



January 15, 2018

Summit Haus Properties
Rick Hodges
1779 Brome Drive
Steamboat Springs, CO 80487

Job Number: 17-10890

Subject: On-Site Wastewater Treatment
System Design, Proposed Residence, Lot
18, Alpine Mountain Ranch Subdivision,
Routt County, Colorado.

Rick,

This report presents the results of an On-site Wastewater Treatment System (OWTS) design for the proposed residence to be constructed within Lot 18 of the Alpine Mountain Ranch Subdivision, 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 October 20, 2017.

Proposed Construction: It is our understanding, based on our conversations with the client and a review of the plans provided by the architect, that the proposed residence will be constructed with five bedrooms when completed. The soil treatment area (STA) for the OWTS will be placed to the west of the proposed residence.

Site Conditions: The property is situated southeast of the intersection of Meadow Creek Drive and Panorama Drive in the Alpine Mountain Ranch Subdivision in Routt County, Colorado. Potable water will be supplied to the lot by the water supply system for the Alpine Mountain Ranch Subdivision. A water well will not be constructed at the site.

The proposed STA is to be located approximately 70 feet west of the proposed residence. The vegetation in this area consists of grasses, weeds, sagebrush, deciduous brush, scrub oak, aspen and scattered pine trees. 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 25 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 structure 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 12 to 24 inches of topsoil and organic materials overlying natural sands and clays and natural sands and gravels or sandstone-claystone bedrock to the maximum depth investigated, 6 feet below the existing ground surface (bgs). Natural sands and clays were encountered below the topsoil and organic materials in both test pits and extended to depths of 2 to 5 feet bgs. The sands and clays were fine to coarse grained with occasional gravels, low to moderately plastic, stiff to dense, slightly moist to moist and brown to light brown in color. Natural sands and gravels were encountered below the sands in clays in test pit 2 and extended to a depth of 5 feet bgs. The sands and gravels were clayey with cobbles and boulders, very low to low plastic, dense to very dense, slightly moist to moist and brown to light brown in color.

Sandstone-claystone bedrock was encountered below the sands and clays in the profile pit at a depth of 5 feet bgs and extended to the maximum depth investigated. The sandstone-claystone bedrock was fine-grained with occasional gravels and cobbles, moderately plastic, medium hard to hard, slightly moist to moist and brown to light 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 inches of natural topsoil and organic materials and deeper sands and clays and sands and gravels 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 48 to 60 inches of topsoil and natural soils 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 (5) for the 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 600 gallons per day (gpd) for a five bedroom system.

Chamber System: The STA should consist of a trench soil treatment area utilizing Standard Infiltrator Chambers. Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.50 gpd/ft² (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 756 square feet is required for this system.

Using information provided by Infiltrator System, Inc., an absorption area of 12ft²/Quick-4 Standard Infiltrator chamber was used in the design. This results in a minimum of sixty-three (63) Quick-4 Standard Infiltrator chambers. The natural topsoil and organics must be scarified a minimum of 4 inches prior to placement of the Infiltrator chambers. The bases and sides of the chambers must be wrapped with a ¼-inch

galvanized steel or synthetic mesh to help prevent rodent intrusion. 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. 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 and Dosing System: A septic tank with a minimum capacity of 1,500-gallons is required for a five bedroom residence. Due to the subsurface conditions encountered at the site, we recommend that a concrete septic tank 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 dosing system should consist of a 2,000-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. **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 the septic tank, between the 2nd and 3rd chambers of the tank. NWCC recommends a high water alarm be installed in the dosing compartment of the septic tank 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 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 for the gravel trench 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 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 System:* The effluent filter at the septic tank outlet should be cleaned when the septic tank is inspected or as required. The siphons should be checked semi-annually to ensure the siphons are functioning properly. If the high water alarm sounds, the system should be inspected and serviced immediately.
- 3) *Soil Treatment Area:* Soil treatment area 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 bed 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 soil treatment area.

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, 2013. 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 on-site wastewater 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.

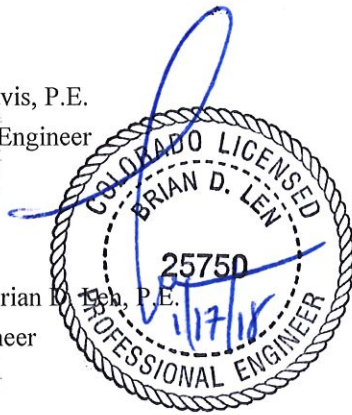
Please be advised that Colorado law requires that a permit must be obtained prior to construction, alteration or use of an OWTS. In addition, this office must be retained by the client to observe the construction/installation of the OWTS and to provide an as-built report to the Routt County Department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

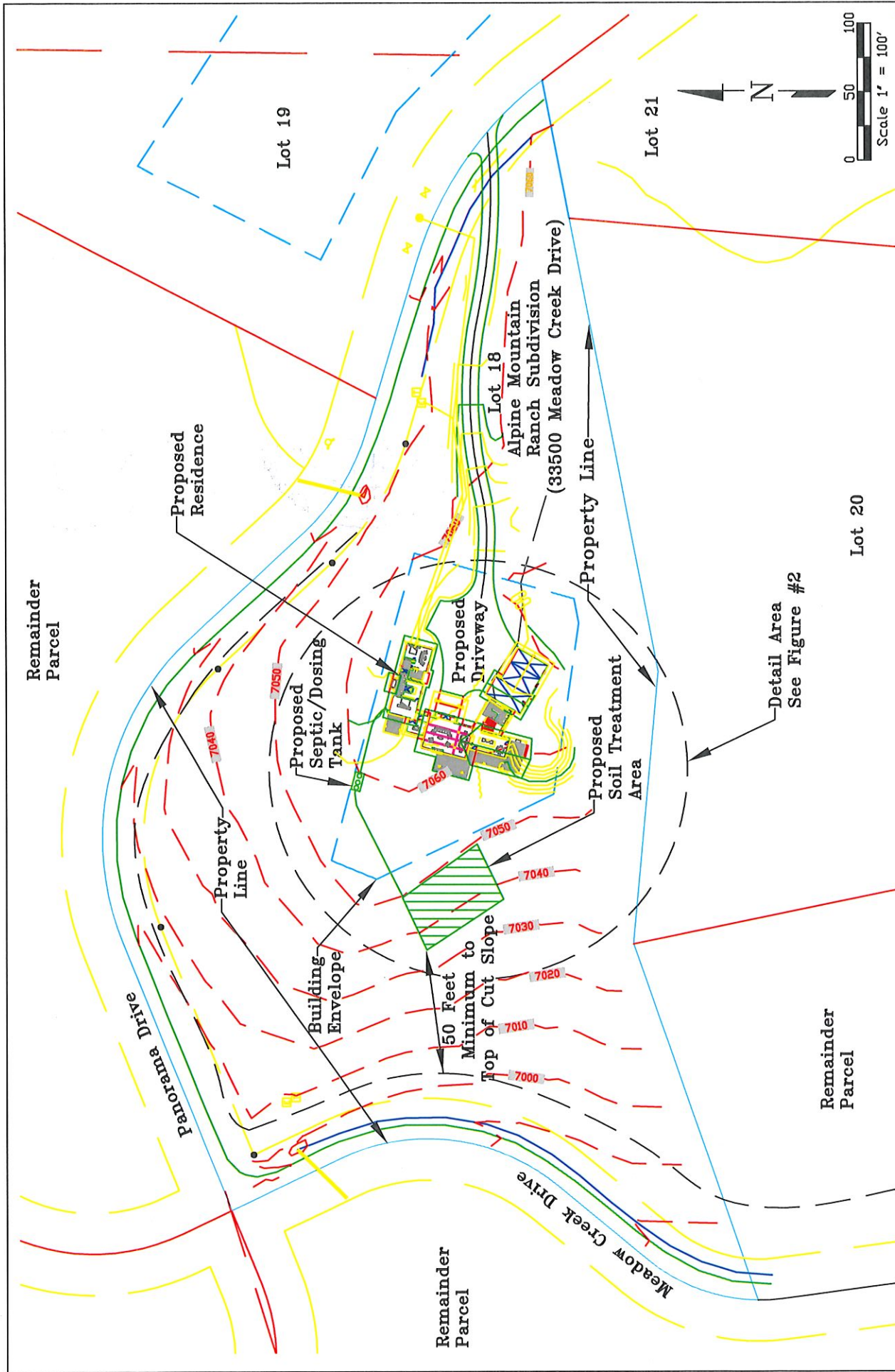
Sincerely,
NWCC, Inc.

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

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



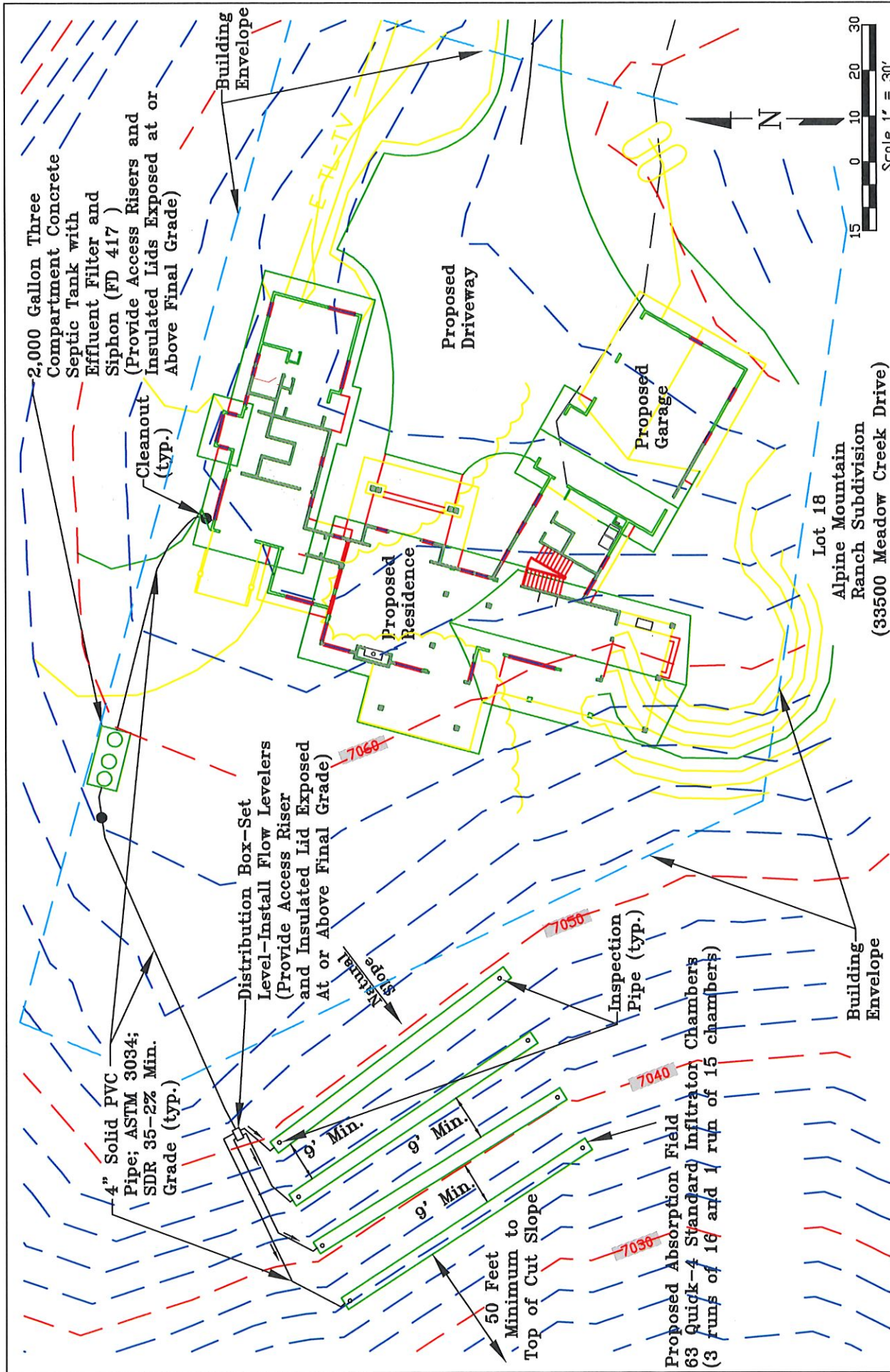
cc: Jamie Curcio



Title: O.W.T.S.-OVERALL SITE PLAN		Date: 1/15/18
Job Name: Proposed Residence		Job No. 17-10890
LOCATION: Lot 18, Alpine Mountain Ranch, Routt County, Colorado		Figure #1

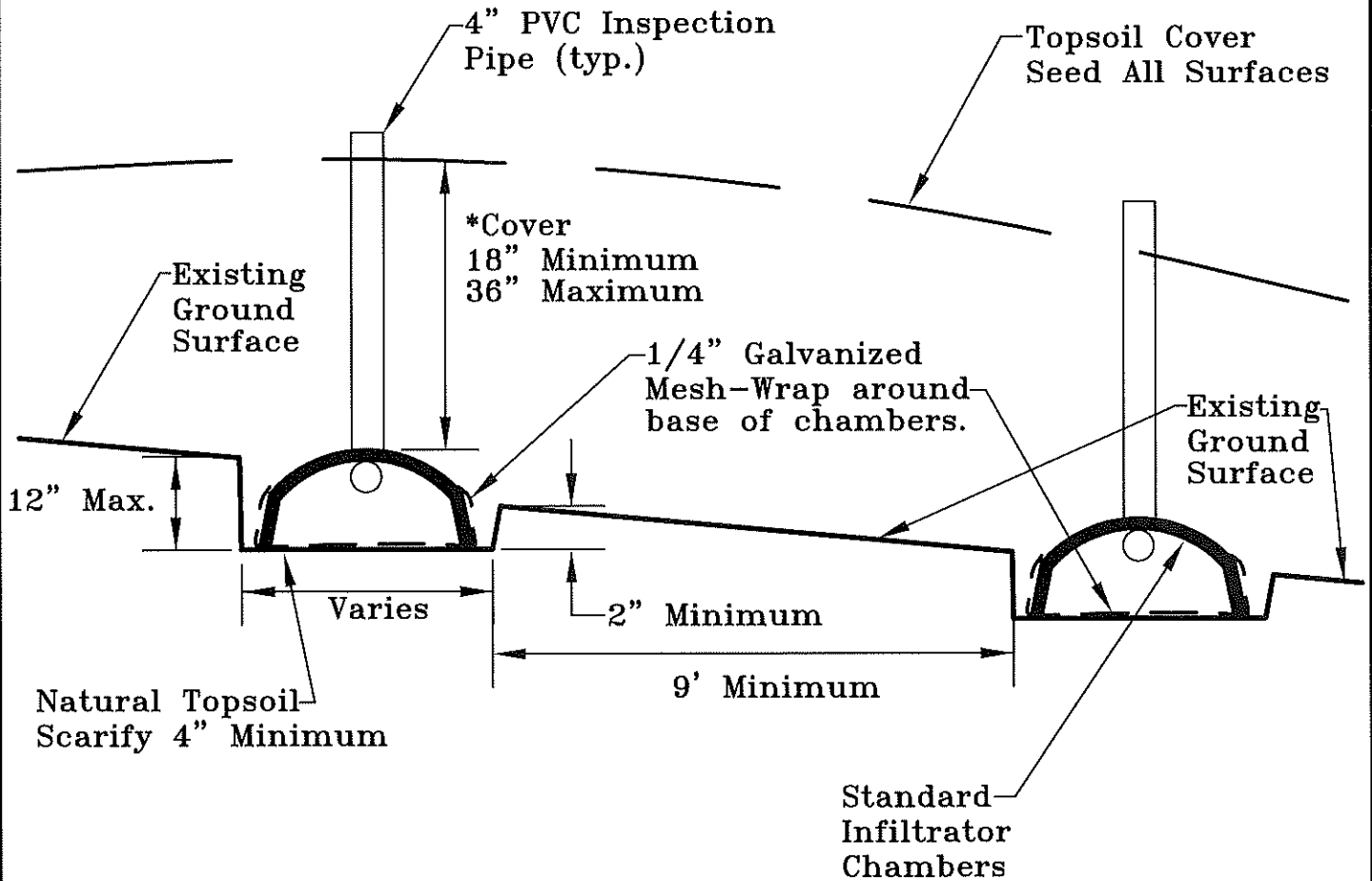
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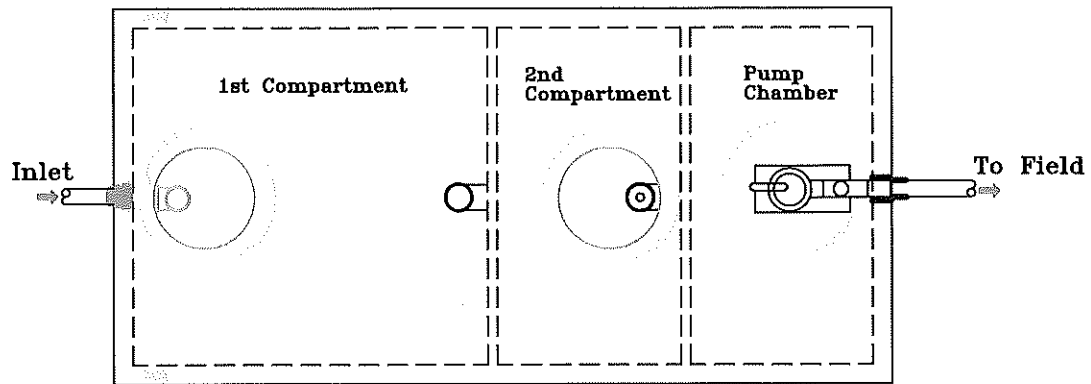


Title: O.W.T.S.-INFILTRATOR SITE PLAN		Date: 1/15/18	 <small>North West Colorado Consultants, Inc.</small> <small>Geotechnical / Environmental Engineering - Materials Testing</small> <small>(970) 732-7888 - Fax (970) 732-7891</small> <small>2550 Cooper Ridge Drive</small> <small>Steamboat Springs, Colorado 80487</small>
Job Name: Proposed Residence	Job No.: 17-10890	Figure #2	
LOCATION: Lot 18, Alpine Mountain Ranch, Routt County, Colorado			

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

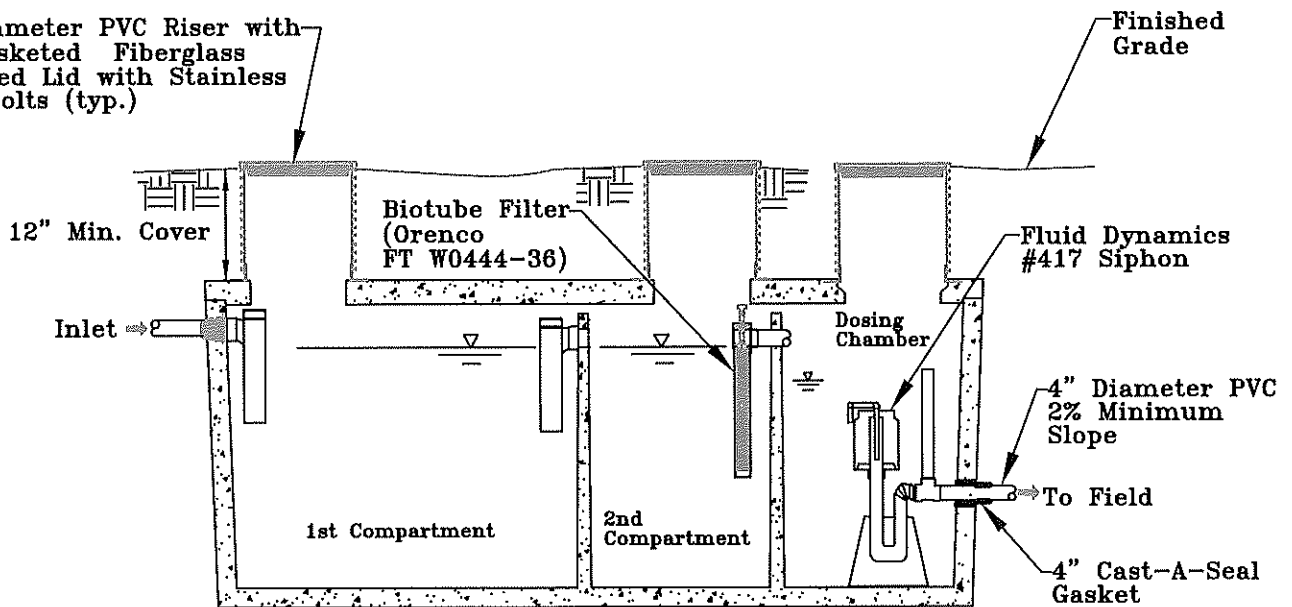


Title: INFILTRATOR SYSTEM CROSS SECTION	Date: 1/15/18	
Job Name: Proposed Residence	Job No. 17-10890	
Location: Lot 18, Alpine Mountain Ranch, Routt County, CO	Figure #3	



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: 1/15/18	
Job Name: Proposed Residence	Job No. 17-10890	
Location: Lot 18, Alpine Mountain Ranch, Routt County, CO	Figure #4	

APPENDIX A

SUMMARY OF DESIGN CALCULATIONS

A. Sewage Volume Calculations

- 1) Number of Bedrooms:.....5 Bedrooms
- 2) Design Flow (Regulations Table 6-1)Q = 600 gpd

B. System Sizing

- 1) Soil Type 2A (Table 10-1)
- 2) Minimum soil treatment area = $Q/LTAR = 600 \text{ gpd}/0.50 \text{ gpd/ft}^2 = 1,200 \text{ ft}^2$
- 3) Infiltrator Area = $1,200 \text{ ft}^2 \times 0.9$ (Dosed Trench-Table 10-2) $\times 0.7$ (Chambers-Table 10-3) = 756 ft^2 .
- 4) Number of Quick-4 Standard Infiltrator Chambers: $756 \text{ ft}^2/12.0 \text{ ft}^2/\text{chamber} = 63.0$ chambers => use 63 Standard Quick-4 chambers.
- 5) Septic Tank - 1,500-gallon septic tank minimum for a five-bedroom residence (Table 9-1).
Recommend 2,000-gallon three compartment septic tank with Siphon.
- 6) Minimum well, spring or cistern setback, per Table 7-2 = 100 feet
- 7) Minimum water body (Pond, Wetlands, Irrigation Ditch) setback, per Table 7-2 = 50 feet
- 8) Minimum water supply line, dry drainage setback, per Table 7-2 = 25 feet
- 9) Minimum property line setback, per Table 7-2 = 10 feet
- 10) Minimum cut slope setback = 50 feet

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 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. Cast iron pipe or 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 absorption field 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 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) 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.
- 10) 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 gravel. 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.
- 11) It is the responsibility of the owner and the installer to comply with all of the minimum setback requirements in the Regulations.