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

December 6, 2021

Empire West Holdings, LLC
c/o Darin Heiter
P.O. Box 6022
Frisco, CO 80443

Job Number: 09-8295

Subject: On-Site Wastewater Treatment System Design, Proposed Heiter Residence, 29550 County Road 14D, Routt County, Colorado.

Darin,

This report presents the results of an On-site Wastewater Treatment System (OWTS) design for your proposed residence to be constructed at 29550 County Road 14D 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 Department of Environmental Health (RCDEH).

NWCC previously completed a Subsoil and Foundation Investigation for this project prepared under the above Job Number and dated March 24, 2009.

Proposed Construction: It is our understanding, based on our conversations with you and our review of the project plans, the proposed residence will have a total of four bedrooms when completed. Therefore, the OWTS has been designed for a total of four bedrooms.

Based on the subsurface conditions encountered at the site and our understanding of the site development, NWCC recommends the proposed Soil Treatment Area (STA) for the OWTS be located to the west and downhill of the proposed residence. The existing well is located southeast of the proposed residence.

Site Conditions: The project site is situated immediately north of County Road 14D in Routt County, Colorado. The lot is an elongated parcel of land, in the east to west direction, consisting of approximately 14.8 acres. Proposed construction will take place in the eastern portion of the parcel, to the north of County Road 14D and near the existing residence, which is to be demolished.

The vegetation in the area of the proposed STA appeared to consist of grasses and weeds with sagebrush. Topography in the area of the proposed STA is variable and generally slopes moderately to strongly down to the west on the order of 15 to 20 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 profile pits were excavated in the area of the proposed STA on October 18, 2021. The subsurface conditions encountered in the profile pits were variable and generally consisted of approximately 24 to 28 inches of topsoil and organic materials overlying natural sands and clays to the maximum depth investigated, 6 feet below the existing ground surface (bgs). The sands and clays were fine to coarse grained, low to moderately, medium dense to stiff, moist and brown in color. The sands and clays classified as SC-CL soils in accordance with the Unified Soil Classification System.

Groundwater was not encountered the profile pits at the time of excavation and no signs of a seasonal high groundwater table was observed.

Percolation testing was not conducted in the area of the STA for the OWTS. Based on our experience in this area, the topsoil and organic materials will most likely exhibit percolation rates of 20 to 40 minutes per inch. Based on the assumed percolation rate of the near surface soils and visual soil classification of the soils encountered in the profile pits, NWCC has classified the natural topsoil and organic materials as Soil Type 2A and Sandy to Silt Loam in accordance with Table 10-1 of the Regulations.

OWTS Design: Based on the subsurface conditions encountered at the site, sloping topography and our understanding of the proposed construction, NWCC recommends the OWTS design consist of a trench soil treatment system utilizing Standard Quik-4 Infiltrator or ADS ARC 36 chambers placed in the upper 2 to 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 proposed residence, as well as the classification for the natural near surface 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, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.5 gpd/ft^2 (Treatment Level 1) and size adjustment factors of 1.0 for a gravity trench system (Table 10-2) and 0.7 for chambers (Table 10-3), a minimum trench absorption area of 735 square feet is required for OWTS.

Using information provided by Infiltrator System, Inc., an absorption area of 12ft^2/Quick-4 Standard Infiltrator chamber or 15 ft^2/ADS ARC 36 chamber was used in the design. This results in a minimum of sixty-two (62) Quick-4 Standard Infiltrator chambers or forty nine (49) ADS ARC 36 chambers.

Natural topsoil materials exposed at the base of the trenches must be scarified a minimum of 4 inches prior to placement of the Infiltrator 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 grades. Extensions or an access manhole should be used as needed to reach final grades. Insulated lids are 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 steel, 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 Infiltrator 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.

Septic Tank: A septic tank with a minimum capacity of 1,250-gallons is required for a four bedroom system. NWCC strongly recommends the client consider using a larger tank, such as 1,500 or 2,000 gallons. Due to the subsurface conditions encountered at the site and our experience with similar projects, NWCC also recommends a concrete septic tank be used.

If a dosing system is used, a size adjustment can be used to reduce the size of the STA. NWCC must be contacted to determine the decreased field sizing and septic/dosing tank requirements, if a dosing system is used.

A Biotube effluent filter (Orenco FT W0444-36) must be installed in the outlet 'T' of the septic tank. NWCC recommends a filter monitor system be installed in the downstream compartment of the septic tank to warn the owner in the event of a filter clog. 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 construction of an access road to allow for pumping the septic tank may be required.

The system design 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 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*: The effluent filter at the septic tank outlet should be cleaned when the septic tank is inspected or as required.

3) *Soil Treatment Area*: Soil treatment area (STA) should be fenced off to livestock. The surface area around the soil treatment area should be observed monthly for signs of failure, such as lush vegetation growth or ponding. Liquid levels within the gravel beds or 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.

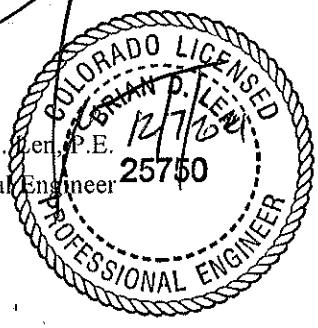
5) *General Notes*: The owner should be aware that the operation of the OWTS is different from a public sewer service. Plastic and other non-biodegradable materials should not be placed into the system. Water use should be monitored so fixtures are not allowed to run if a seal malfunctions. Allowing 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 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 structures 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.

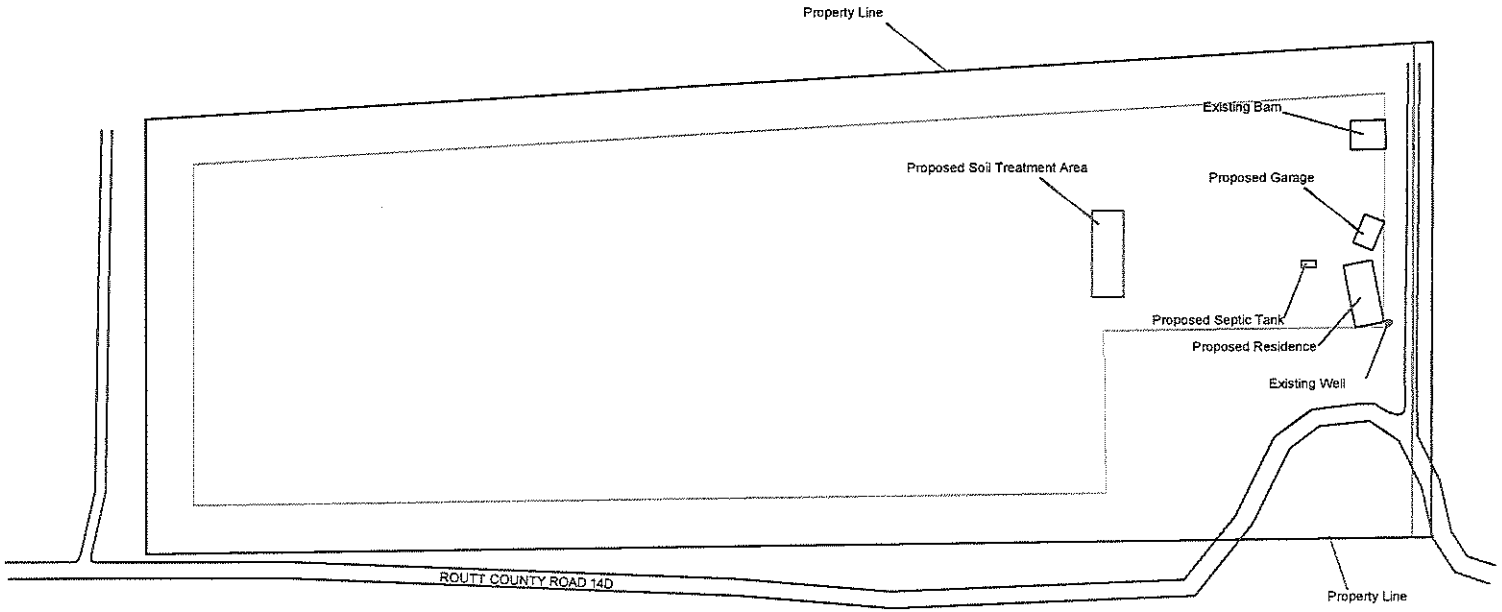
Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an on-site wastewater treatment system. In addition, this office must be retained by the client to observe the construction/installation of the OWTS and to provide an as-built report to the RCDEH 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.



Brian D. Len, P.E.
Principal Engineer



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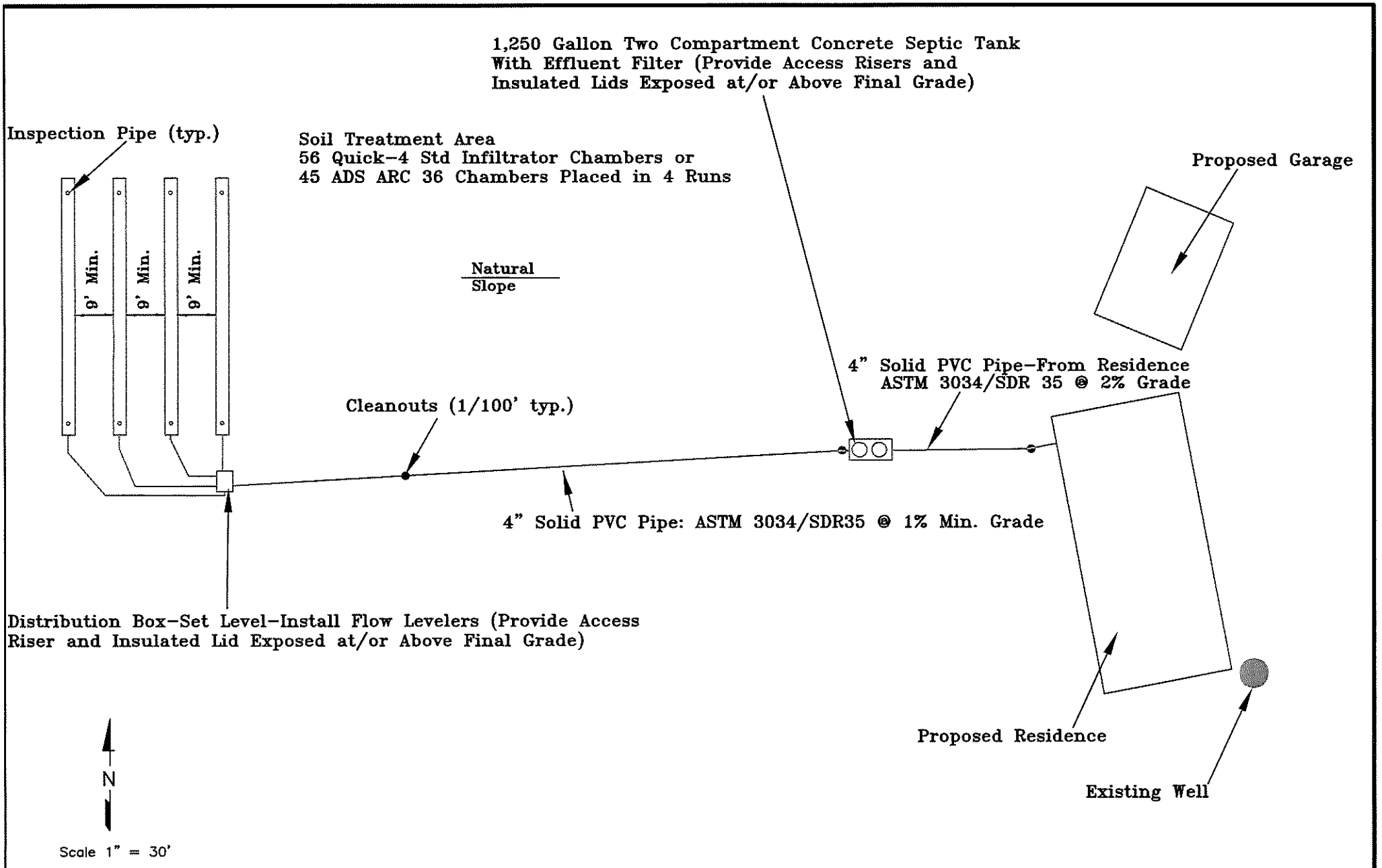
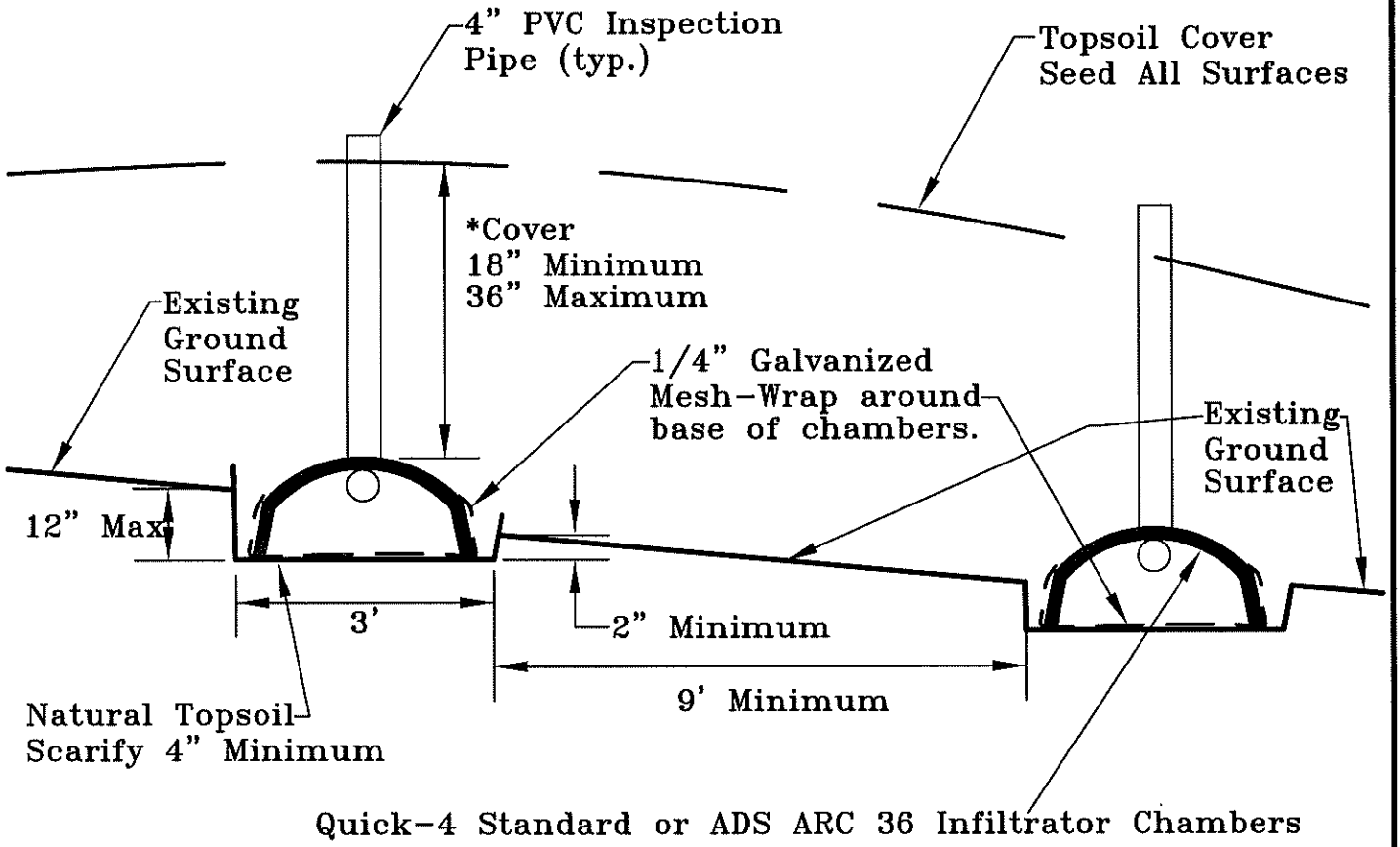
Scale 1" = 200'

Title: OWTS – OVERALL SITE PLAN		**Date:** 12/6/2021	NWCC North West Colorado Consultants Inc Geotechnical / Environmental Engineering - Materials Testing (970)879-7555 – Fax (970)8797551 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Proposed Heiter Residence		**Job No.** 09-8295	
LOCATION: 29550 County Road 14D, Routt County, Colorado		**Figure** #1	

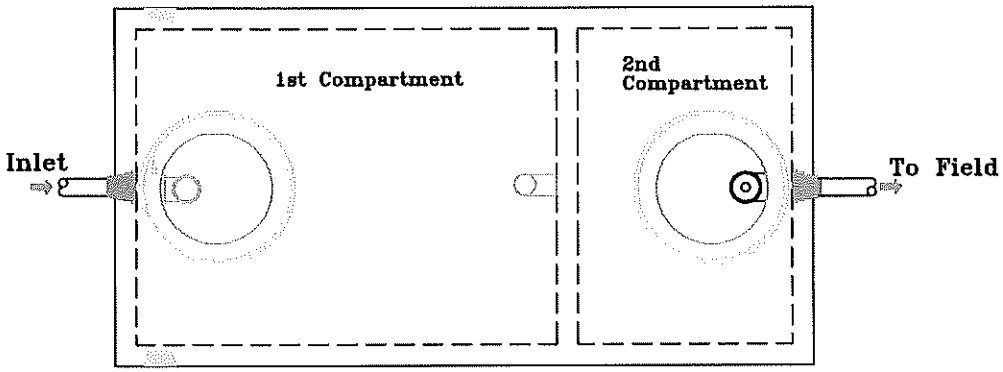


Title: OWTS – CHAMBER SITE PLAN		Date: 12/6/2021	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Proposed Heiter Residence		Job No. 09-8295	(970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
LOCATION: 29550 County Road 14D, Routt County, Colorado		Figure #2	

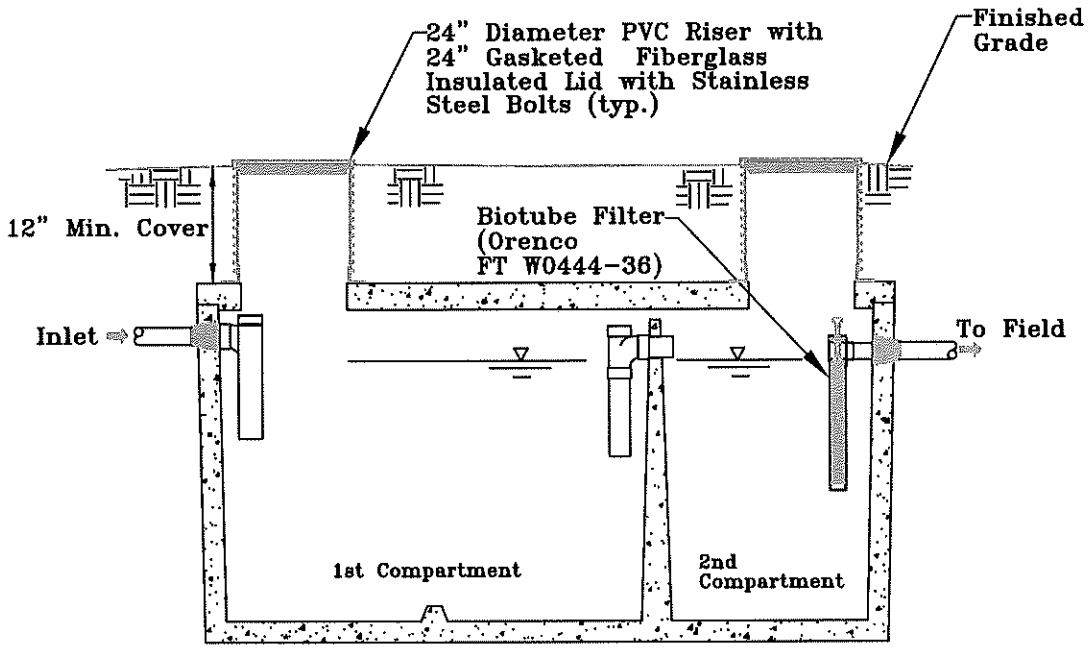
* The chambers should be backfilled in accordance with the manufacturer's recommendations.



Title: INFILTRATOR SYSTEM CROSS SECTION	Date: 12/5/2021	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Proposed Heiter Residence	Job No. 09-8295	
Location: 29550 County Road 14D, Routt County, Colorado	Figure #3	



Top View



Section View

* Note: Septic tank shown is a typical 2-compartment septic tank configuration. Installer must submit detail from septic tank manufacturer, for approval by NWCC prior to construction.

Title: OWTS – SEPTIC TANK DETAILS	Date: 12/5/2021	NWCC 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
Job Name: Proposed Heiter Residence	Job No. 09-8295	
Location: 29550 County Road 14D, Routt County, Colorado	Figure #4	

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 2A (Table 10-1)

2) Minimum soil treatment area = Q/LTAR = 525 gpd/0.5 gpd/ ft^2 = 1,050 ft^2

3) Infiltrator Area = 1,050 ft^2 x 1.0 (Gravity Trench-Table 10-2) x 0.7 (Chambers-Table 10-3) = 735 ft^2.

4) Number of Quick-4 Standard. Infiltrator Chambers: 735 ft^2/12.0 ft^2/chamber = 61.3 chambers => use 62 Standard Quick-4 chambers.

4a) Number of ADS ARC 36 Chambers: 735 ft^2/15ft^2/chamber = 49.0 chambers => use 49 ADS ARC 36 chambers.

5) Septic Tank – Minimum 1,250-gallon septic tank for a four-bedroom residence (Table 9-1).

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/ DosingTank	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 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 chambers and piping, 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.

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 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 or chambers. 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 STA and all tanks.

8) Disturbed surfaces and berms shall be covered with topsoil and heavily seeded. Heavy farm equipment and livestock should be fenced or kept off of the STA.

9) Inspection pipes to be constructed of PVC pipe. Inspection pipes must allow observation of the infiltrative surface at the bottom of the chambers. Cleanouts must be placed in the solid distribution line upstream of the septic tank at maximum intervals of 100 feet or above any pipe bends 45 degrees or greater. Cleanouts must be placed in the solid distribution line between the buildings and septic tank at a maximum interval of 50 feet.

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