



June 9, 2021

Nathan Nicholas
1701 Constellation Drive
Colorado Springs, CO 80905

Job Number: 20-11970

Subject: On-Site Wastewater Treatment
System Design, Proposed Nicholas
Residence, Tract 65, Section 17, T8N,
R85W, Routt County, Colorado.

Nathan,

This report presents the results of an On-site Wastewater Treatment System (OWTS) Design for the proposed Nicholas Residence to be constructed within Tract 65 in Section 17 of Township 8 North, Range 85 West in Routt County, Colorado. The design was completed in accordance with Colorado Department of Public Health and Environment-Water Quality Commission On-site Wastewater Treatment System Regulation #43 (Regulation), as adopted by Routt County.

NWCC previously completed a Subsoil and Foundation Investigation (SFI) for the proposed residence under this job number in a report dated June 3, 2021.

Proposed Construction: It is our understanding the proposed residence will be constructed with three bedrooms when completed. A bathroom will be constructed in the proposed garage located northwest of the residence. The soil treatment area (STA) for the OWTS will be placed to the east-northeast of the proposed residence and east of the garage.

Site Conditions: The property is situated at the northwest end of Moon Hill Drive in Routt County, Colorado. Potable water will be supplied to the lot by a new potable water well located approximately 80 feet northwest of the residence and 30 feet northwest of the proposed garage.

The proposed STA will be located approximately 40 feet northeast of the proposed residence and approximately 135 feet east-southeast of the proposed well. The vegetation in the area of the proposed STA consists of grasses, weeds and deciduous brush with cottonwood trees. The topography in the area of the proposed STA is relatively flat and generally slopes very gently down to the south on the order of 1 to 3 percent.

A site plan showing the overall site and approximate locations of the existing features and proposed structures and OWTS is provided in Figure #1. A detailed site plan showing the proposed structures along with the proposed OWTS is shown in Figure #2.

Subsurface Conditions: Two test pits were excavated in the area of the proposed STA at the time of the field investigation for the SFI. The subsurface conditions encountered in the area of the STA generally consisted of a layer of topsoil and organic materials overlying natural sands and gravels to the maximum depth investigated, 6 feet below the existing ground surface (bgs).

Natural topsoil and organic materials were encountered at the ground surface and were approximately 12 inches in thickness. The topsoil and organic materials consisted of sandy to silty loam. Natural sands and gravels were encountered below the layer of topsoil and organic materials and extended to the maximum depth investigated. The natural sands and gravels were clean to slightly silty, fine to coarse grained cobbles and occasional small boulders, very low to non-plastic, medium dense to dense, moist to wet and brown to gray in color.

Groundwater was encountered at a depth of 4 feet bgs in each of the test pits at the time of excavation. The seasonal high groundwater table appeared to be 1 to 2 feet bgs.

Percolation testing was not conducted at the site; however, the upper 12 inches of natural topsoil and organic materials will likely exhibit percolation rates of 10 to 20 minutes per inch. Based on the assumed percolation rate of the near surface soils and visual soil classification of the soils encountered in the test pits, NWCC would classify the natural topsoil and organic materials as Soil Type 2 in accordance with Table 10-1 of the Regulations.

OWTS Design: Based on our understanding of the existing and proposed construction, NWCC has determined, using Table 6-1 of the Regulations, an effluent design flow of 450 gallons per day (gpd) for the three bedroom residence. Based on the depth to the seasonal groundwater table, soil classifications and assumed percolation rate the OWTS design consists of a minimum 2 feet mounded, unlined (open bottom) sand filter.

The OWTS design presented below is based on the total anticipated number of bedrooms for the structures, as well as the assumed percolation rate and classification for the natural soils. Based on the soil type and design effluent flow and using an application rate 0.8 gpd/ft^2 (Treatment Level 1-Secondary Media), a minimum sand filter bed area of 563 square feet is required for the residence. Therefore, the sand filter bed will need to be 12 feet wide by 47 feet in length with a minimum depth of 2 feet of sand filter material to achieve a minimum vertical separation of 3 feet from the anticipated groundwater table. The sand filter material must be approved by NWCC prior to use and consist of a clean, well graded sand, which meets ASTM C33 specifications for concrete sand with 1 percent or less passing the No. 200 sieve. Based on a soil type 2 for the topsoil and organic materials, the minimum basal area required is 750 square feet. The minimum basal area can be achieved by constructing the sand fill materials at a 1 to 1 (H):1(V) or flatter slope. Compacted clay fill materials, a minimum of 12 inches in thickness, must be placed around the perimeter of the mounded sand filter at a minimum 3(H):1(V) final slope configuration.

A pressurized distribution system is required for the mounded sand filter. The pressurized distribution system will consist of six 1.5-inch diameter PVC pipe (Schedule 40) laterals with 5/32-inch diameter orifice's spaced at 48 inches on center. The orifices should be oriented to spray upward (12 o'clock) and should be staggered between adjacent pipes. To allow the distribution lines to drain and prevent freezing, NWCC recommends two of the orifices, in each lateral, be oriented downward (6 o'clock). The perforated distribution lines should be placed in a minimum of 12 inches of washed gravel (3/4" to 2.5" diameter) placed over the sand filter materials.

Septic Tank and Dosing System: A septic tank with a minimum capacity of 1,000-gallons is required for the three bedroom residence. Due to the subsurface conditions encountered at the site, NWCC recommends a concrete septic tank be used.

The manhole lids must be exposed at final grades. Manhole ring extensions should be used as needed to reach final grades. The tank must be placed to allow access for pumping. Generally, a septic tank can be pumped from 100 feet away with a maximum lift of 10 feet; however, a local sewage pumping contractor should be consulted in regards to the tank maintenance access.

The mounded sand filter treatment system is required to be pressurized. NWCC recommends a 1,250-gallon, three compartment septic/dosing tank be used for the system. The pump system for the pressurized dosing system will consist of a high head pump (Orenco PF 5005) with a 2-inch diameter PVC (Schedule 40) discharge assembly to achieve a 60" residual head at the last orifice. The pump must be installed in an Orenco Biotube pump vault with a 24-inch Biotube filter. The effluent will be distributed to each of the perforated distribution lines from the pumps discharge assembly through a 2-inch diameter solid PVC (Schedule 40) transport line to a level manifold, 1 1/2-inch diameter solid PVC (Schedule 40) pipe, located at the west end of the mounded sand filter bed. The solid 2-inch diameter PVC transport line should be constructed to drain to the dosing tank or manifold when the pump is off. NWCC recommends a minimum soil cover of 48 inches and/or insulation to prevent freezing if the piping is not allowed to drain.

NWCC recommends the system have a high level alarm float, a low level/pump off float and a pump ON/OFF float. We recommend the floats in the dosing tank be set to provide a dose of 100 to 125 gallons. A control panel with high level alarm (light and audible) should be placed outside the residence in a location that allows line of sight between the control panel and the pump chamber. The control panel should not be placed adjacent to a bedroom area, since an audible clicking will occur when the pump cycles on and off. A secondary or backup pump stored on-site for quick change over is also recommended in the event of a pump failure.

The system design for the sand filter system is presented in Figures #1 through #5. The design calculations are shown in Appendix A and the specifications for the system are given in Appendix B. Any variance of equipment/materials specified in this design must be approved by NWCC prior to construction.

Operation and Maintenance: Observing the operation and performing routine maintenance of the OWTS is essential to allow proper, long term functioning of the system. NWCC recommends the operation be monitored and a qualified, licensed maintenance contractor provide maintenance of the system.

- 1) Septic Tank: The scum and sludge accumulation in the septic tank should be monitored yearly. Once the scum or sludge thickness reaches 25% of the chamber depth, the septic tank should be pumped. A pumping frequency of 1 to 3 years is likely at the design flows used for this system; however, depending on use, pumping may only be required every 3 to 5 years.
- 2) Effluent Filter and Dosing/Pump System: The effluent filter in the pump vault should be cleaned when the septic tank is inspected or as required. The effluent pump should be checked semi-annually to ensure the pump is functioning properly. If the high water alarm sounds, the system should be inspected and serviced immediately. NWCC strongly recommends a backup pump be stored on-site for quick change over in the event of a pump failure.
- 3) Sand Filter Soil Treatment Area: STA should be fenced off to livestock. The surface area around the STA should be observed monthly for signs of failure, such as lush vegetation growth or ponding. Liquid levels within the gravel bed should be observed through the observation pipes.
- 4) Treated Water: NWCC does not recommend water softeners or water treatment systems be connected to the OWTS. The chemical and hydraulic loading from the backwash of these treatment systems may be detrimental to the OWTS. If a treatment system is used, a separate dry well should be constructed for the backwash waste. In addition, chemically treated water from a swimming pool or spa must not be discharged into the OWTS.
- 5) Floor Drains: NWCC does not recommend garage floor drain systems be connected to the OWTS. Oils, grease and chemicals from vehicles may be detrimental to the OWTS. NWCC recommends garage floor slab be sloped to drain to the garage door. If a garage floor drain is constructed, NWCC recommends the drain be connected to a separate sand/oil interceptor tank, which can be pumped as required.
- 6) General Notes: The owner should be aware that the operation of the OWTS is different from a public sewer service. Plastic and other non-biodegradable materials should not be placed into the system. Water use should be monitored so fixtures are not allowed to run if a seal malfunctions. Allowing fixtures to flow continuously to prevent water lines from freezing or a malfunctioning faucet or toilet can consume in excess of 1,000 gallons per day. Excessive flows could continually flood and cause premature failure of the system. No plastic or landscaping that requires additional irrigation should be placed over the absorption field.

Limitations: The procedures and design criteria used in this evaluation/design were obtained from the EPA "Design Manual - On-site Wastewater Treatment and Disposal Systems", 1980, as well as the Colorado Department of Public Health and Environment-Water Quality Control Commission, On-site Wastewater Treatment System Regulation, Regulation #43, effective June 30, 2017.

The OWTS design presented is based on currently accepted design procedures, the proposed structures and usage of the facilities. If the usage of the structure or addition of new facilities to those currently planned in the building changes, the OWTS design will also most likely change. It should also be noted that all OWTS require periodic maintenance as noted above. The failure of the owner to provide periodic inspection and maintenance of the system can lead to premature system failure.

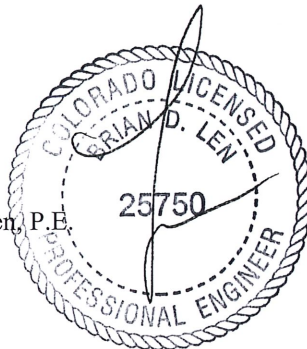
Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an OWTS. In addition, this office must be retained by the client to observe the construction/installation of new components of the OWTS and evaluate the existing absorption field as well as provide an as-built report to the Routt County Department of Environmental Health when the construction is completed.

If you have any questions concerning this report, or if we may be of further service, please contact this office.

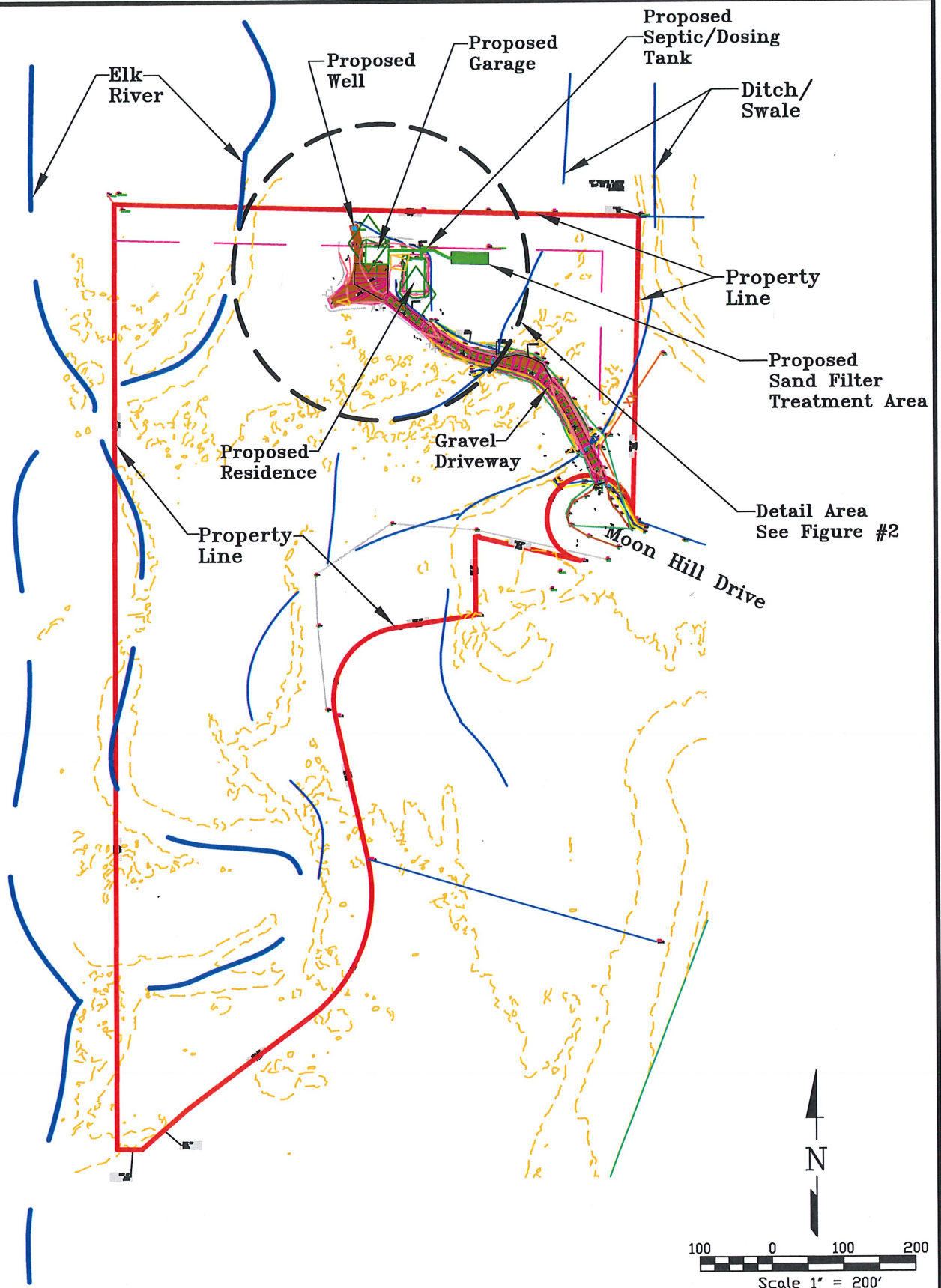
Sincerely,
NWCC, Inc.

Timothy S. Travis, P.E.
Senior Project Engineer

Reviewed by Brian D. Lenz, P.E.
Principal Engineer



cc: Jonah Lotz



Title: **OWTS - OVERALL SITE PLAN**

Job Name: **Proposed Nicholas Residence**

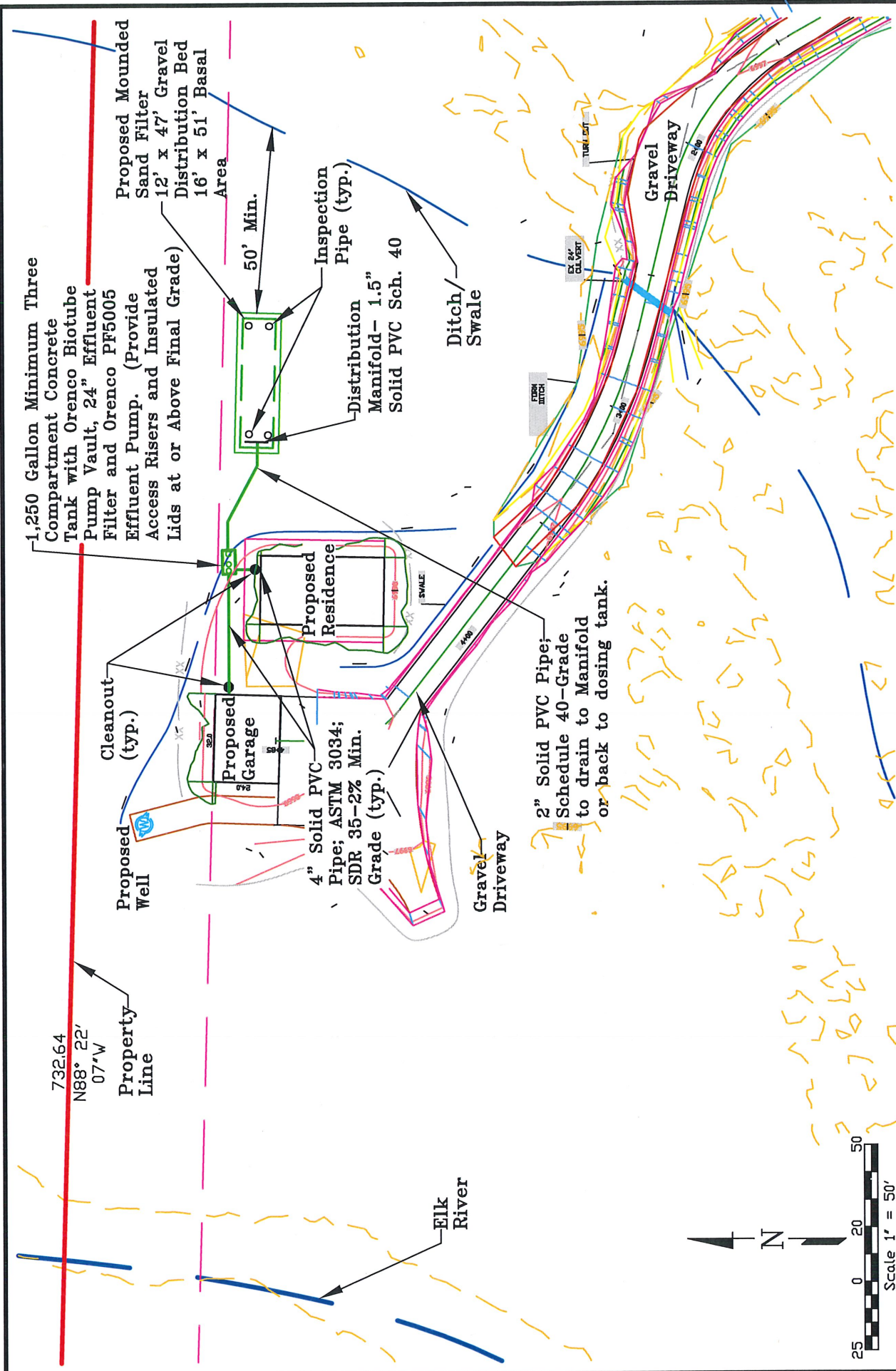
Location: **Tract 65, Section 17, T8N, R85W, Routt County, CO**

Date: **6/3/2021**

Job No. **20-11970**

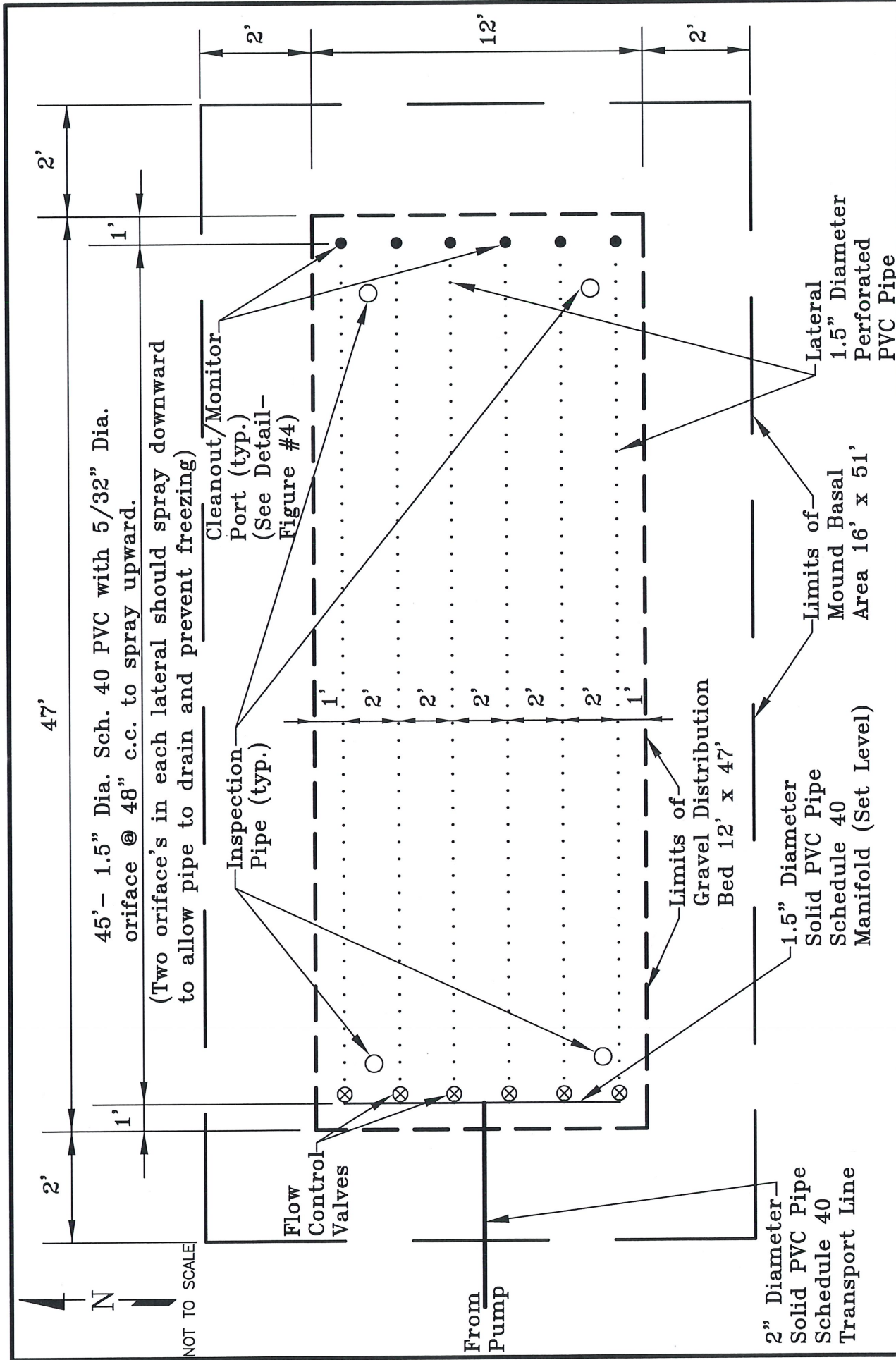
Figure **#1**

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Title: OWTS - MOUNDED SAND FILTER SITE PLAN		Date: 6/3/2021
Job Name: Proposed Nicholas Residence	Job No. 20-11970	
LOCATION: Tract 65, Section 17, T8N, R85W, Routt County, Colorado	Figure # 2	

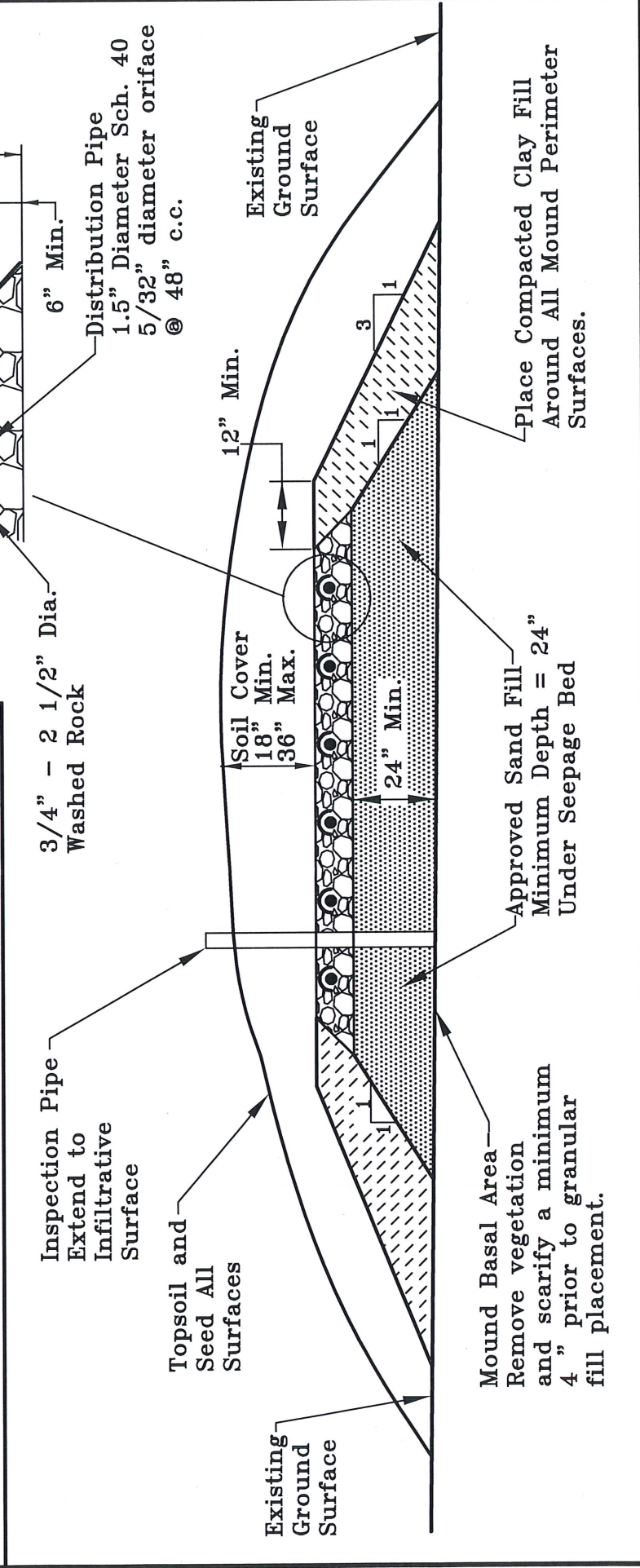
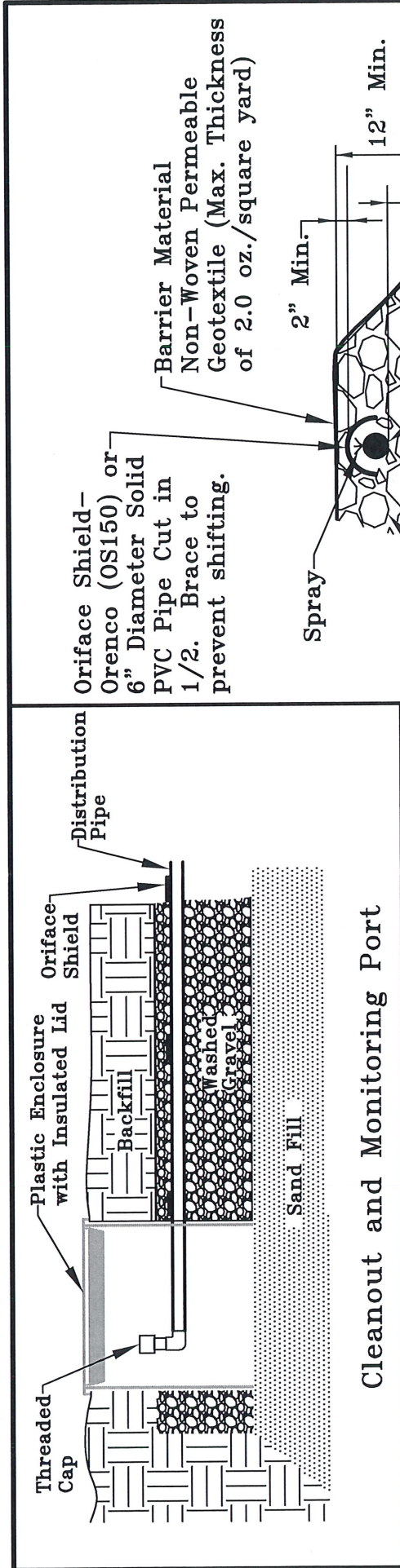
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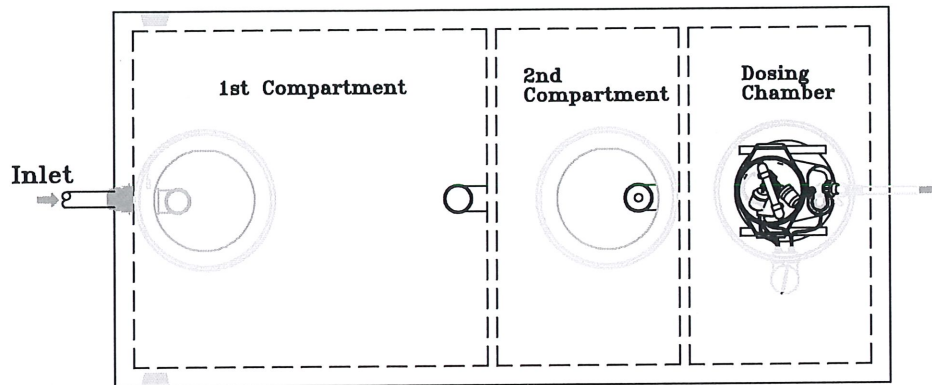
Title: OWTS - MOUNDED SAND FILTER PLAN		Date: 6/3/2021	
Job Name: Proposed Nicholas Residence		Job No. 20-11970	
LOCATION: Tract 65, Section 17, T8N, R85W, Routt County, Colorado		Figure #3	



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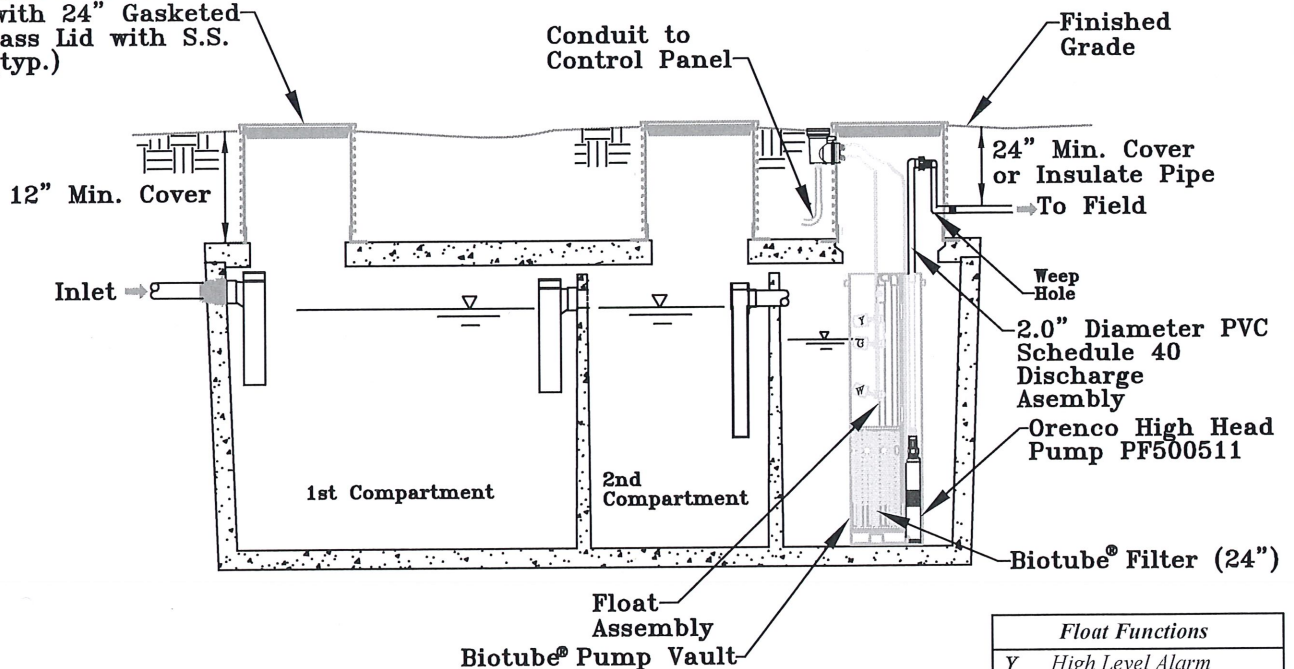


<p>Title: OWTS-MOUNDED SAND FILTER GRAVEL BED CROSS SECTIONS</p>	<p>Date: 6/3/2021</p>	<p>North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970) 879-7888 • Fax (970) 879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487</p>
<p>Job Name: Proposed Nicholas Residence</p>	<p>Job No. 20-11970</p>	
<p>LOCATION: Tract 65, Section 17, T8N, R85W, Routt County, Colorado</p>	<p>Figure # 4</p>	



Top View

24" Diameter PVC Riser with 24" Gasketed Fiberglass Lid with S.S. Bolts (typ.)



Section View

Float Functions	
Y	High Level Alarm
G	Override Timer ON/OFF
W	LLA/RO

* Note: Septic tank shown is a typical 3-compartment septic tank/pump configuration. Installer must submit detail from septic tank manufacturer, for approval by NWCC prior to construction.

Title: OWTS - SEPTIC TANK DETAILS		Date: 6/3/2021	
Job Name: Proposed Nicholas Residence		Job No. 20-11970	
Location: Tract 65, Section 17, T8N, R85W, Routt County, CO		Figure #5	

APPENDIX A

SUMMARY OF DESIGN CALCULATIONS

A. Sewage Volume Calculations

1) Proposed Residence: Three Bedrooms

2) Design Flow (Table 6-1) Q = 450 gpd

B. System Sizing

1) Soil Type 2 (Natural Topsoil) (Table 10-1)

2) Minimum mounded sand filter bed area = $Q/LTAR = 450\text{gpd}/0.8\text{gpd}/\text{ft}^2 = 563\text{ ft}^2$

3) Minimum basal area = $450\text{ gpd}/0.6\text{ gpd}/\text{ft}^2 = 750\text{ ft}^2$.

4) Designed sand filter bed area = $12' \times 47' = 564\text{ ft}^2$.

5) Designed basal area = $(12' + 2' + 2') \times (47' + 2' + 2') = 816\text{ ft}^2$.

6) Septic Tank - 1,000-gallon septic tank minimum for the three-bedroom residence (Table 9-1).

Minimum Horizontal Setbacks in Feet

	Spring, Well, Potable Water Supply Cistern	Potable Water Supply Line	Dwelling, Occupied Building	Property Line, Piped or Lined Irrigation Ditch	Waterbody (Lake, Water Course, Irrigation Ditch, Wetland)	Dry Gulch/Swale, Subsurface Drain, Intermittent Irrigation Lateral
Septic Tank/ Dosing Tank	50	10	5	10	50	10
Building Sewer or Effluent Line	50	5		10	50	10
Soil Treatment Area	100	25	20	10	50	25

APPENDIX B

- 1) The Rules and Regulations of the CDPHE and Routt County Department of Environmental Health must be complied with during the installation/construction of the system.
- 2) Periodic inspections must be made by NWCC at the following points during construction:
 - a. After subgrade excavation and septic tank and solid PVC pipe installation.
 - b. After placement of sand fill, washed gravel and perforated PVC piping, prior to backfilling.
NWCC should observe flow control valve adjustment for proper spray height.
 - c. Upon final completion of the project.
- 3) The 4-inch PVC pipe shall conform to ASTM 3034/SDR 35 or better quality. Pressurized lines shall consist of Schedule 40 PVC or other approved piping material suitable for pressurized wastewater transmission. Pressurized lines should be constructed to drain to field or pump tank or have adequate cover and/or insulation to prevent freezing. The piping should also be tested prior to approval. The perforated pipe in the STA should be constructed level.
- 4) Soils beneath the pipes entering and leaving a septic or dosing tank, which has been excavated, shall be backfilled in 6 inch lifts and mechanically compacted to a minimum of 95% of the maximum standard Proctor density. PVC pipe meeting ASTM 3034-SDR 35 or schedule 40 shall be used for 5 feet on the inlet and outlet sides of the tank.
- 5) Provide a minimum of 12 inches of soil cover over the septic tank, 18 inches of soil over the STA and 24 inches of soils cover over all pipes. Any piping placed under a driveway or other plowed areas should have a minimum of 48 inches of soil cover or be protected from freezing using insulation or other approved means. Manhole and distribution box lids must be exposed at final grades. Provide manhole ring or distribution box extensions as needed to reach final grades. Insulated lids are required.
- 6) Special care should be taken when backfilling the system to prevent disturbance/crushing of the distribution lines. In addition, the distribution lines must be carefully bedded to minimize the settlement in these lines.
- 7) Surface drainage shall be ditched and diverted away from the soil treatment area and all tanks.
- 8) Disturbed surfaces, mounds and berms shall be covered with topsoil and heavily seeded. Heavy farm equipment and livestock should be fenced or kept off of the soil treatment area.
- 9) The washed rock shall be covered with non-woven permeable geotextile (max. 2 oz/square yard) barrier material before overlying soils layers are placed. The washed rock will consist of gravel from 0.75 to 2.5 inches in size. The sand filter materials must be approved prior to use by NWCC and consist of a clean, well graded sand meeting ASTM C33 for concrete sand with 1 percent or less passing the No. 200 sieve.