



March 2, 2021

Altitude Custom Builders  
Nate Reynolds  
P.O. Box 88013  
Steamboat Springs, CO 80488

Job Number: 20-12006

Subject: On-Site Wastewater Treatment  
System Design, Blandford Residence  
and Caretaker Residence, Homestead  
B8, Marabou Subdivision, Filing 1,  
Routt County, Colorado.

Nate,

This report presents the results of an On-site Wastewater Treatment System (OWTS) design for the Blandford Residence, currently under construction, and the proposed Caretaker Residence to be constructed within Homestead B8 of the Marabou Subdivision, Filing 1 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 (SFI) for the site under this job number in a report dated January 29, 2018. NWCC also completed an OWTS Design for the residence under this job number dated January 30, 2018.

**Proposed Construction:** It is our understanding, based on our conversations with the client, that the residence, currently under construction, will be constructed with a total of four bedrooms when completed. The proposed caretaker unit will be located southeast of the residence and constructed with two additional bedrooms. The soil treatment area (STA) for the OWTS will be placed to the west-northwest of the residence.

**Site Conditions:** The property is situated east-southeast of the intersection of River Drum Trail and River Otter Trail in Filing 1 of the Marabou Subdivision in Routt County, Colorado. Potable water will be supplied to the lot by the water supply system for the Marabou Subdivision. A water well will not be constructed at the site.

The proposed STA is to be located approximately 80 feet west-northwest of the residence. The vegetation in this area consists of grasses and weeds with scattered sagebrush and deciduous brush. The topography in the area of the proposed STA is variable and generally slopes moderately to strongly down to the west-southwest on the order of 10 to 15 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 STA at the time the field investigation was completed for the SFI. The subsurface conditions encountered in the test pits consisted of approximately 24 to 30 inches of topsoil and organic materials (silty loam) overlying natural clays to the maximum depth investigated, 8 feet below the existing ground surface (bgs). The clays were slightly sandy, fine-grained, moderately to highly plastic, stiff to very stiff, to moist and brown in color. Groundwater was not encountered in the test pits at the time of excavation and no evidence of a seasonal groundwater table was observed.

Based on soil conditions and percolation testing conducted at adjacent sites, NWCC has estimated that the upper 24 to 30 inches of natural topsoil and organic materials will exhibit percolation rates ranging from 20 to 40 minutes per inch (mpi). Based on the assumed percolation rates and visual soil classification, NWCC has classified the upper 30 inches of topsoil (silty loam) as Soil Type 2A 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 chamber trench soil treatment system constructed in the upper 12 inches of natural topsoil and organic materials.

The OWTS design presented below is based on the total anticipated number of bedrooms (4) for the residence and (2) for the Caretaker Residence, as well as the assumed percolation rate and 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 residence and 300 gpd for the caretaker residence.

**Trench/Chamber System:** The STA should consist of a trench soil treatment area utilizing Infiltrator Quick-4 Standard or ADS ARC 36 chambers. Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.50 gpd/ft<sup>2</sup> (Treatment Level 1) and size adjustment factors of 0.9 for a dosed trench system (Table 10-2) and 0.7 for chambers (Table 10-3), a minimum trench absorption area of 1,650 square feet is required for the four bedroom residence and two bedroom caretaker.

Using information provided by Infiltrator System, Inc., an absorption area of 12ft<sup>2</sup>/Quick-4 Standard Infiltrator chamber was used in the design. This results in a minimum of eighty-seven (87) Quick-4 Standard Infiltrator chambers. NWCC recommends the chambers be installed with a total of four runs with three runs having 22 chambers/run and one run having 21 chambers/run. An alternate to using Quick-4 Standard Infiltrator chambers is to use ADS ARC 36 chambers. Using an absorption area of 15ft<sup>2</sup>/ARC 36 chamber, a minimum of seventy (70) ARC 36 chambers can be used for the OWTS. If the ARC 36 chambers are used, NWCC recommends the chambers be installed with a total of four runs with two runs having 16 chambers/run and two runs having 17 chambers/run.

The soils exposed at the base of the trenches must be scarified a minimum of 4 inches prior to placement of the chambers. A distribution box, with flow equalizers, must be used to ensure equal flow to all of the trenches. The distribution box lid must be exposed at final grade. Extensions or an access manhole should be used as needed to reach final grade. An insulated lid is required to prevent freezing. A minimum of 18 inches of soil cover must be placed over the chambers in accordance with the manufacturer's recommendations. All finished surfaces should have a minimum of 3 inches of topsoil materials and seeded to prevent erosion.

The bases and sides of the chambers must be wrapped with a ¼-inch galvanized or stainless steel, or synthetic mesh to help prevent rodent intrusion. NWCC also recommends that the system be fenced off to livestock. If the system is not activated within 30 days of installation or if extended periods of inactivity occur at the residence, the chambers must be periodically flooded with water, every 30 days, to prevent rodents from nesting and burrowing in the chambers, which could result in another premature failure of the system.

**As noted above, if a dosing system is not used, the minimum STA required will increase and NWCC must be consulted to determine the required number of chambers.**

Septic Tanks and Dosing System: A septic tank with a minimum capacity of 1,250-gallons is required for the four bedroom residence and a septic tank with a minimum capacity of 1,000-gallons is required for the two bedroom caretaker residence. Due to the subsurface conditions encountered at the site, we recommend that concrete septic tanks be used. We also recommend the septic tank capacity be increased if future additions to the residence are anticipated.

NWCC has designed the OWTS with a dosing system to be used to distribute effluent to the absorption field. The septic tank/dosing system for the residence should consist of a 2,000-gallon three-compartment septic tank with the siphon installed in the downstream compartment of the tank. The septic tank/dosing system for the caretaker residence should consist of a 1,250-gallon three-compartment septic tank with the siphon installed in the downstream compartment of the tank. NWCC recommends a Fluid Dynamics FD417 automatic dosing siphon for the residence and caretaker residence. **A size adjustment for a dosed system was used in the sizing of the STA. If a dosing system is not used in the system, the size of the STA will need to be increased. NWCC must be consulted to determine the increased system size and to determine if the STA will fit on the site, if a dosing system is not used.**

A Biotube effluent filter (Orenco FT W0444-36) must be installed in the outlet 'T' of each septic tank, between the 2<sup>nd</sup> and 3<sup>rd</sup> chambers of the tanks. NWCC recommends a high water alarm be installed in the dosing compartment of the septic tanks to warn the owner in the event of a siphon malfunction. The manhole lids must be exposed at final grades. Manhole ring extensions should be used as needed to reach final grades. The tanks 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 construction of an access road to allow for pumping the septic tanks may be required.

The system design for the trench-chamber system is presented in Figures #2 and #3. Typical septic tank details are presented in Figure #4. 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 Tanks:** The scum and sludge accumulation in the septic tanks should be monitored yearly. Once the scum or sludge thickness reaches 25% of the chamber depth, the septic tanks 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 Filters:** The effluent filters at the septic tank outlets should be cleaned when the septic tanks are pumped and inspected or as required. If the high water alarm sounds, the filters should be inspected and serviced immediately.
- 3) **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 chambers 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, or be properly daylighted in accordance with current regulations.
- 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 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

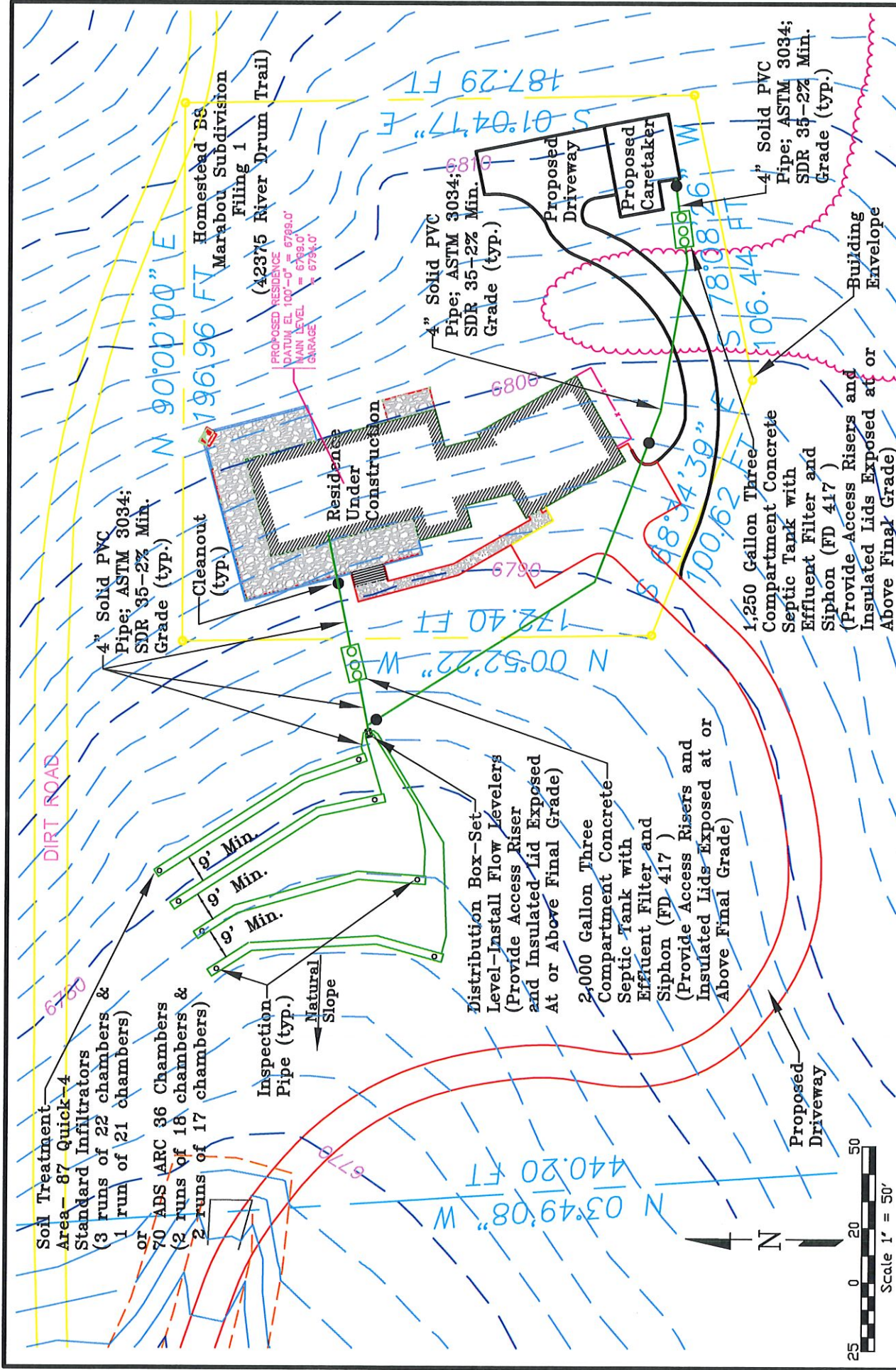
Reviewed by Brian D. Jensen, P.E.  
Principal Engineer







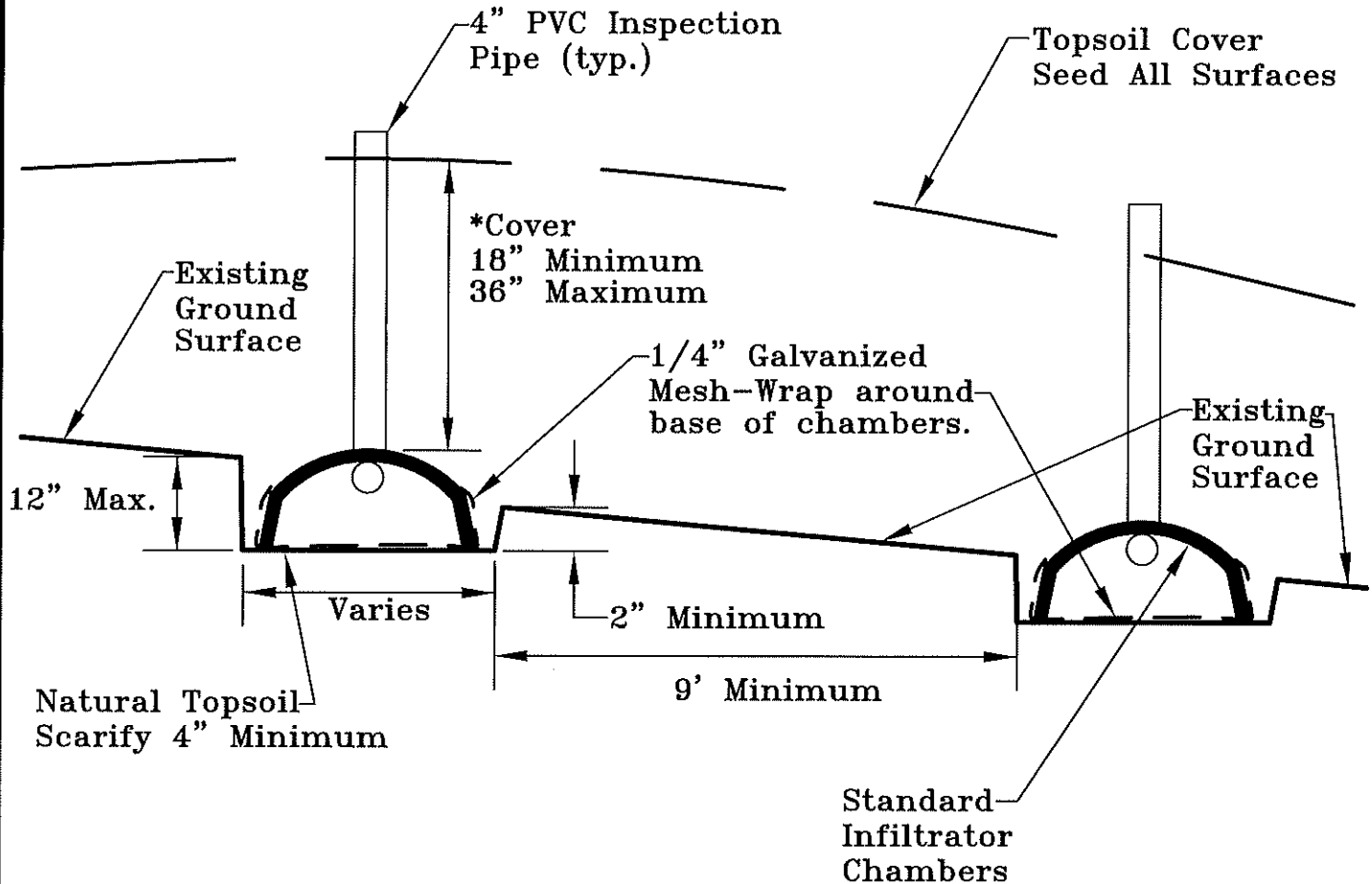





Title: <b>OWTS - CHAMBER/TRENCH SITE PLAN</b>		Date: <b>3/1/2021</b>
Job Name: <b>Blandford Residence/Caretaker</b>		Job No. <b>20-12006</b>
LOCATION: <b>Homestead B8, Marabou Sub., Fil. 1, Routt County, Colorado</b>		Figure <b>#2</b>

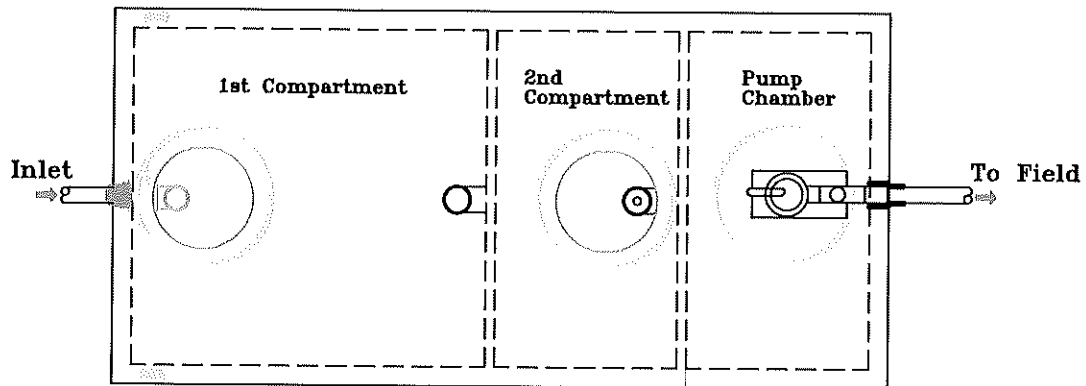
**NWCE**  
 NORTHWEST COLORADO CONSULTANTS, INC.  
 Geological / Environmental Engineering - Nevada Testing  
 (970) 875-7888 - Fax (970) 875-7891  
 2280 Copper Ridge Drive  
 Steamboat Springs, Colorado 80487

- \* The chambers should be backfilled in accordance with the manufacturer's recommendations.



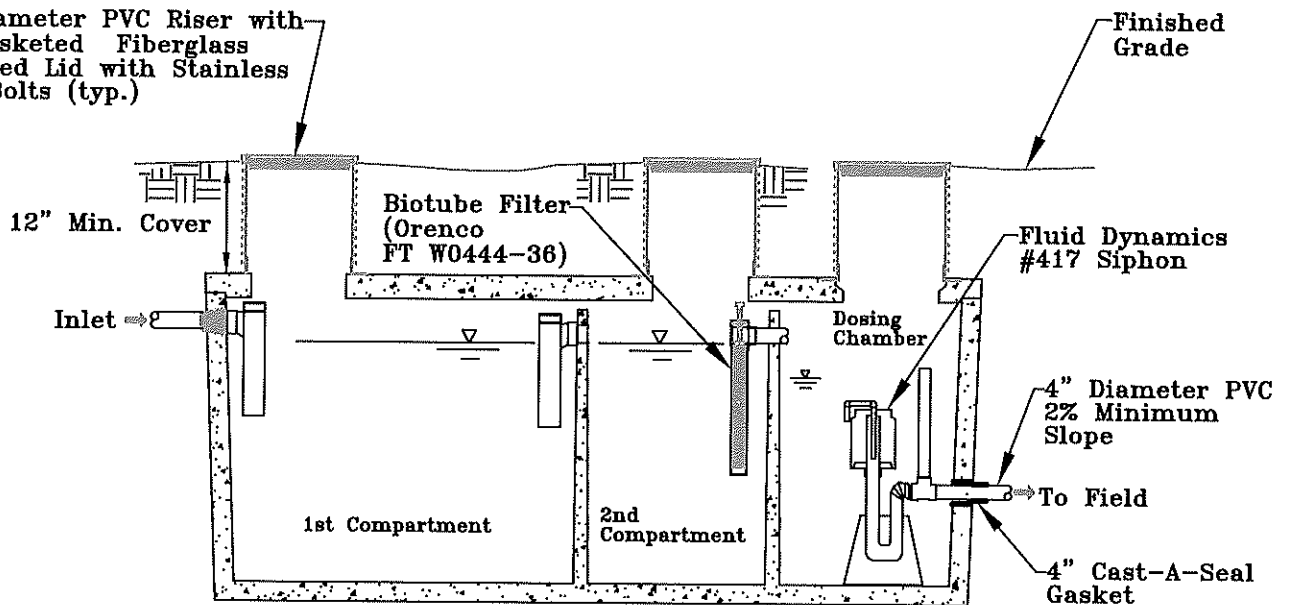
Title: <b>INFILTRATOR SYSTEM CROSS SECTION</b>	Date: <b>3/1/2021</b>	 <p><b>NWCC</b> North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487</p>
Job Name: <b>Blandford Residence/Caretaker</b>	Job No. <b>20-12006</b>	
Location: <b>Homestead B8, Marabou Sub., Fil. 1, Routt Cnty, CO</b>	Figure <b>#3</b>	





Top View

24" Diameter PVC Riser with  
24" Gasketed Fiberglass  
Insulated Lid with Stainless  
Steel Bolts (typ.)



Section View

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

Title: O.W.T.S.-SEPTIC TANK DETAILS

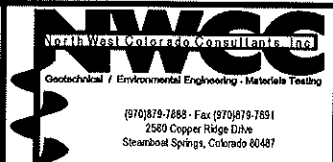
Date: 3/1/2021

Job Name: Blandford Residence/Caretaker

Job No. 20-12006

Location: Homestead B8, Marabou Sub., Fil. 1, Routt Cnty, CO

Figure #4



## APPENDIX A

### SUMMARY OF DESIGN CALCULATIONS

#### A. Sewage Volume Calculations

- 1) Number of Bedrooms-Residence: .....4 Bedrooms
- 2) Design Flow (Regulations Table 6-1) ..... Q = 525 gpd
- 3) Number of Bedrooms-Caretaker Residence: .....2 Bedrooms
- 4) Design Flow (Regulations Table 6-1) ..... Q = 300 gpd
- 5) Total Design Flow..... Q = 825 gpd

#### B. System Sizing

- 1) Soil Type 2A (Table 10-1)
- 2) Minimum soil treatment area =  $Q/LTAR = 825 \text{ gpd} / 0.50 \text{ gpd/ft}^2 = 1,650 \text{ ft}^2$
- 3) Chamber Area =  $1,650 \text{ ft}^2 \times 0.9 \text{ (Dosed Trench-Tab. 10-2)} \times 0.7 \text{ (Chambers-Tab 10-3)} = 1,040 \text{ ft}^2$ .
- 4) Number of Quick-4 Standard. Infiltrator Chambers:  $1,040 \text{ ft}^2 / 12.0 \text{ ft}^2/\text{chamber} = 86.6$   
 chambers => use 87 Standard Quick-4 chambers residence and caretaker.
- 4a) Number of ADS ARC 36 Chambers:  $1,040 \text{ ft}^2 / 15.0 \text{ ft}^2/\text{chamber} = 69.3$  chambers => use 70 Standard ARC 36 chambers for residence and caretaker.
- 4) Septic Tank - 1,250-gallon septic tank minimum for a four-bedroom residence and 1,000-gallon minimum for two-bedroom caretaker residence (Table 9-1).  
 Recommend 2,000-gallon three compartment septic tank with Siphon for main residence and 1,250-gallon three compartment septic tank with siphon for caretaker residence.

#### 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 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, septic tank and solid PVC pipe installation.
  - b. After placement of washed gravel and perforated PVC pipe or chambers, prior to backfilling.
  - c. Upon final completion of the project.
- 3) The 4-inch PVC pipe shall conform to ASTM 3034/SDR 35 or better quality.
- 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. 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 chambers and 24 inches of soils cover over all pipes. Any piping placed under a driveway or other plowed areas must be Schedule 40 pvc and 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 chambers and 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) Inspection pipes to be constructed of PVC pipe and inspection pipes must be extended to infiltrative surface at bottom of the chambers. Cleanouts must be placed in the solid distribution line upstream of the septic tank at maximum intervals of 100' or above any pipe bends 45 degrees or greater.
- 10) It is the responsibility of the owner and the installer to comply with all of the minimum setback requirements in the Regulations.