CTL | THOMPSON

February 17, 2022

Patsy Verhoeven and Tim Horne
PO Box 8226
Aspen, CO 81612

Subject: Soil Evaluation and OWTS Design
Proposed Residence
58 Wa Bun Way
Lot 9, Indian Mountain, Filing No. 6
Park County, Colorado
Project No. SU01097.000 - 132

As requested, we have prepared this soil evaluation report and onsite wastewater treatment system (OWTS) design for the proposed residence at the subject location. We previously provided an OWTS Design for the site (see Project Number SU01097 – 130 dated June 19, 2015). The OWTS regulations for Park County have changed since our previous design. We performed this soil evaluation in accordance with current Park County Environmental Health Department (PCEH) OWTS Regulations, dated June 28, 2018 and effective August 12, 2018. The soil evaluation is required by the PCEH to characterize subsurface conditions where OWTS are to provide sewer service for residential dwellings. Design documents, required when subsurface conditions are not suitable for a conventional OWTS, are included with this report. This report and information should be presented to the PCEH for the application of the septic permit.

PROPOSED CONSTRUCTION

The proposed construction on the site will consist of a new single-family residence. We have been asked to design a new system for a 2-bedroom residence. The proposed location of the structure is shown on Figure 2. Potable water is to be supplied by a new well. Wastewater is to be managed by an OWTS.

SITE DESCRIPTION

On February 12, 2022, a site evaluation was conducted by a representative of CTL. The parcel is located on the southeast side of Wa Bun Way in the Indian Mountain subdivision near Como, CO as shown on Figure 1. The site has a general slope down to the southeast with a drainage feature running southeast to northwest through the middle of the lot. No surface water was observed in the drainage at the time of our site investigation. The slope in the area of the STA generally slopes down to the east at approximately 19 percent. The landscape position of the test site is designated LL, as represented in the EPA's *Onsite Wastewater Treatment Systems Manual*. Ground cover at the proposed soil treatment area (STA) consisted of coniferous trees, aspens, and grass.

Wells

Potable water will be supplied by a new well. The proposed well is located on Figure 3. PCEH requires a minimum setback distance of 200 feet from a well to all soil treatment areas. Minimum setbacks from potable water supply lines and STA/septic tank must also be maintained. To the best of our knowledge, no other water wells exist in the near vicinity. The neighboring soil treatment area to the east is beyond the 200-foot setback from the proposed well.

Surface Water Features/Setbacks

Notable features requiring minimum setback distances from the proposed OWTS, as indicated in Table 7-1 of the PCEH OWTS Regulations, are shown on Figure 3 and were located or observed on the site during our preliminary investigation, reconnaissance, and soil investigation. A minimum setback distance of 5 feet must be maintained between the residence and the septic tank. A minimum setback distance of 10 feet must be maintained between the property lines and the STA.

SUBSURFACE CONDITIONS

The subsurface conditions were investigated by observing the excavation of three profile pits (see Figure 7). Subsurface conditions encountered in the pits consisted of about 6 inches of topsoil. Beneath the topsoil in each pit, we encountered sandy clay loam soils. The sandy clay loam soils contained 35 to 60 percent gravel with a granular structure shape and moderate structure grade. The sandy clay loam soils classified as Soil Type R-1, Matrix Soil Type 3. Practical excavation refusal occurred on hard bedrock in each of the profile pits at a depth of 4.5 feet in Pro-1, 3.5 feet in Pro-2, and 2 feet in Pro-3. The hard bedrock is considered a limiting layer. Groundwater and/or indications of the seasonal groundwater level were not observed in any of the profile pits.

SOIL TREATEMENT AREA – UNLINED, MOUNDED SAND FILTER

The subsurface conditions are not appropriate for a conventional OWTS for the location tested due to the quantity of rock present and presence of a limiting layer (shallow bedrock). PCEH regulations require an engineer to design the OWTS where conventional systems are not suitable. The STA size is designed based on the sandy clay loam soils encountered in the profile pits, which was determined to be Soil Type R-1, Matrix Soil Type 3 in Table 10-1A *Long Term Acceptance Rates* in the PCEH OWTS Regulations. According to Table 10-1A, this requires a minimum 2-foot-deep unlined sand filter. Shallow bedrock will require the system to be mounded. The OWTS Regulations for PCEH provide minimum STA sizes for OWTS. Refer to Exhibit C for the full STA mound calculations.

Wastewater strength is assumed to be typical residential. Some fixtures, such as garbage disposals, washing machines, and water treatment systems, can increase demand on the OWTS and additional flows should be accounted for in the capacity of the OWTS. If a water softening system is installed, it should be a new, high efficienty system set to regenerate based on the rate of water flow. It would also be prudent to oversize the septic tank and/or STA for enhanced performance and for future improvements to the residence.

Refer to Figures 3 through 6 and Exhibit B for recommendations for OWTS components. All components of the OWTS shall meet or exceed PCEH regulations. Our recommendations include the installation of an effluent pumping system with an effluent filter. The filter reduces the gross solids entering the STA, thereby prolonging the life of the OWTS and enhancing treatment. In addition, wheeled traffic that can compact the soil and impede percolation should be avoided in the STA excavation. Prior to installation of the STA, all topsoil must be removed. Following removal of topsoil, the ground surface should be scarified. This report and information including planned number of bedrooms and system options should be presented to the PCEH for application of the septic permit.

SEPTIC AND DOSE TANKS

- A minimum septic tank capacity of 1,000 gallons is required for a 2-bedroom residence. We recommend providing a Front Range Precast, Inc. (FLXX) three compartment electric lift septic tank. An Orenco Systems PF-3005 high head effluent pump should be placed in the third compartment of the tank within a Biotube Pump Vault. A tank product sheet is provided in Exhibit B.

- We should be advised to revise our recommendations if future bedrooms or other items that may result in an increase of flow or strength of wastewater are planned.

- The tank must be set level. The excavation bottom should be free of large rocks and other objects that could damage the tank. A 4 to 6-inch thick leveling course of CDOT Class 6 base course aggregate is recommended.

- Tank should be backfilled in accordance with manufacturer's recommendations.

- A minimum of 2 feet and maximum of 4 feet of soil cover should be provided over the tank. Soil can be mounded over the tank to achieve the 2-foot minimum soil cover. Risers should be used to extend the lids to finished grade. Exposed lids should be secured against unauthorized entry. Bottom risers should be sealed water tight to top of tank.

- Tank must meet Park County Regulations.

EFFLUENT PUMP

- An Orenco Systems PF-3005 high head effluent pump should be used to pressure-dose the STA. The pump should be housed within a Biotube Pump Vault.

- Pump should be capable of a flow rate of 32.5 gallons per minute at 18.1 feet of total head. The distribution laterals have a volume of approximately 10 gallons. Along with the transport pipe and manifold, the total volume is about 19 gallons. The on-off float within the 500-gallon dose tank should be set 12 inches apart, which will dose 79 gallons. There will be minimal drain back to the tank. Based on the design flow of 300 gpd, the pump will dose about 4 times per day. A pump performance curve is provided in Exhibit B.

- Pump should have a quick-disconnect within 24 inches of the access lid to allow for routine maintenance and replacement.

- Set high water alarm float to allow for 300-gallon reserve, or as much as practical.

- Pumps, floats and control panel to be wired to dedicated circuit. Final connection by licensed electrician. All connections to be separate from tank environment and weather-tight to prevent corrosion. Alarm location at owner's request.

- A cycle or elapsed time meter is required to be installed within control panel.

SEWER LINE

- The sewer line from the building to the septic tank should not be less than the diameter of the building drain and not less than 4 inches in diameter. The sewer pipe should have a rating of SDR35 or better.

- Sewer pipe should be sloped at 2% minimum from the building to the septic tank except for the last 5 feet, which should be sloped no more than 4% to help limit disturbance of solids in the tank.

- A minimum of 36 inches of cover soil should be provided over the sewer pipe. Paved areas, patios, or other areas without vegetative cover may be more susceptible to frost. We recommend 48 inches of cover in those areas. If less cover is provided, the pipe should be insulated on the top and sides with 2-inch blue board (R-10 min.).

- The sewer pipe should be bedded in compacted ¾ inch roadbase or native soils provided that the native soils contain no angular rocks or rocks larger than 2½ inches in diameter to help prevent settlement of the pipe. Sags could cause standing effluent to freeze and damage piping.

- Install cleanout pipes within 5 feet of building foundation and every 100 feet of sewer pipe. We recommend using a double-sweep cleanout.

- 90-degree bends are prohibited per PCEH regulations. All 90-degree bends should be installed by using two 45-degree elbows.

EFFLUENT TRANSPORT PIPE

- Effluent transport pipe shall consist of 1.5-inch diameter Schedule 40 PVC pipe, or stronger, and be installed from the dose tank to the STA manifold piping.

- It is imperative that the transport line completely drains between pump cycles, otherwise freezing will occur. The high point will be at the septic tank. The transport pipe should be sloped at 2% minimum from the high point to drain to the STA after each dose cycle.

- A 1/8-inch weephole should be provided in the effluent transport pipe at the high point within the dose chamber to allow drainage to the STA after dosing.

- The effluent transport pipe should be bedded in compacted ¾ inch roadbase or native soils provided that the native soils contain no angular rocks or rocks larger than 2½ inches in diameter to help prevent settlement of the pipe. Sags could cause standing effluent to freeze and damage piping.

- A minimum of 18 inches of cover soil should be provided over the effluent transport pipe. Paved areas, patios or other areas without vegetative cover may be more susceptible to frost. In these areas, or if less than 18 inches of cover is provided, the pipe should be insulated on top and sides with 2-inch thick blue board insulation (R-10 minimum).

- All 90-degree bends should be installed using a 90-degree long-sweep or by using two 45 degree elbows.

DISTRIBUTION LATERAL PIPE

- Distribution lateral pipe shall consist of 1.5-inch diameter Schedule 40 PVC pipe, installed level.

- Piping should be perforated as noted on STA Plan View, Figure 4.

- A cleanout should be provided at the end of each lateral.

GRAVEL BED AGGREGATE

Gravel bed aggregate shall have 100 percent passing the 2.5-inch sieve, 0-20 percent passing 0.75-inch sieve and 0-3 percent passing the No. 4 sieve.

SAND FILTER

The sand filter material must meet requirements "Secondary" sand as specified by PCEH and the Colorado Department of Public Health and Environment. "Secondary" sand must have an effective size range of 0.15-0.60mm, have a uniformity coefficient of <7.0, and <3.0% fines passing #200 sieve. A gradation of the sand media must be presented to PCEH dated no more than one month prior to the installation date.

INSTALLATION OBSERVATIONS

PCEH will need to observe the OWTS during construction. PCEH also requires that the design engineer observes construction to verify substantial compliance with the design. PCEH and our office should be given proper notice to observe the OWTS prior to backfilling and any other stages of construction as required. Installation observations by this office are not included in the cost of this study and will be billed to the client or others as authorized by our service agreement.

MAINTENANCE AND OPERATION

The OWTS requires conscientious maintenance and operation to provide a reasonable service life. The owner must consider that the OWTS does not have the same "unlimited" capacity as a municipal sewer system. OWTS are sized for a limited hydraulic loading and exceeding that loading on a continual basis can harm the system and cause irreparable damage. Septic tanks should be checked periodically for scum and sludge accumulation and pumped as necessary. Refer to Exhibit A for general maintenance and operation considerations.

LIMITATIONS

Accepted industry standards, methods and state and/or county guidelines were used to conduct this investigation. Exposure to subsurface conditions is limited from observations of profile pits. Variations of subsurface conditions present under the STA site may exist from that observed in the profile pits. Typical wastewater flows and characteristics for residential dwellings are provided by state and/or county guidelines. In some cases actual flows and characteristics may vary substantially from typical estimates. This investigation is not absolute and these variations may affect the performance of the OWTS. PCEH and CTL | Thompson should be notified if subsurface variations are observed during construction or if there are any changes in the proposed location or construction. If we can be of further service in discussing the contents of this report or in the analysis of the interaction of subsoil conditions and the OWTS, please call.

An installer that is experienced and approved by the PCEH is recommended for the installation of the OWTS. Due to variables, such as, but not limited to construction methods, individual usage, maintenance habits, soil heterogeneity and climate, no warranty expressed or implied as to the longevity or performance of the OWTS is made. We encourage owners of OWTS to visit www.nesc.wvu.edu for additional resources for literature about OWTS.

Due to the changing nature of onsite wastewater engineering standards and practices, the information and recommendations provided in this report are only valid for two years following the date of issue. Following that time, our office should be contacted to provide, if necessary, any updated recommendations and design criteria as appropriate. CTL|Thompson appreciates the opportunity to be a member of your team. If you have any questions regarding the information in this report, please do not hesitate to contact us at your convenience.

Very truly yours,
CTL|THOMPSON, INC.

Brittany Niggeler
Staff Geologist

Reviewed By:

George Benecke III, P.E.
Division Manager, Summit County

Attachments: Exhibits A-C, Figures 1-7

cc. patsyfish@gmail.com

EXHIBIT A

ONSITE WASTEWATER TREATMENT SYSTEM
MAINTENANCE AND CARE

Maintenance that involves possible human contact with sewage materials should be conducted by a qualified professional that is aware of, and has experience in dealing with biologic hazards, and implementation of precautionary methods to reduce the risk of illness or injury caused by potentially hazardous conditions.

Routine Maintenance

- Septic tanks should be checked annually for liquid level, sludge and scum accumulation and pumped as necessary. Septic tanks are typically pumped every 2 to 4 years. Pumping frequencies will vary depending on usage. Effluent screens should be cleaned as needed and when the tank is pumped. Operational level of septic tanks is when full. Levels lower than the outlet may indicate a leaky tank.

Non-routine Maintenance

- Leaks from faucets, toilets and other plumbing that drains into the sewer should be repaired before the STA has been damaged.

- Backfill materials in trenches and excavations may settle over time. Areas that have settled should be refilled, re-graded and re-vegetated to promote positive surface drainage away from OWTS components.

- Disposal of harsh chemicals and non-biodegradable items into the sewer should be avoided.

- Avoid septic tank additives! Some additives can damage your system. Under normal conditions human wastes contribute sufficient "biology" to maintain activity of the system.

- Avoid discarding garbage disposal grindings, fats and grease in the sewer.

- Liquid laundry detergents are preferred over powder detergents. Some powder laundry detergents contain fillers that may not completely dissolve and contribute to the sludge or scum. Septic tanks and filters may require more frequent service if powder detergents are used.

- The surface and slopes of the STA should be seeded with a native-type or drought resistant vegetation cover to reduce erosion. Vegetation over the STA should be kept mowed. Gardens should not be located over STAs.

- Maintain a packet that includes the OWTS design report, maintenance records, phone numbers of the installer and septic tank pumper and other paperwork relating to the OWTS in a readily accessible location.

Other Considerations

- The system is designed for a finite hydraulic load. Overloading the system with frequent peak loads and continuous high loads can harm the system. Continued high sewer volumes not accounted for in the design of this system may require additional soil treatment area. Conventionally, the system is not intended to accommodate hot tubs or spas.

- Spread laundry loads through the week. Limit usage to one laundry load in a day or 4 per week, or upgrade the OWTS to accommodate additional flow.

- Practice water conservation. Install water saving devices to reduce wastewater volume.

- Irrigation over the STA should be avoided or extremely limited. Watering over the STA will add to the hydraulic loading, which can adversely affect the performance, and longevity of the OWTS.

- Plumbing from underground irrigation systems should not be allowed within 5 feet of the backfill of the STA.

- Livestock and wheeled traffic or other activities that can compact the soil should not be allowed over the STA.

- Trees and shrubs should not be planted within the plant's root zone of the STA. Trees should not be planted so that the STA would be shaded as the tree matures. Consult with your local nursery for tree information.

- Some water treatment systems produce significant amounts of "reject" water that can increase hydraulic loading to the OWTS. The "reject" water is not considered wastewater and does not need to be treated. Other uses for this water, such as irrigation, should be considered before connecting the treatment system to the sewer. The STA will need to be upgraded if significant amounts of "reject" water are introduced into the system.

Installer: _____ Phone Number: _____

Pumper: _____ Phone Number: _____

EXHIBIT B

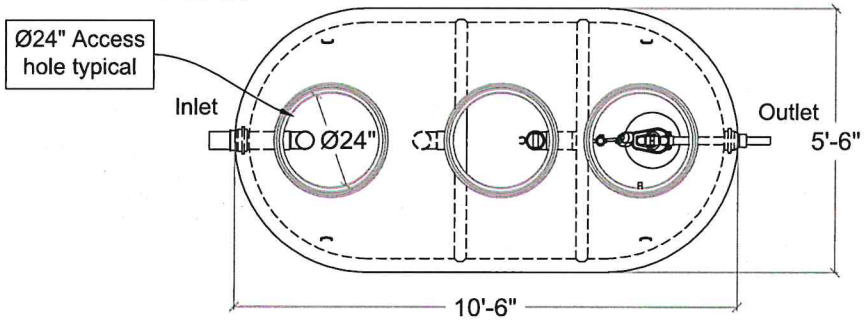
Septic Tank Product Sheet

Pump Performance Curve

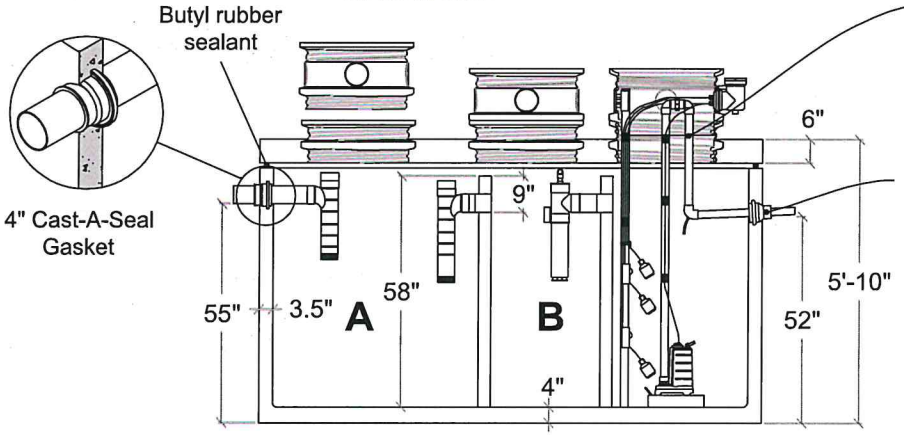
1250 Gal. Three Compartment Electric Lift Septic Tank

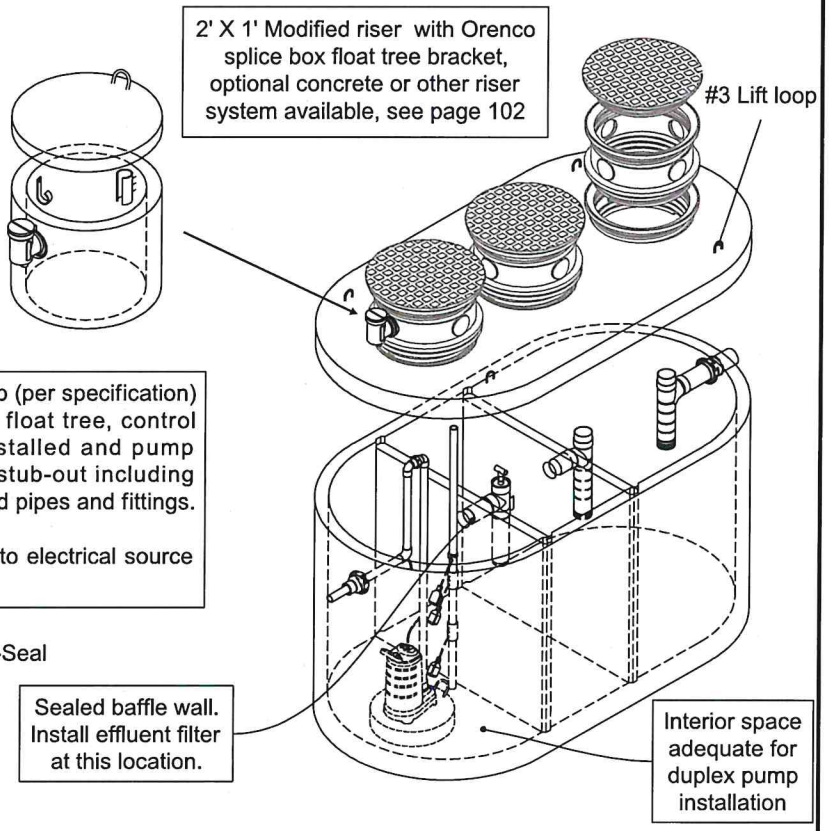
FLXX® FLXX®

PLAN



SECTION





- Monolithic tank meets ASTM C-1227 Spec. for water and wastewater structures.
- Butyl rubber sealant meets Fed. Spec. SS-S-210A. (Provided with tank)
- All plumbing shown in diagram is 4" SDR 35. (Provided with tank)
- Follow standard practice for installation of underground precast concrete structures. (See page 2 for ASTM C-891 Summary)

Note: N.T.S.

Part #	Capacities (gallons) A	B	Lift Station Chamber	Discharge per Cycle	Approximate Weights Tank	Lid	Baffle Walls	Total
PCA-000-267	640	420	330 Gal.	Variable 6.6 Gal. / Vertical inch	8,430 lbs	3,370 lbs	1,820 lbs	13,620 lbs
Total Capacity: 1390 gallons								

FLXX® WATERTIGHT

Front Range Precast Concrete, Inc.
5901 Dexter Street, Unit 102, Commerce City, CO 80022
Phone (303) 442-3207 - (800) 783-3207 - Fax (303) 442-3209
www.flxx.com

Pump Selection for a Pressurized System - Single Family Residence Project

SU01097.000 - 132 / 58 Wa Bun Way

Parameters

Discharge Assembly Size	1.50	inches
Transport Length	78	feet
Transport Pipe Class	40	
Transport Line Size	1.50	inches
Distributing Valve Model	None	
Max Elevation Lift	5	feet
Manifold Length	8	feet
Manifold Pipe Class	40	
Manifold Pipe Size	1.50	inches
Number of Laterals per Cell	3	
Lateral Length	30	feet
Lateral Pipe Class	40	
Lateral Pipe Size	1.50	inches
Orifice Size	5/32	inches
Orifice Spacing	2	feet
Residual Head	5	feet
Flow Meter	None	inches
'Add-on' Friction Losses	0	feet

Calculations

Minimum Flow Rate per Orifice	0.68	gpm
Number of Orifices per Zone	48	
Total Flow Rate per Zone	32.5	gpm
Number of Laterals per Zone	3	
% Flow Differential 1st/Last Orifice	0.8	%
Transport Velocity	5.1	fps

Frictional Head Losses

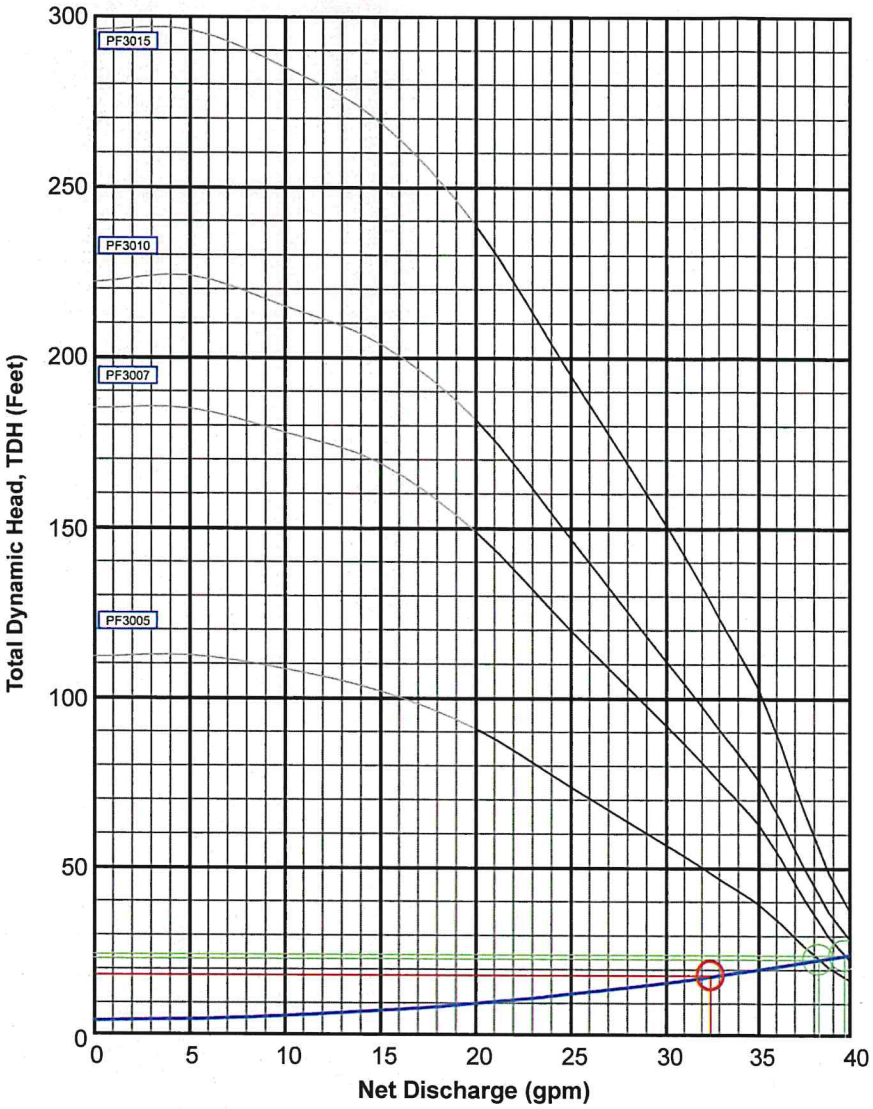
Loss through Discharge	3.2	feet
Loss in Transport	4.7	feet
Loss through Valve	0.0	feet
Loss in Manifold	0.1	feet
Loss in Laterals	0.1	feet
Loss through Flowmeter	0.0	feet
'Add-on' Friction Losses	0.0	feet

Pipe Volumes

Vol of Transport Line	8.2	gals
Vol of Manifold	0.8	gals
Vol of Laterals per Zone	9.5	gals
Total Volume	18.6	gals

Minimum Pump Requirements

Design Flow Rate	32.5	gpm
Total Dynamic Head	18.1	feet



PumpData

PF3005 High Head Effluent Pump
30 GPM, 1/2HP
115/230V 1Ø 60Hz, 200V 3Ø 60Hz

PF3007 High Head Effluent Pump
30 GPM, 3/4HP
230V 1Ø 60Hz, 200/460V 3Ø 60Hz

PF3010 High Head Effluent Pump
30 GPM, 1HP
230V 1Ø 60Hz, 200/460V 3Ø 60Hz

PF3015 High Head Effluent Pump
30 GPM, 1-1/2HP
230V 1Ø 60Hz, 200/230/460V 3Ø 60Hz

Legend

System Curve:
Pump Curve:
Pump Optimal Range:
Operating Point:
Design Point:

Orenco SYSTEMS
PROTECTING THE WORLD'S WATER

EXHIBIT C

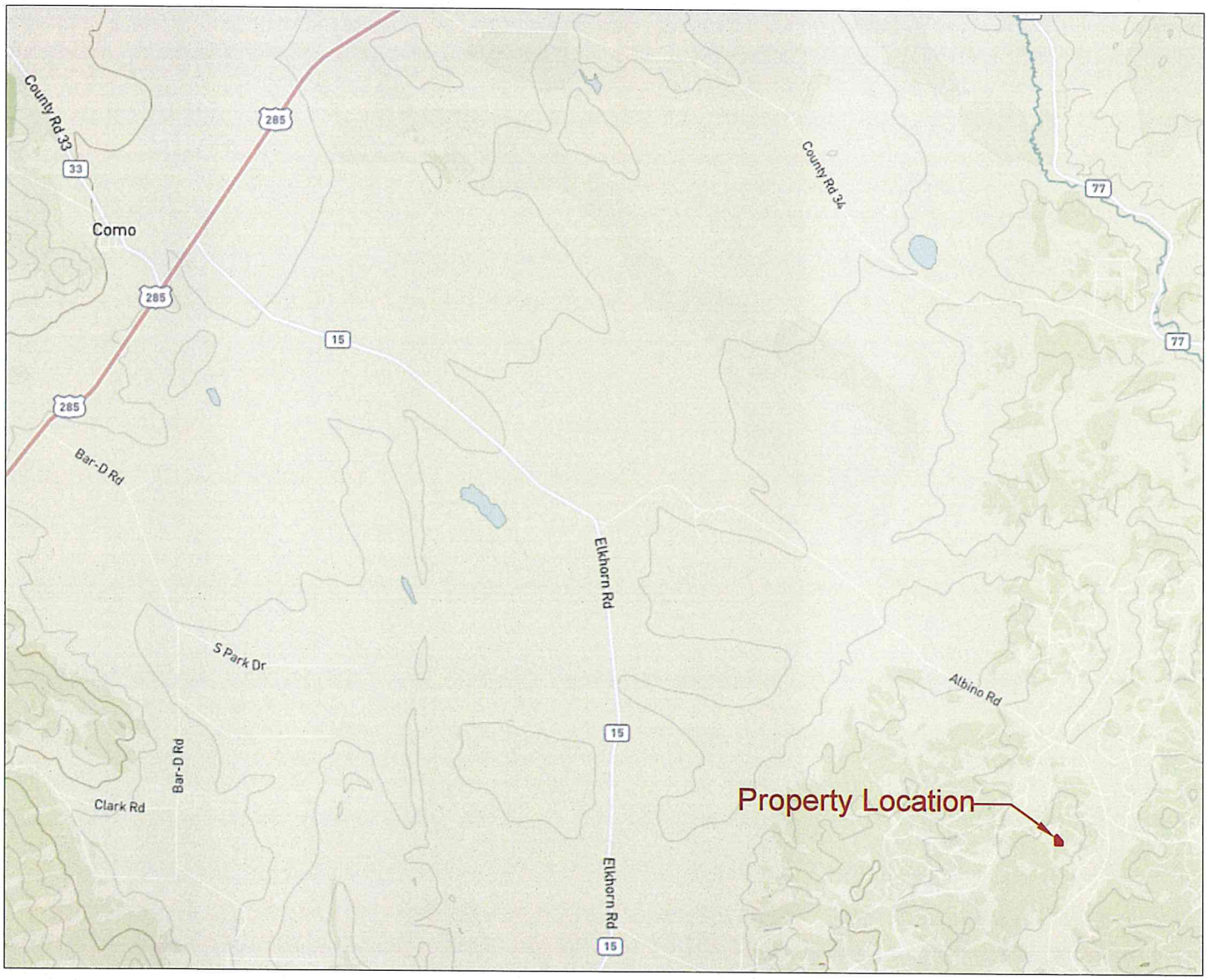
STA MOUND CALCULATIONS
Adapted from Mound Wastewater Treatment Systems document proved by the Colorado Department of Public Health and Environment; Revised August, 2017
Note: Refer to Figure 5 for component designations

Site Criteria
Design Flow = 300 gpd
Treatment Level 3 (TL3) – Mounded System with greater than 24" of sand
Long Term Acceptance Rate (LTAR) for Secondary Sand = 0.80 gpd/ft^2
LTAR for receiving Soil Type R-1, Matrix Soil Type 3 = 0.35 gpd/ft^2
Linear Loading Rate (LLR) = 9.0 gpd/ft
Slope = 19%
Distribution media depth (E) = 0.83' for Gravel
Mound soil cover depth (F) = 1.0'
Final slope of mound = 3:1

Infiltrative Surface Size
Minimum infiltrative surface width (A) = LLR/Sand LTAR
= 9.0 gpd/ft/0.80 gpd/ft^2 = 11.25' use 11'3"
Minimum infiltrative surface length (B) = Design Flow/LLR = 300 gpd/9.0 gpd/ft = 33.3'
use 34'
Minimum/Recommended Infiltrative Surface Size = 11'3"x 34'

Basal Area Size and Dimensions
Minimum basal area width (I) = LLR/Receiving Soil LTAR = 9.0 gpd/ft/0.35 gpd/ft^2
I = 25.7' use 26'
Minimum Downslope Width= (I-A) =26'-11'3" =14'9"

Not to scale



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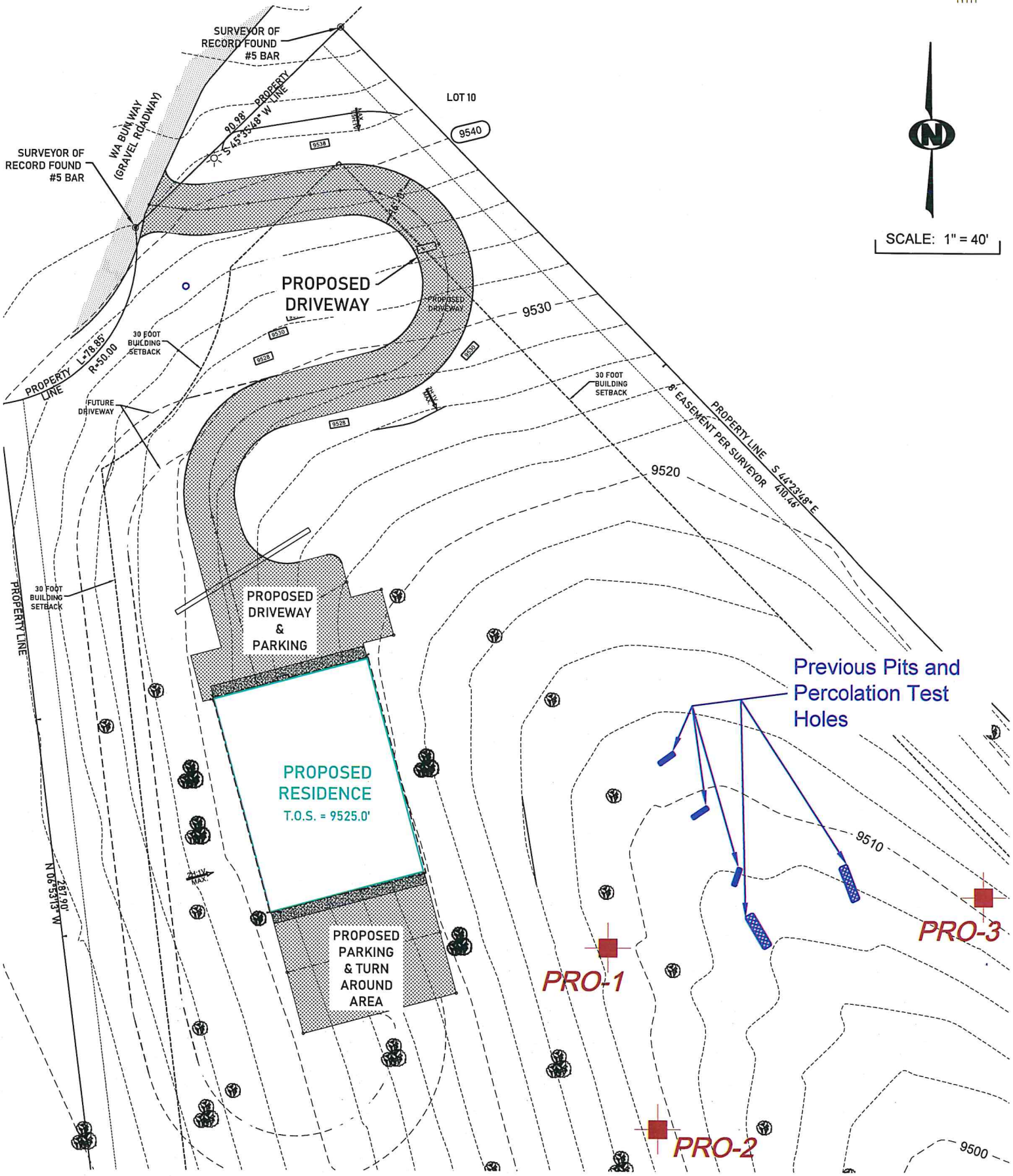
Vicinity Map

FIGURE 1



Locations of Profile Pits

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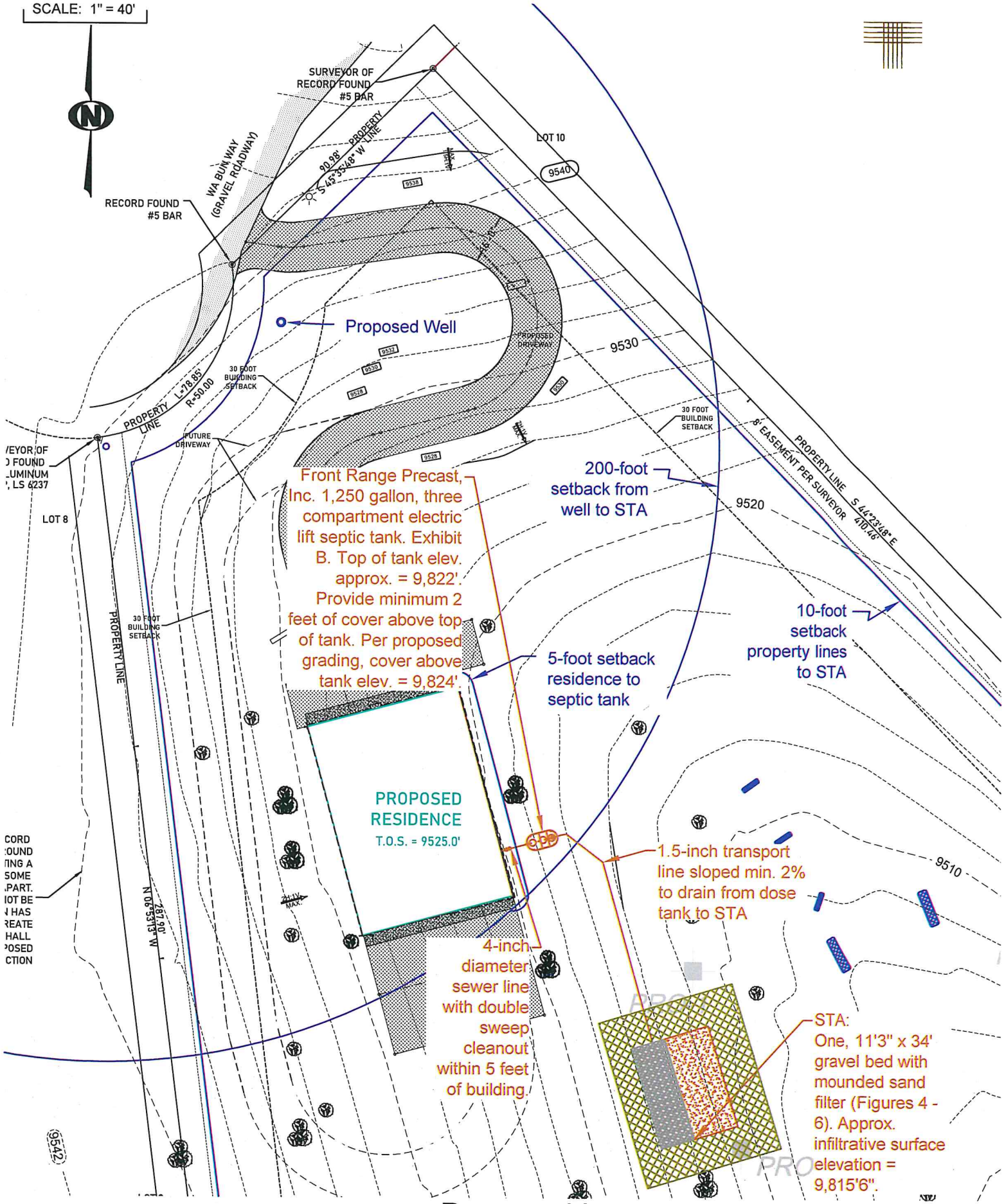
FIGURE 2



Proposed Location of Onsite Wastewater Treatment System

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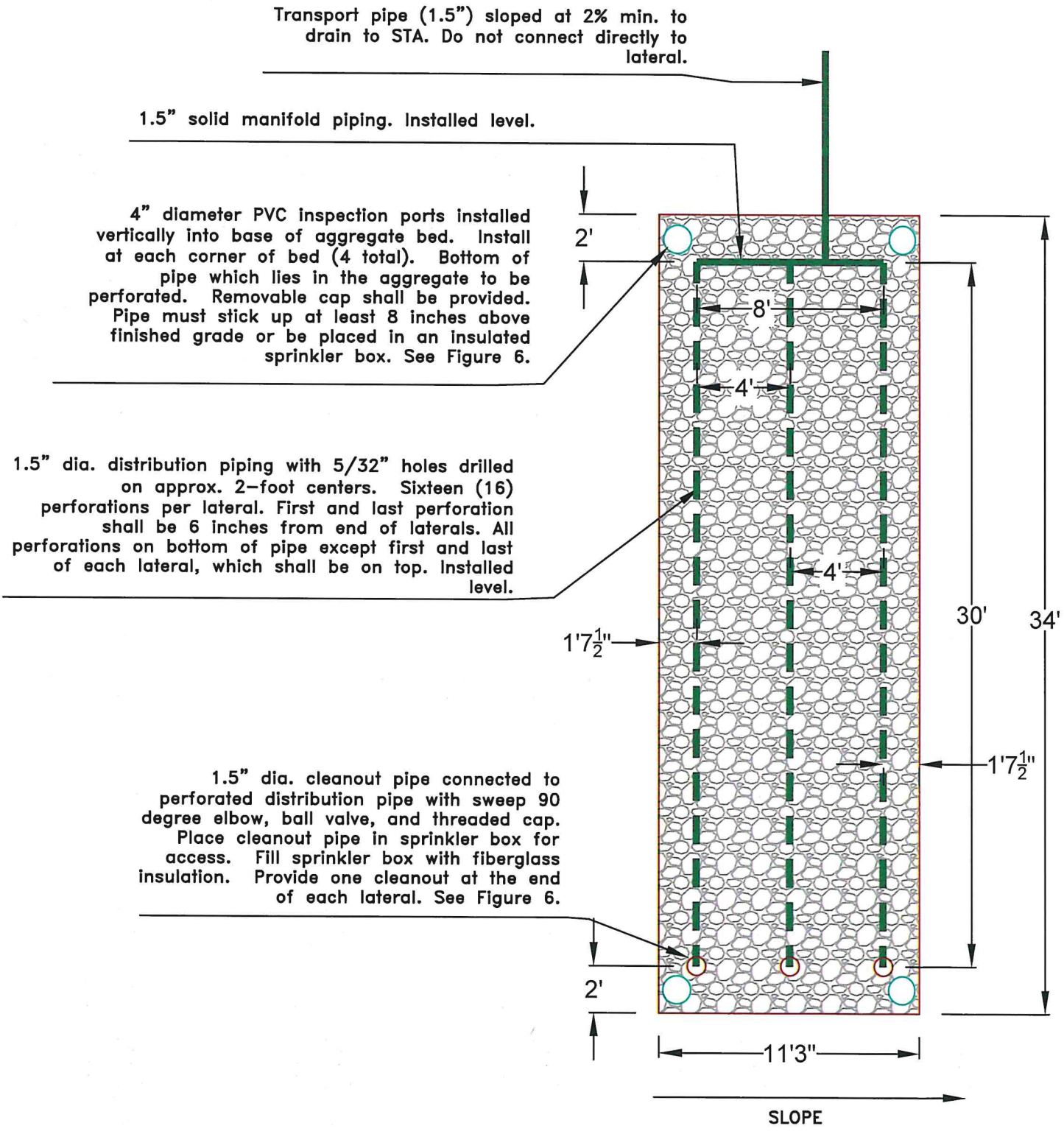
FIGURE 3

GRAVEL BED PLAN VIEW
(NOT TO SCALE)



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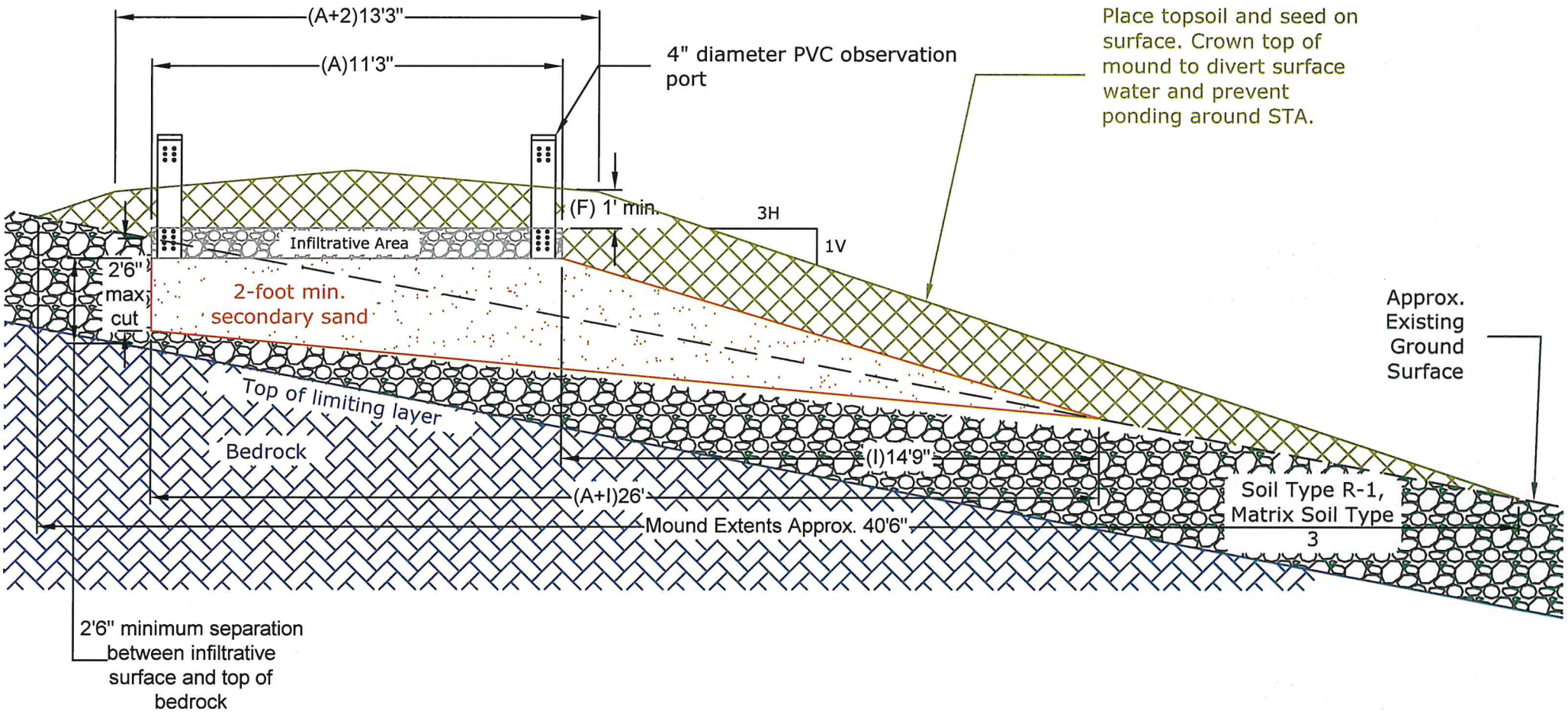
STA Plan View
FIGURE 4

CROSS SECTION
(Not to scale)



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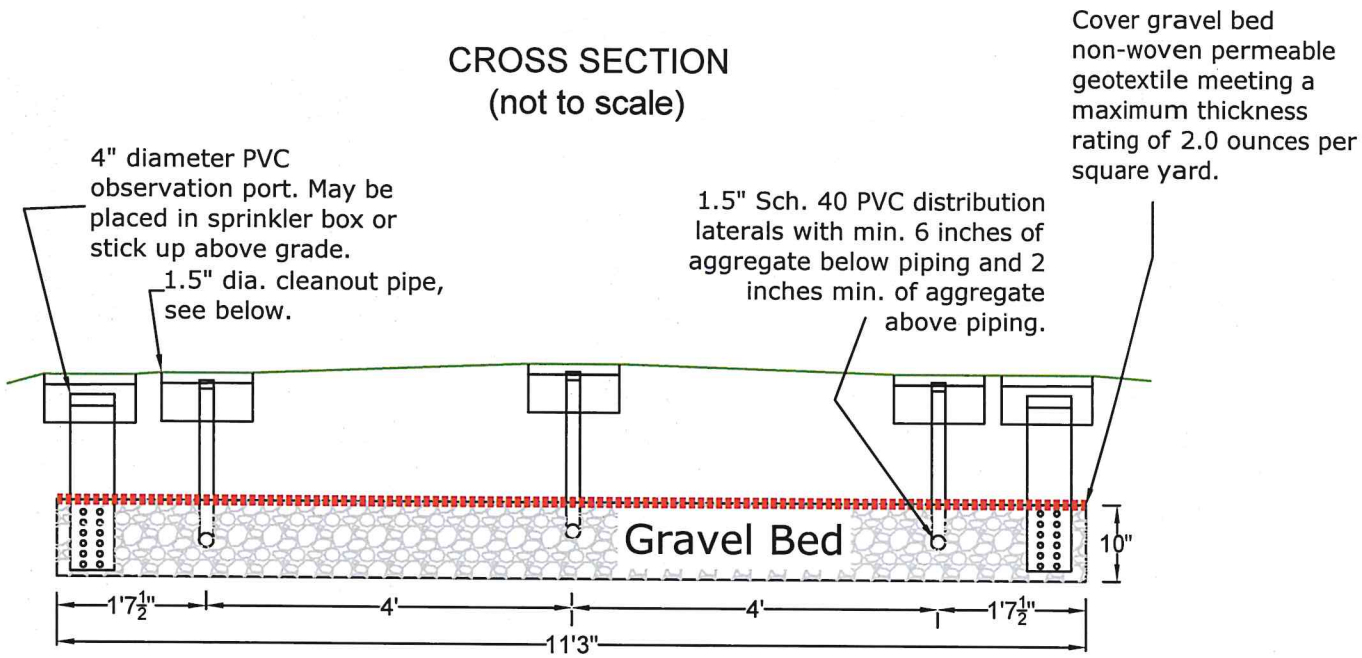
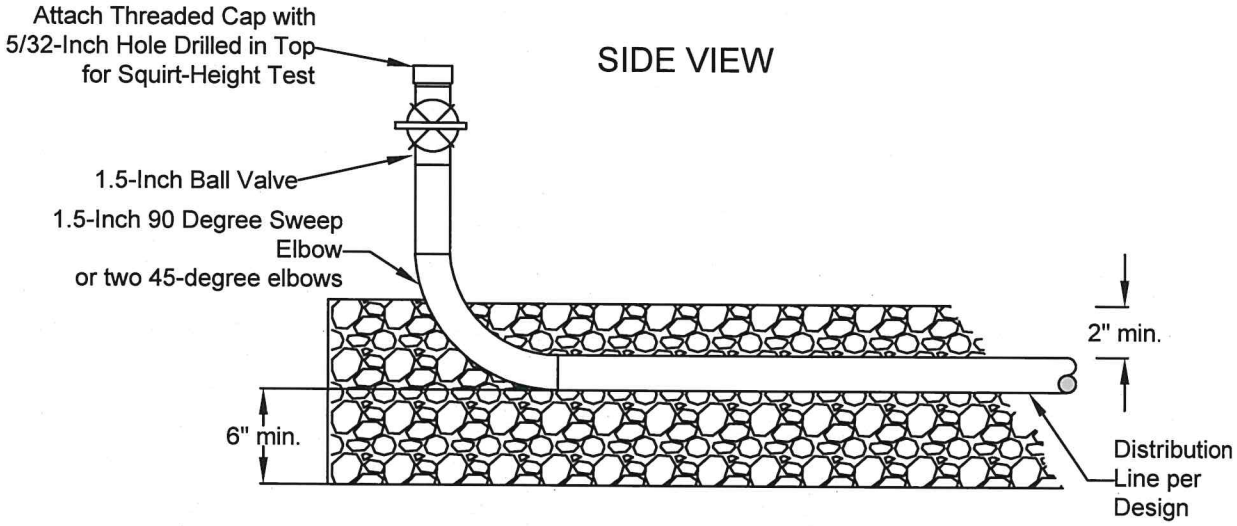
STA Profile View
FIGURE 5

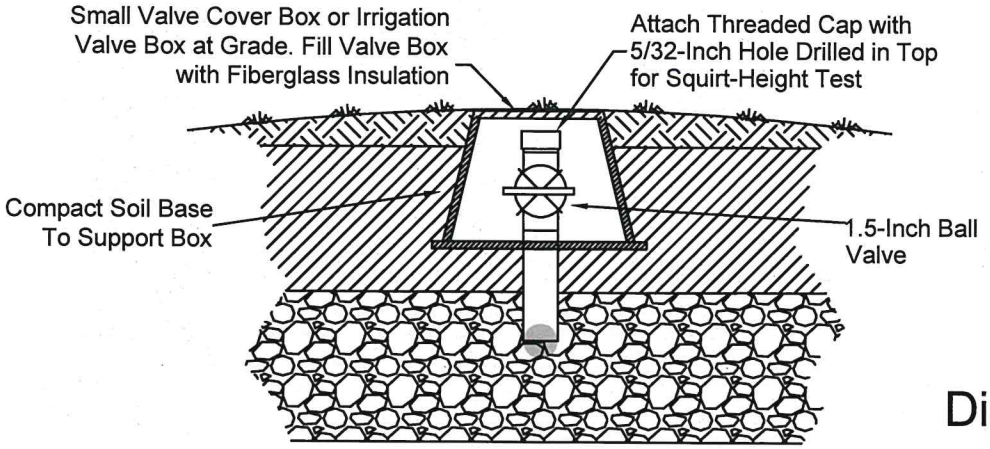
CROSS SECTION
(not to scale)



SIDE VIEW



END VIEW



Distribution Lateral Cleanout Details

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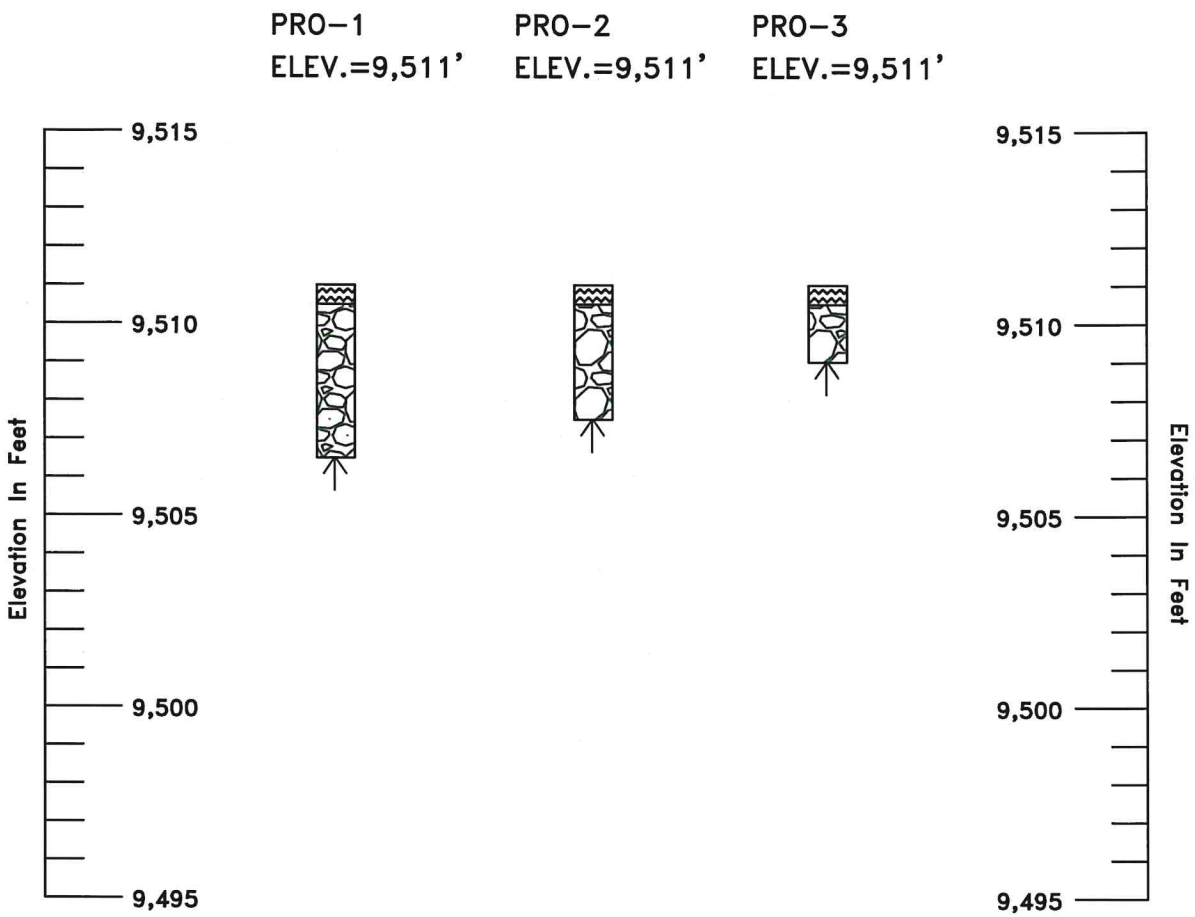
FIGURE 6



LEGEND:

TOPSOIL; silty sand, with roots, dark brown.

SANDY CLAY LOAM: 35 to 60 percent gravel, granular structure shape, moderate structure grade, friable to firm consistence, 5 YR 4/2, no redox features. Soil Type R–1, Matrix Soil Type 3.

Indicates practical excavation refusal on hard bedrock.

NOTES:

1. The pits were excavated with a track–mounted excavator on February 12, 2022.
2. No groundwater was observed in the pits at the time of excavation. Groundwater levels can fluctuate.
3. Pit locations as shown on Figure 2 were measured from site features and should be considered approximate.
4. Pit elevations are estimated from topography shown on Figure 2 and should be considered approximate.
5. These profile pits are subject to the explanations, limitations and conclusions contained in this report.

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Summary Logs of Profile Pits

FIGURE 7