NorthWest Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing

August 4, 2023

Beth Herbert
PO Box 273
Yampa, CO 50433
happytraveler23@yahoo.com

Job Number: 23-13059

Subject: On-Site Wastewater Treatment System Design, Proposed Herbert Residence, 18195 Highway 131, Routt County, Colorado.

Beth,

This report presents the results of an On-site Wastewater Treatment System (OWTS) design for your proposed residence to be constructed at 18195 Highway 131 in Routt County, Colorado. This 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 the Routt County Board of Health. NWCC previously completed a Subsoil and Foundation Investigation at this site under this job number and dated July 15, 2023, and updated July 31, 2023.

Proposed Construction: It is our understanding that the residence will have a total of 4 bedrooms when completed. The proposed soil treatment area (STA) will be situated approximately 50 feet northeast of the proposed residence. A water well currently exists over 250 feet to the south of the proposed residence. Any new wells must be located a **minimum** of 100 feet from the STA.

Site Conditions: The proposed building site is located west of HWY 131 in Routt County, Colorado. Sheds and a barn currently exist at the site. The Yampa River runs approximately 70 feet to the west of the proposed residence. Mapped wetlands exist over 100 feet south of the proposed residence. Vegetation in the area of the proposed STA consists of grasses, weeds and willows. The topography in the area of the proposed OWTS STA is fairly flat. A site plan showing the overall site features with locations of the proposed residence, OWTS and STA is shown in Figure #1. A detailed site plan of the proposed OWTS is shown in Figure #2.

Subsurface Conditions: Two profile pits were excavated near the proposed STA on June 22, 2023. The subsurface conditions encountered in the profile pits were somewhat variable and generally consisted of approximately 18 to 24 inches of topsoil and organic materials overlying sands, gravels and cobbles that extended to the maximum depth investigated, 6 feet below the existing ground surface (bgs). Groundwater was encountered at 1 ½ to 3 feet bgs. The high-water line appeared to be between 1 and 2 feet bgs.

Percolation testing was not completed in the area of the proposed STA. Based on our experience in this area, the topsoil and organic materials will likely exhibit percolation rates between 16 and 25 minutes per inch. Based on the assumed percolation rate of the topsoil and organic materials, NWCC has classified the topsoil and organic materials (sandy loam to silt loam) as Soil Type 2 in accordance with Table 10-1 of the Regulations.

OWTS Design: Based on the soils encountered at the site and our understanding of the proposed construction, NWCC recommends the OWTS design consist of a minimum 2-foot thick pressurized, unlined (open bottom) sand filter placed over the natural topsoil and organic materials.

The OWTS design presented below is based on the total anticipated number of bedrooms (4) for the structure, as well as the Soil Type classification for the natural soils. Considering the anticipated construction, NWCC has determined, using Table 6-1 of the Regulations, an effluent design flow of 525 gallons per day (gpd) for a four bedroom system.

Based on the soil type and design effluent flow and using an application rate 0.8 gpd/ft^2 (Treatment Level 1) for the imported secondary media/sand filter materials, a minimum gravel bed area of 657 ft^2 is required for this system. Therefore, a gravel bed 55' by 12' will be required.

Based on a Soil Type 2 and an application rate of 0.6 gpd/ft^2, the minimum sand filter basal area required is 875 ft^2. The minimum basal area can be achieved by constructing the 2 feet of sand fill materials at a 1(H):1(V) or flatter slope from the edge of the gravel bed. Therefore, the basal area of the sand filter for each bed will be 16 feet wide by 59 feet in length, which equals 944 ft^2, which exceeds the minimum area required, 875 ft^2.

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 3 percent or less passing the No. 200 sieve. A minimum of 2 feet of sand filter materials must be placed over the natural topsoil and organic materials.

A pressurized distribution system is required for the sand filter system. The pressurized distribution system will consist of six 1.5-inch diameter PVC pipe (Schedule 40) laterals with 1/8-inch diameter orifices spaced at 36 inches on center for each bed.

The orifices should be oriented to spray upward (12 o'clock). 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. A flow control valve must be placed in each of the lateral lines, after the manifold. The flow control valves should be adjusted to maintain a minimum 5 feet spray height at the last orifice.

Properly compacted clay fill materials, a minimum of 12 inches in thickness, must be placed around the perimeter of the mounded sand filter system at a minimum 3(H):1(V) final slope configuration.

A septic tank with a minimum capacity of 1,250-gallons is required for a four-bedroom residence. Due to the subsurface conditions encountered at the site, NWCC recommends a concrete septic tank be used. Since the system will have to be pressurized, NWCC recommends a 2,000-gallon, three compartment septic/dosing tank be used for the system.

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 regarding tank maintenance access.

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 ½-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 septic 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. NWCC recommend the floats in the dosing tank be set to provide a dose of approximately 110 to 130 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 is presented in Figures #2 to #4 and typical septic/dosing tank details are presented in Figure #5. The design calculations and minimum required setbacks 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 provides 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 pumps are 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) *Soil Treatment Area*: The 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 sand filter 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 OWS. 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 daylighted properly in accordance with current regulations or 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 STA.

Limitations: The procedures and design criteria used in this 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 in this report 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 on-site wastewater treatment systems 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.

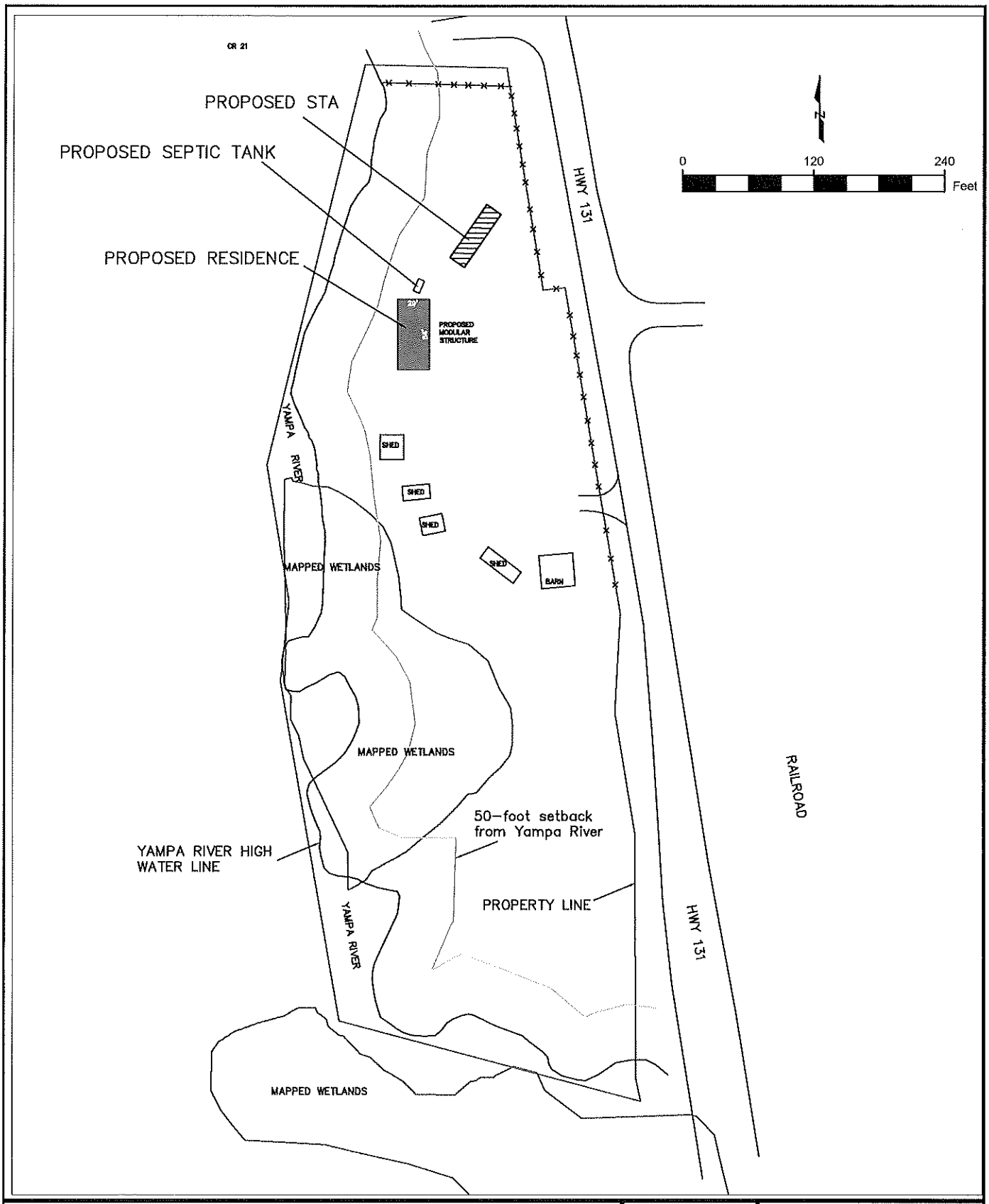
Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an OWTS. **In addition, this office must be retained by the client to observe the construction/installation of the OWTS and to provide an as-built report to the Routt County Department 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.

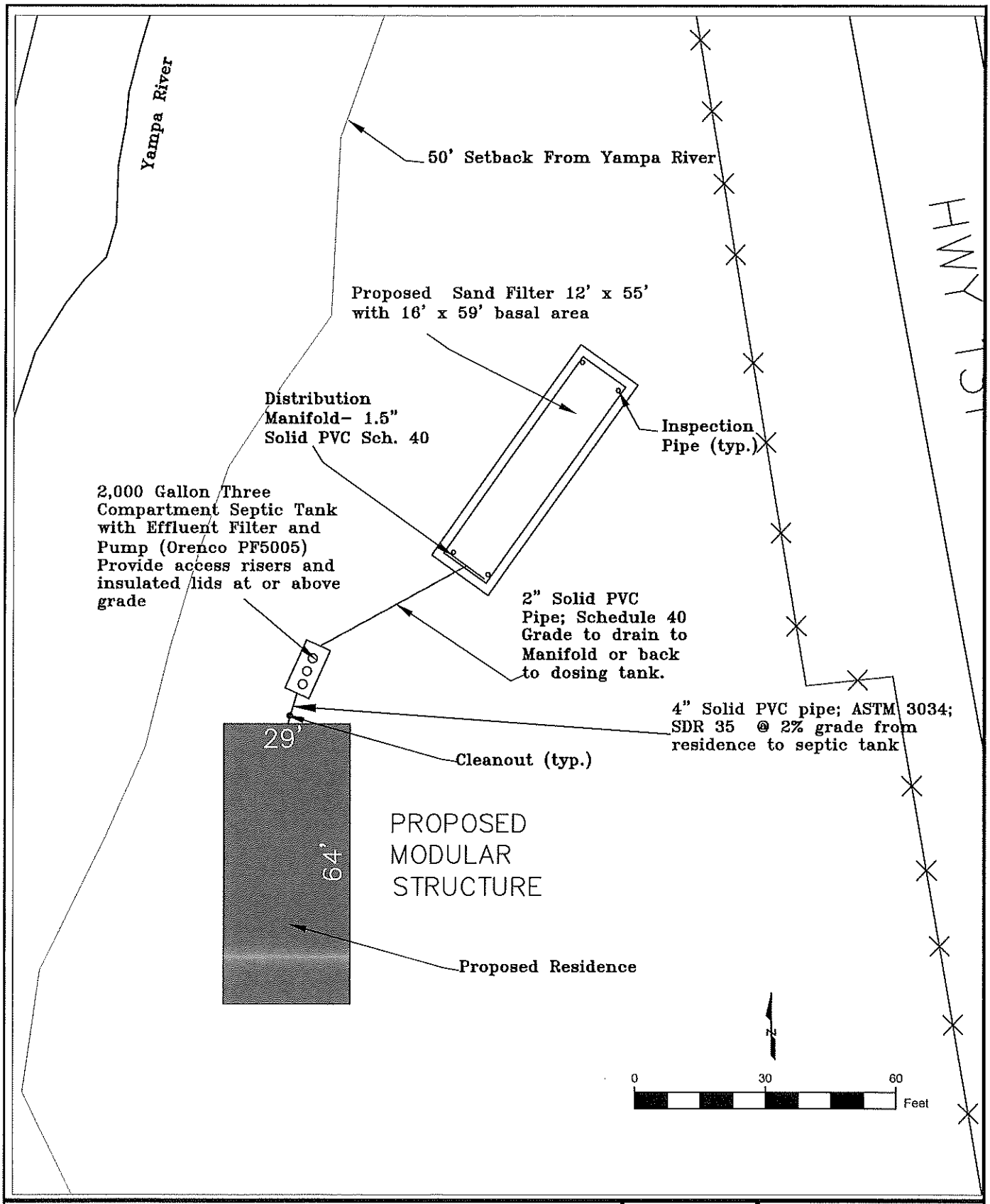
Sincerely,
NWCC, INC.

Erika K. Hill, P.E., P.G.
Sr. Project Engineer

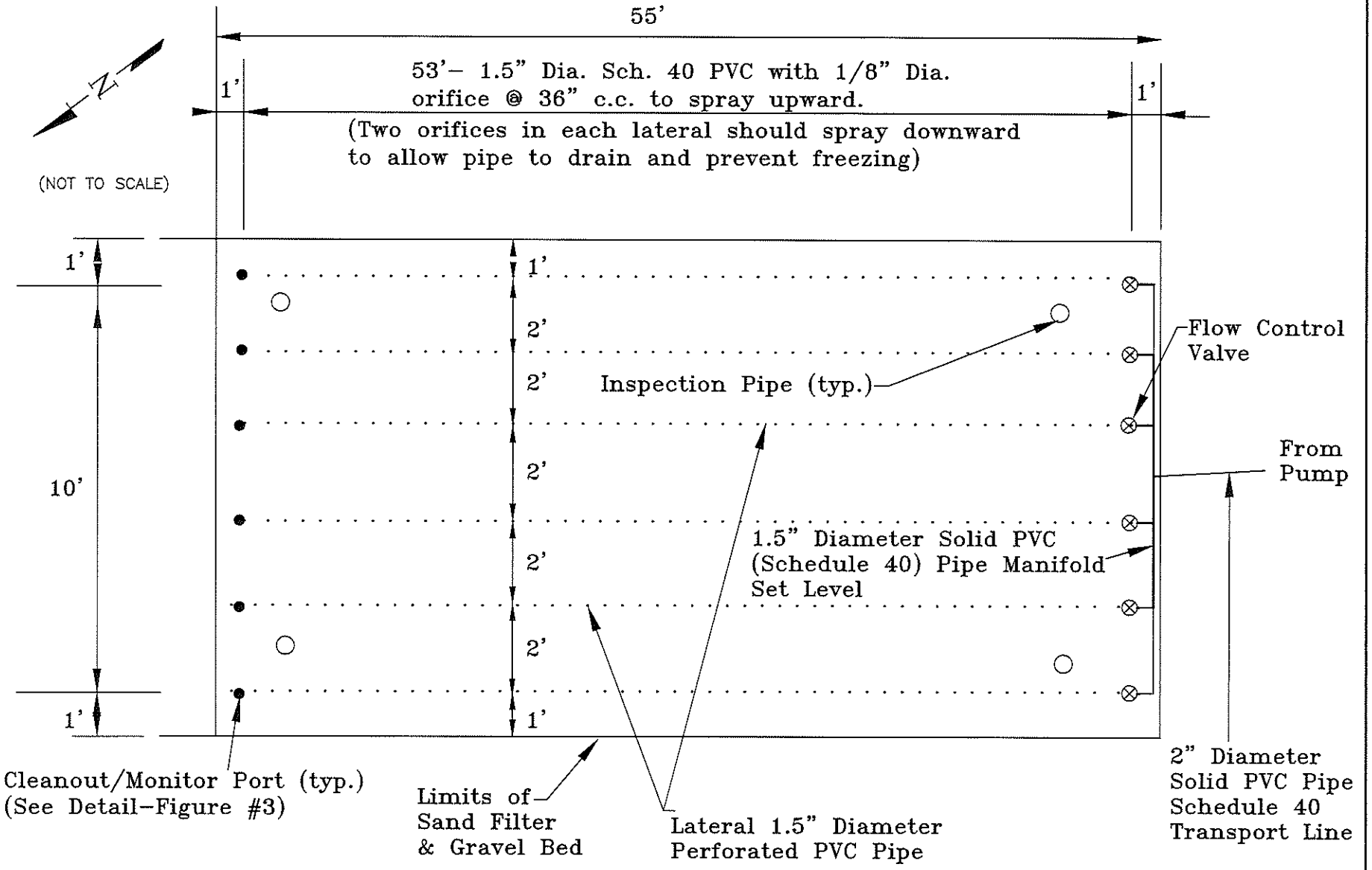
Reviewed by, Brian D. Len, P.E.
Principal Engineer



Title: OWTS – OVERALL SITE PLAN	**Date:** 8/3/23	NWC North West Colorado Consult Geotechnical / Environmental Engineering • Materials Testing
Job Name: Proposed Herbert Residence	**Job No.** 23-13059	(970)879-7888 • Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: 18195 Highway 131, Routt County, Colorado	**Figure** #1	



Title: OWTS – DETAIL SITE PLAN	Date: 8/3/23	NWC North West Colorado Consult Geotechnical / Environmental Engineering • Materials Testing (970)879-7888 • Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Proposed Herbert Residence	Job No. 23-13059	
Location: 18195 Highway 131, Routt County, Colorado	Figure #2	



Title: OWTS – SAND FILTER/GRAVEL BED PLAN		Date: 8/3/23
Job Name: Proposed Herbert Residence		Job No. 23–13059
LOCATION: 18195 Highway 131, Routt County, Colorado		Figure #3

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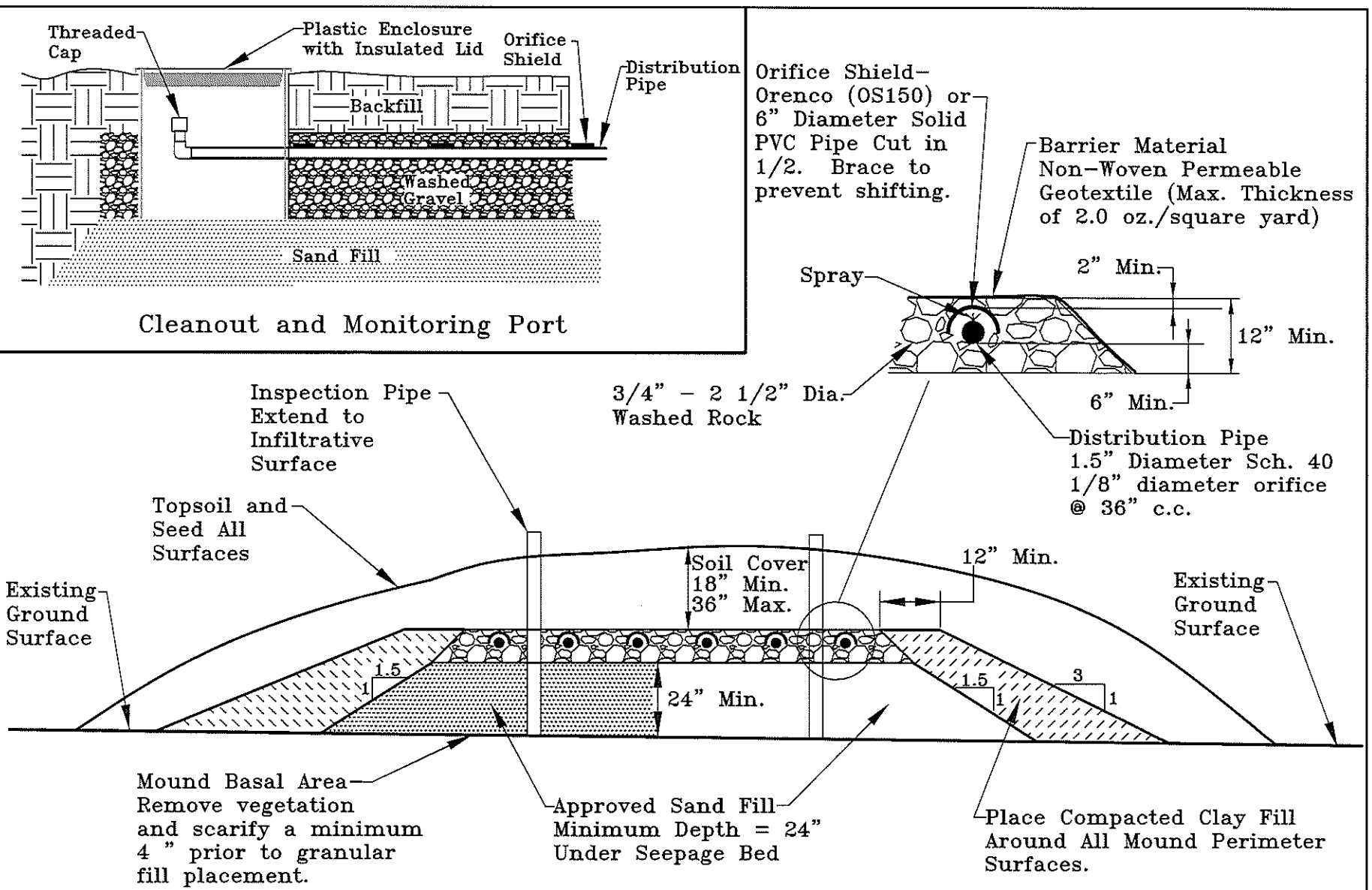
North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing
(970)879-7888 • Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

Cleanout and Monitoring Port



Title:	MOUNDED SAND FILTER GRAVEL BED CROSS SECTIONS	Date:	8/3/23
Job Name:	Proposed Herbert Residence	Job No.	23-13059
LOCATION:	18195 Highway 131, Routt County, Colorado	Figure	#4

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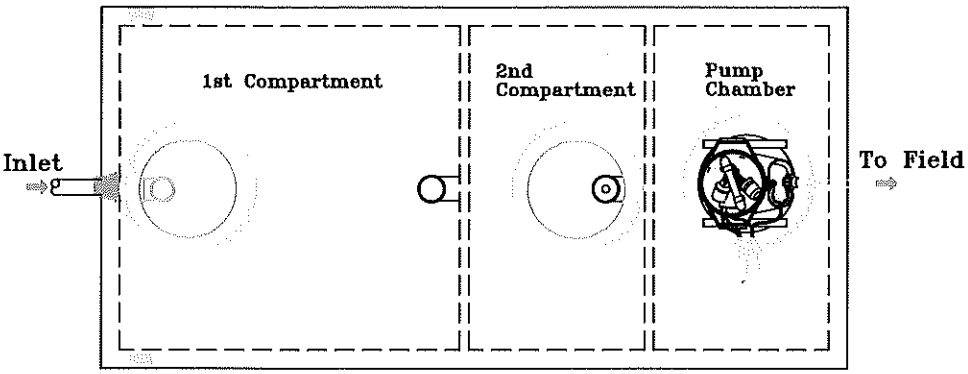
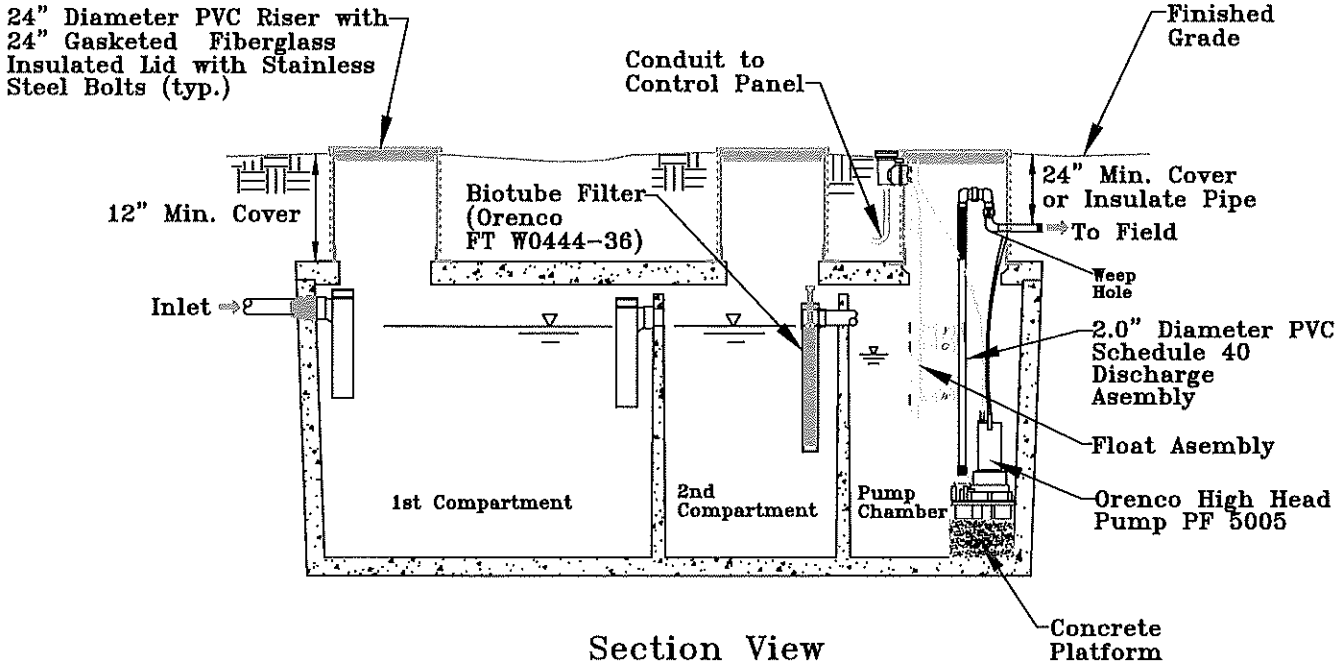
North West Colorado Consultants, Inc.
Geotechnical / Environmental Engineering • Materials Testing
(970)879-7888 • Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487



Top View



Section View

* 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.

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

Title: OWTS-SEPTIC TANK DETAILS		Date: 8/3/23
Job Name: Proposed Herbert Residence		Job No. 23-13059
Location: 18195 Highway 131, Routt County, Colorado		Figure #5

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Geotechnical / Environmental Engineering • Materials Testing
(970)879-7888 • Fax (970)879-7691
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487

APPENDIX A

SUMMARY OF DESIGN CALCULATIONS

A. Sewage Volume Calculations

1) Number of Bedrooms:.....4 Bedrooms

2) Design Flow (Regulations Table 6-1).....Q = 525 gpd

B. System Sizing

1) Soil Type 2 (Table 10-1)

2) Minimum mounded gravel bed area = Q/LTAR = 525 gpd/0.8 gpd/ ft^2 = 657 ft^2

3) Minimum sand filter basal area = 525 gpd/0.6 gpd/ ft^2 = 875 ft^2.

4) Designed mounded gravel bed area = 12' x 55' =660 ft^2.

5) Designed sand filter basal area = (12' + 4') x (55' + 4') = 944 ft^2.

6) Septic Tank - 1,250-gallon septic tank minimum for a four-bedroom residence (Table 9-1).
2,000-gallon three compartment septic/pump tank recommended.

Minimum Horizontal Setbacks in Feet

	Spring, Well, Potable Water Supply Cistern	Potable Water Supply Line	Structure with basement, crawl space or footing drain	Property Line, Piped or Lined Irrigation Ditch	Waterbody (Lake, Water Course, Irrigation Ditch, Wetland)	Dry Gulch/Swale
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 (RCDEH) 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 pipe, prior to backfilling. NWCC should observe flow control valve adjustment for proper spray height.
   c. Upon final completion of the project.

3) Four-inch PVC pipe shall conform to ASTM 3034/SDR 35 or better quality. Pressurized lines shall consist of solid 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. NWCC recommends a minimum 20 psi testing pressure. The perforated pipe in the absorption field should be constructed level.

4) Soils beneath the pipes entering and leaving a septic or aeration 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. Cast iron pipe or PVC pipe meeting or exceeding 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, 12 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 or pressure lines not allowed to drain should have a minimum of 48 inches of soil cover or be protected from freezing using insulation or other approved means. Manhole lids must be exposed at final grades. Provide manhole ring extensions as needed to reach final grades.

6) A layer of compacted clay fill materials should be placed along the sides of the mounded basal area that are constructed above the existing ground surface. The clays should be compacted to at least 95% of the maximum standard Proctor density and have at least 70% passing the No. 200 sieve.

7) Special care should be taken when backfilling the system to prevent disturbance/crushing of the distribution lines. In addition, the distribution lines should be carefully bedded to minimize the settlement in these lines.

8) Surface drainage shall be ditched and diverted away from the STA and all tanks.

9) 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 STA.

10) Washed rock shall be covered with synthetic filter fabric (Mirafi 140N) barrier material before overlying soils layers are placed. The washed rock will consist of gravel from 0.75 to 2.5 inches in size.

11) Inspection pipes to be constructed of PVC pipe with the portion of the pipe penetrating the gravel and sand being perforated. Inspection pipes must be extended to infiltrative surface at bottom of sand fill. Cleanouts must be placed in the solid distribution line downstream of the septic tank at maximum intervals of 100' or above any pipe bends 45 degrees or greater.

12) It is the responsibility of the owner and the installer to comply with all of the minimum setback requirements in the Regulations.

13) 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 3 percent or less passing the No. 200 sieve.