	Total Flow
33.00	Total Rec. Design Flow This Trench (GPM)
4.41%	Percent Delta from Design
61	Length of Distribution Pipe (FT)
7.25	Spacing of orifice holes (FT)

PENTAIR

SHEF100 Shown

HYDROMATIC® SHEF50/100 SUBMERSIBLE HIGH HEAD EFFLUENT PUMPS

WWW.HYDROMATIC.COM

SHEF50/100
Submersible High Head Effluent Pumps

Applications:

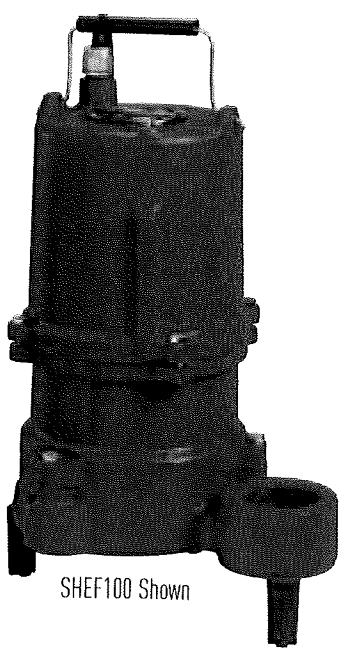
- Septic Tank Effluent
- High Head Sump
- Dewatering

SHEF100 Features:

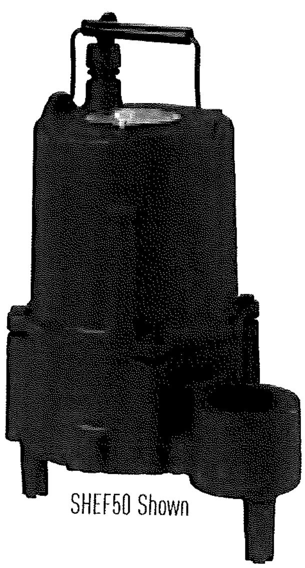
- 1 HP
- 208-230 voltage (1ø) 208-230/460, 575 voltage (3ø)
- 2" discharge
- 3/4" solids handling
- Capacities to 87 GPM
- Heads to 90 feet
- Automatic or manual models

SHEF50 Features:

- 1/2 HP
- 115/208-230 dual voltage (1ø) 208-230/460, 575 voltage (3ø)
- 2" discharge
- 3/4" solids handling
- Capacities to 63 GPM
- Heads to 63 feet
- Automatic or manual models



SHEF100 Shown



SHEF50 Shown

The HYDROMATIC® SHEF50/100 submersible pumps are specifically designed to meet the demands of residential high head septic tank effluent or sump applications. The 2 inch NPT discharge pumps feature an energy-efficient 1/2 or 1 horsepower motor, automatic and manual versions, and a wide variety of voltages including dual voltage 208-230 volt single and three phase. The SHEF50 can handle capacities up to 63 gallons per minute and heads to 63 feet. The SHEF100 can handle capacities up to 87 gallons per minute and heads to 90 feet.

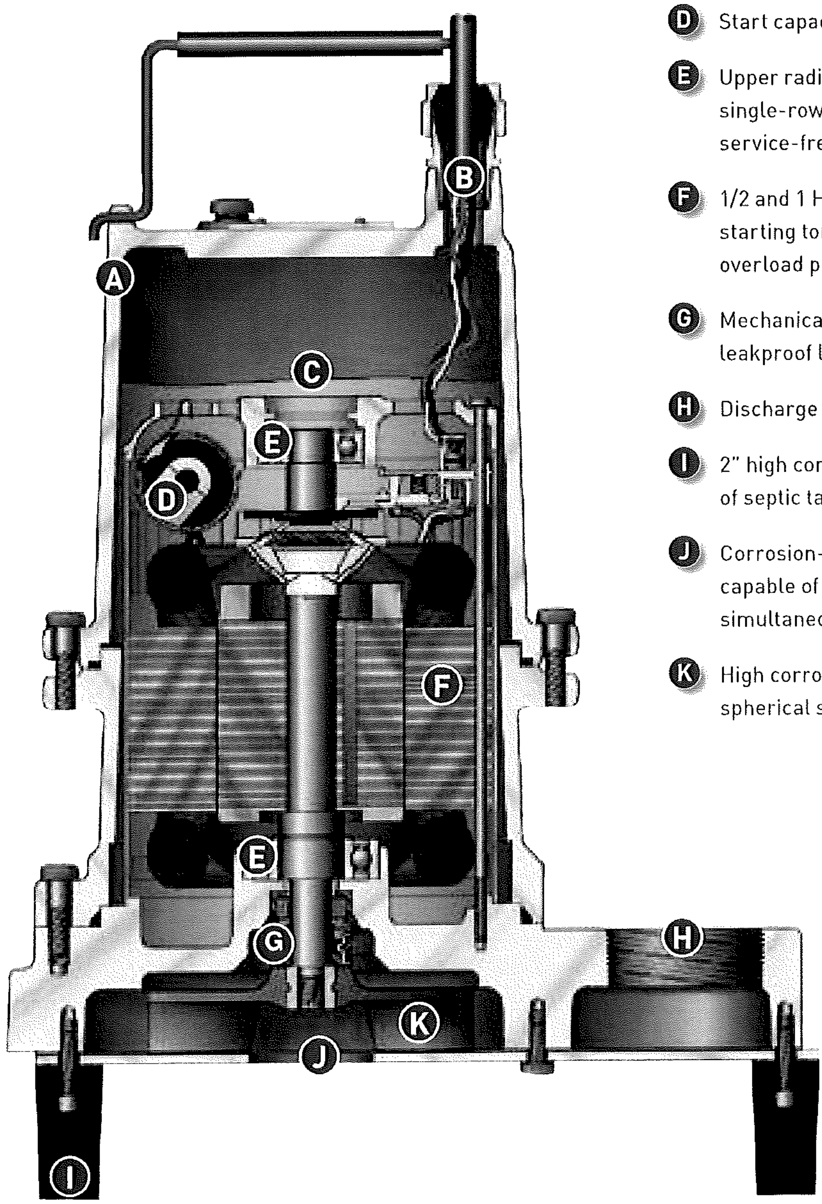
The SHEF50/100 features a heavy-duty cast iron construction that provides durability for a long service life, as well as dissipating heat from the motor for cooler operation. All fasteners are stainless steel for corrosion resistance. The pump's semiopen, nonclog design impeller passes 3/4" (spherical) solids and is made from a super tough engineered plastic that provides the highest level of corrosion resistance and the toughness to withstand the impact of solid materials. The impeller, molded to a bronze insert, also features pump-out vanes to preclude material from building up around the shaft and seal. The pump's unique (patent pending) nonclog design baseplate has an electrostatically applied polyester coating for corrosion resistance and provides a strainer-free inlet capable of passing two (2), 3/4" (spherical) solids simultaneously. The inlet area is raised off the bottom of the septic tank or sump basin by the pump's 2" high legs constructed of engineered thermoplastic material for maximum corrosion resistance.

The SHEF50/100's oil-filled motor provides superior cooling characteristics, allowing the motor to run cool and quiet. The oil-filled design also provides permanent lubrication of the shaft bearings, minimizing maintenance and extending the service life of the pump. The oil-filled motor design allows for even heat dissipation. On single phase models the windings feature a built-in thermal overload that resets automatically.

Automatic models feature an easily adjustable wide-angle float switch, incorporating a unique piggyback plug arrangement. This plug allows for simple conversion to manual operation by simply removing the switch plug and inserting the pump's motor plug into the electrical outlet. This feature provides an easy way of periodically cycling the pump to ensure it is operating properly.

SHEF50/100

The SHEF50/100 are completely submersible "high head" pumps for use in residential septic tank effluent pumping applications and are available in automatic and manual configuration. Automatic models feature a wide-angle float switch with piggyback plug-in arrangements. Switch is adjustable, easy to service and allows for simple conversion to manual operations.



- **A** High quality cast iron construction of pump volute, motor housing and seal housing provides long life.
- **B** Water resistant power cord has a compression fit connection and an epoxy potting for double protection against water entry. Lengths of 20 and 30 feet are available with molded plugs, depending on model variations.
- **C** Oil-filled motor provides superior cooling and permanent lubrication of bearings, minimizing maintenance and extending service life.
- **D** Start capacitor 1ø models only.
- **E** Upper radial- and lower thrust bearings are heavy-duty, single-row ball bearings that are permanently lubricated for service-free life.
- **F** 1/2 and 1 HP capacitor-start (1ø) motors provide maximum starting torque. Motor windings contain automatic thermal overload protection (1ø).
- **G** Mechanical shaft seal is carbon and ceramic-faced for long leakproof life.
- **H** Discharge is standard 2" NPT.
- **I** 2" high corrosion-resistant legs raise pump's inlet from bottom of septic tank pump chamber.
- **J** Corrosion-resistant, nonclog base with strainer-free inlet capable of passing two (2), 3/4" diameter spherical solids simultaneously.
- **K** High corrosion-resistant, nonclog impeller passes two (2), 3/4" spherical solids.

SHEF50/100

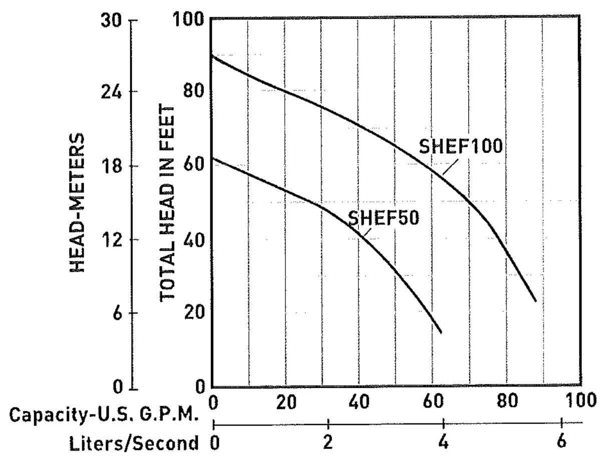
PUMP CHARACTERISTICS

Pump/Motor Unit	Submersible				
Manual Models (50)	M1	M2	M3	M4	M5
Automatic Models	A1	A2	-	-	-
Horsepower	1/2				
Full Load Amps	14.5	7.6/7.1	3.2/3.1	1.6	1.2
Motor Type	Capacitor Start				
R.P.M.	3450				
Phase Ø	1 Ø		3 Ø		
Voltage	115	208-230	208-230	460	575
Manual Models (100)		M2	M3	M4	M5
Automatic Models		A2	-	-	-
Horsepower	1				
Full Load Amps	13.6/12.1		6.0/5.8	2.8	1.9
Motor Type	Capacitor Start		3 Ø		
R.P.M.	3450				
Phase Ø	1 Ø		3 Ø		
Voltage	208-230		208-230	460	575
Hertz	60				
Temperature	140°F Max Fluid Temp.				
NEMA Design	L		B		
Insulation	Class B				
Discharge Size	2" NPT std.				
Solids Handling	3/4"				
Unit Weight	58 lbs. (50)		65 lbs. (100)		
Power Cord	115V, 14/3, SJTW-A; 230V, 1ø, 16/3 SWT-A; 3ø, 16/4, STW-A, All cords 20' std. with 30' opt.				

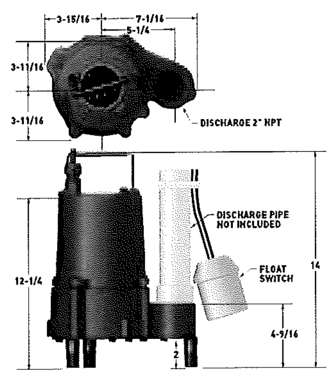
MATERIALS OF CONSTRUCTION

Handle	Stainless Steel
Lubricating Oil	Dielectric Oil
Motor Housing	Cast Iron
Pump Casing	Cast Iron
Shaft	Stainless Steel
Mechanical Shaft Seal	Seal Faces: Carbon/Ceramic Seal Body: Brass Spring: Stainless Steel Bellows: Buna-N
Impeller	Engineered Thermoplastic
Upper Bearing	Single Row Ball Bearing
Lower Bearing	Single Row Ball Bearing
Bottom Plate	Single Row Ball Bearing
Fasteners	Stainless Steel
Legs	Engineered Thermoplastic

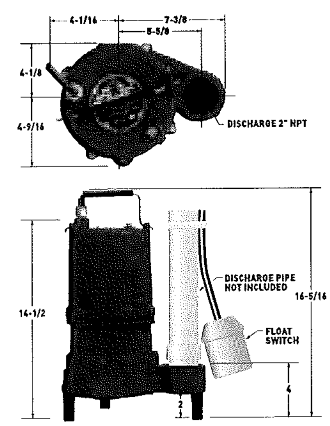
PERFORMANCE DATA



DIMENSIONAL DATA



SHEF50



SHEF100

All dimensions in inches. Metric for international use. Component dimensions may vary ± 1/8 inch.
Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate.
On/Off level adjustable.

PENTAIR

USA
293 WRIGHT STREET, DELAVAN, WI 53115 WWW.HYDROMATIC.COM
PH: 888-957-8677 ORDERS FAX: 800-426-9446

CANADA
269 TRILLIUM DRIVE, KITCHENER, ONTARIO, CANADA N2G 4W5
PH: 519-896-2163 ORDERS FAX: 519-896-6337

Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

W-02-6370 (11/21/12)