



November 28, 2018

Lucky 8 Ranch
23850 Tobiano Trail
Oak Creek, CO 80467

Attn: Nick Osadchuk

Job Number: 17-10928

Subject: On-Site Wastewater Treatment
System Design, Lucky 8 Ranch-
Proposed Manager's Residence, 23850
Tobiano Trail, Routt County, Colorado.

Nick,

This report presents the results of an On-site Wastewater Treatment System (OWTS) Design for the proposed Manager's Residence to be constructed within the Lucky 8 Ranch located at 23850 Tobiano Trail 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 Manager's Residence under this job number in a report dated October 31, 2018.

Proposed Construction: It is our understanding, based on our conversations with Jake's Drafting, the proposed Manager's Residence will be constructed with a total of three bedrooms. The soil treatment area (STA) for the OWTS will be placed to the east of the proposed residence.

Site Conditions: The property is situated east of County Road 29 in Routt County, Colorado. Potable water will be supplied to the proposed residence by an existing well located approximately 40 feet southwest of the proposed residence.

The proposed STA is located approximately 55 feet east of the proposed Manager's Residence. The vegetation in this area consists of grasses and weeds. The topography in the area of the proposed STA is variable and generally slopes moderately down to the east-southeast on the order of 10 to 12 percent.

A site plan showing the overall site and approximate locations of the existing features and proposed structure and OWTS is provided in Figure #1. Detailed site plans showing the proposed residence along with the proposed OWTS and alternate OWTS are shown in Figures #2 and #5.

Subsurface Conditions: Two test pits were excavated in the area of the OWTS at the time the field investigation was completed for the SFI. The subsurface conditions encountered in the test pits consisted of approximately 30 inches of topsoil and organic materials overlying natural clays to the maximum depth investigated, 7 feet below the existing ground surface (bgs). The clays were slightly sandy, fine-grained, moderately plastic, stiff to very stiff, 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 previously conducted at adjacent sites, NWCC has estimated that the upper 30 inches of natural topsoil and organic materials in this portion of the site will exhibit percolation rates ranging from 20 to 40 minutes per inch (mpi). Based on the assumed and actual percolation rates, and visual soil classification, NWCC has classified the upper 30 inches of topsoil materials 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 bed or trench soil treatment system constructed 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 (3) for the residence, as well as the classification for the natural topsoil and organic materials. Considering the anticipated construction, NWCC has determined, using Table 6-1 of the Regulations, an effluent design flow of 450 gallons per day (gpd) for a three bedroom system.

Gravel Bed System: Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.5 gpd/ft² (Treatment Level 1) and size adjustment factors of 1.2 for a gravity distribution bed (Table 10-2) and 1.0 for gravel distribution media (Table 10-3), a minimum gravel bed area of 1,080 square feet is required for the residence. Therefore, a gravel distribution bed, at least 12 feet wide and 90 feet long will be required for the system. Due to site constraints and overhead power line, the system should be constructed using two gravel beds, each 12 feet wide and 45 feet in length.

If the owner elects to use a dosing system in the construction of the system, the size of the STA area required will decrease. NWCC must be contacted to provide adequate sizing of the soil treatment area if dosing is used.

The natural topsoil and organic materials exposed below the gravel bed should be scarified a minimum of 4 inches prior to placement of the washed gravels. A minimum of 18 inches of soil cover is required over the gravel bed. All finished surfaces should have a minimum of 3 inches of topsoil materials and seeded to prevent erosion.

Trench/Chamber System: An alternate OWTS to the gravel bed design presented above would be to use a trench absorption system utilizing chambers. Based on the soil type, design effluent flow, a Long Term Acceptance Rate (LTAR) of 0.5 gpd/ft² (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 STA of 630 square feet is required for the residence.

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 fifty-three (53) Quick-4 Standard Infiltrator chambers. NWCC recommends the chambers be installed with four runs with one run having 14 chambers/run and three runs having 13 chambers/run. An alternate to using Quick-4 Standard Infiltrator chambers is to use ADS ARC 36 chambers. Using an absorption area of 15ft²/ARC 36 chamber, a minimum of forty-two (42) ARC 36 chambers can be used for the OWTs. If the ARC 36 chambers are used, NWCC recommends the chambers be installed with two runs having 11 chambers/run and two runs having 10 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 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 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 used, the minimum STA required will decrease and NWCC must be consulted to determine the required number of chambers.

Septic Tank: A septic tank with a minimum capacity of 1,000-gallons is required for a three 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 additional bedrooms are anticipated in the future.

A Biotube effluent filter (Orenco FT W0444-36) should be installed in the outlet 'T' of the downstream 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.

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

The system design for the gravel bed system is presented in Figures #2 through #4 and the alternate design for the chamber trench system is presented in Figures #5 through #6. Septic tank details are presented in Figure #7. 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. If the high water alarm sounds, the system 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 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 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.

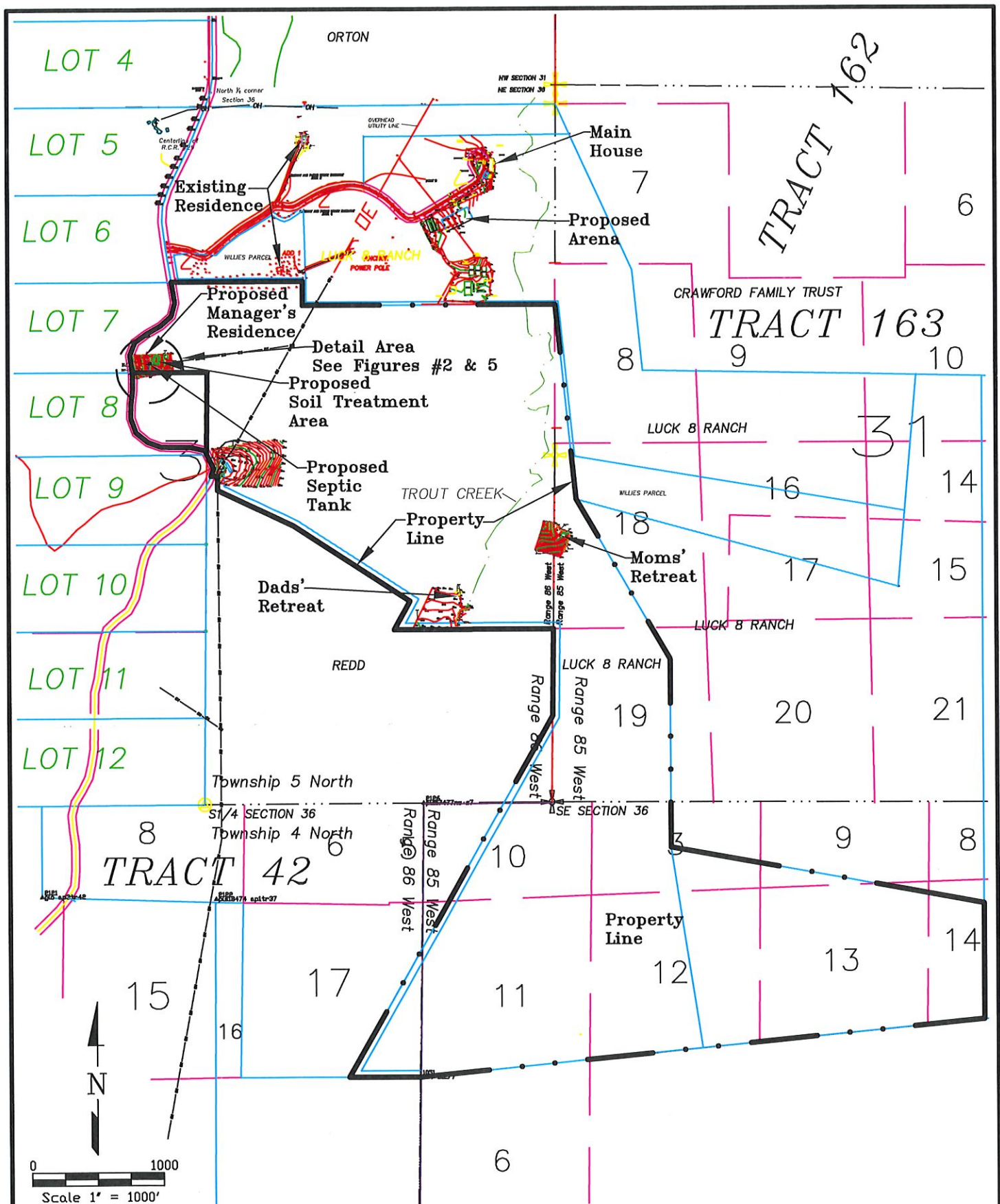
Sincerely,
NWCC, Inc.

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

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



cc: Jake's Drafting



Title: OWTS - OVERALL SITE PLAN

Job Name: Lucky 8 Ranch-Manager's Residence

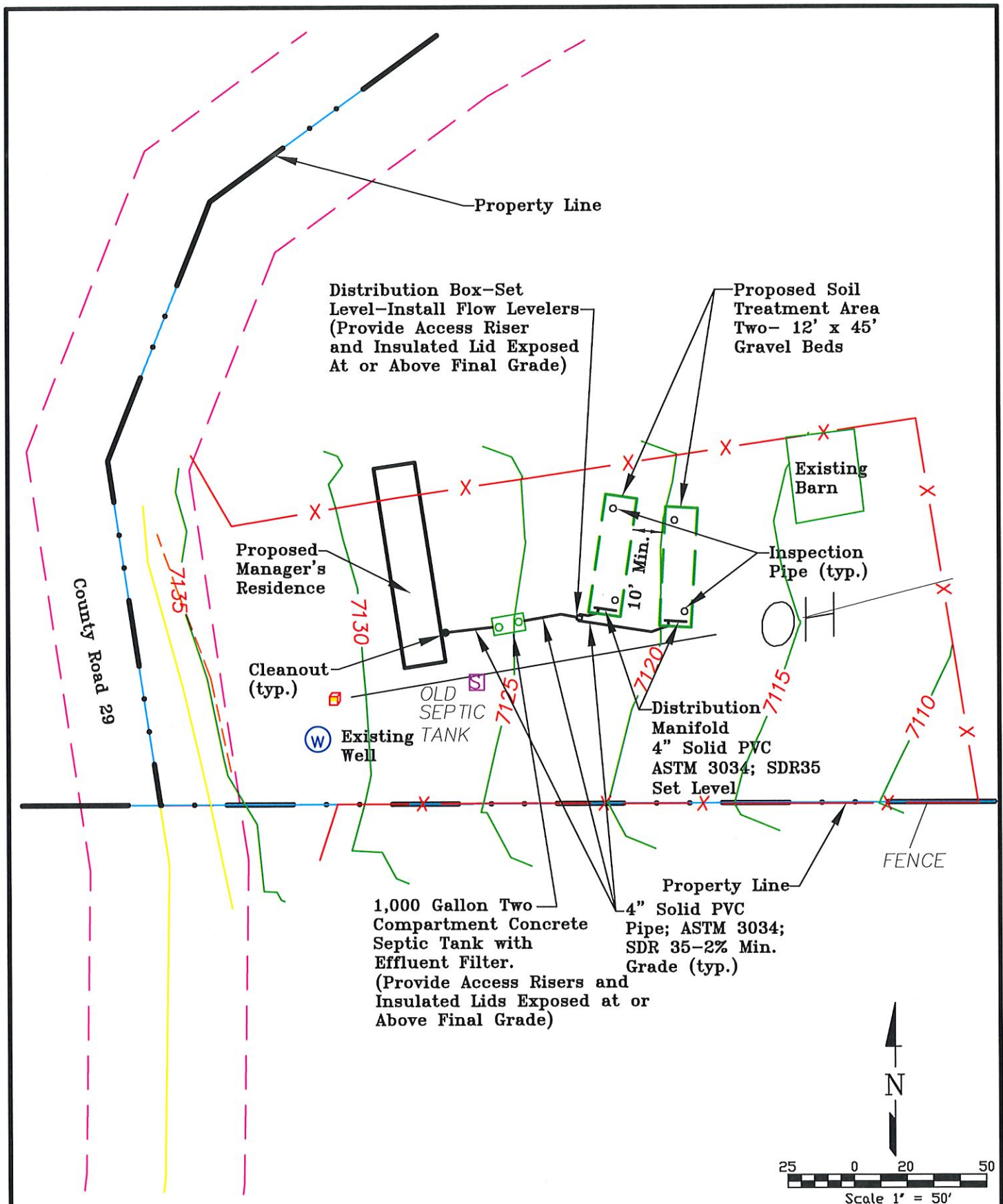
Location: 23850 Tobiano Trail, Routt County, Colorado

Date: 11/19/18

Job No. 17-10928

Figure #1

NWCC
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Geotechnical / Environmental Engineering - Materials Testing
(970)879-7888 - Fax (970)879-7891
2580 Copper Ridge Drive
Steamboat Springs, Colorado 80487



Title: **OWTS - GRAVEL BED SITE PLAN**

Job Name: **Lucky 8 Ranch-Manager's Residence**

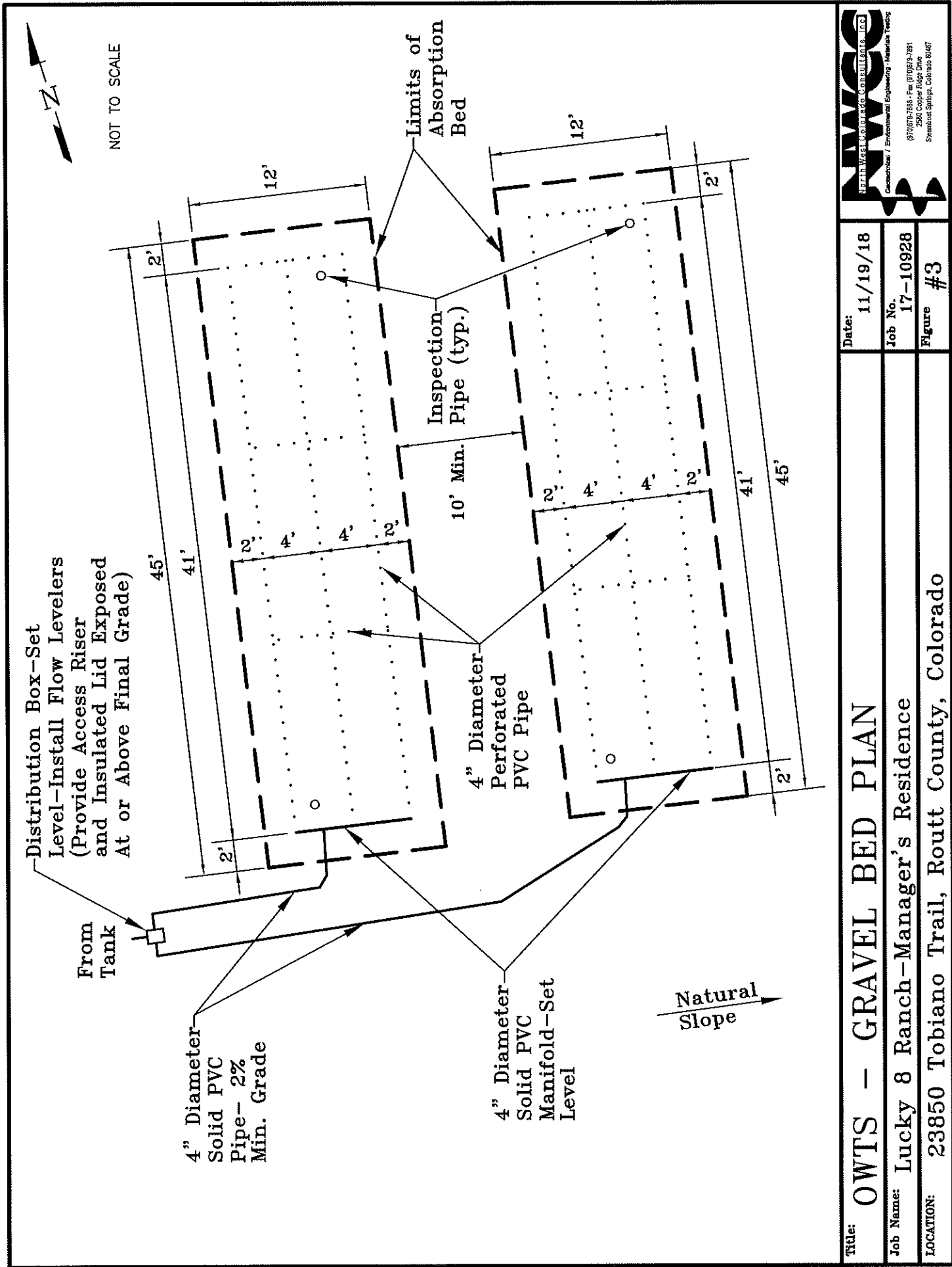
Location: **23850 Tobiano Trail, Routt County, Colorado**

Date: **11/19/18**


Job No. **17-10928**

Figure **#2**

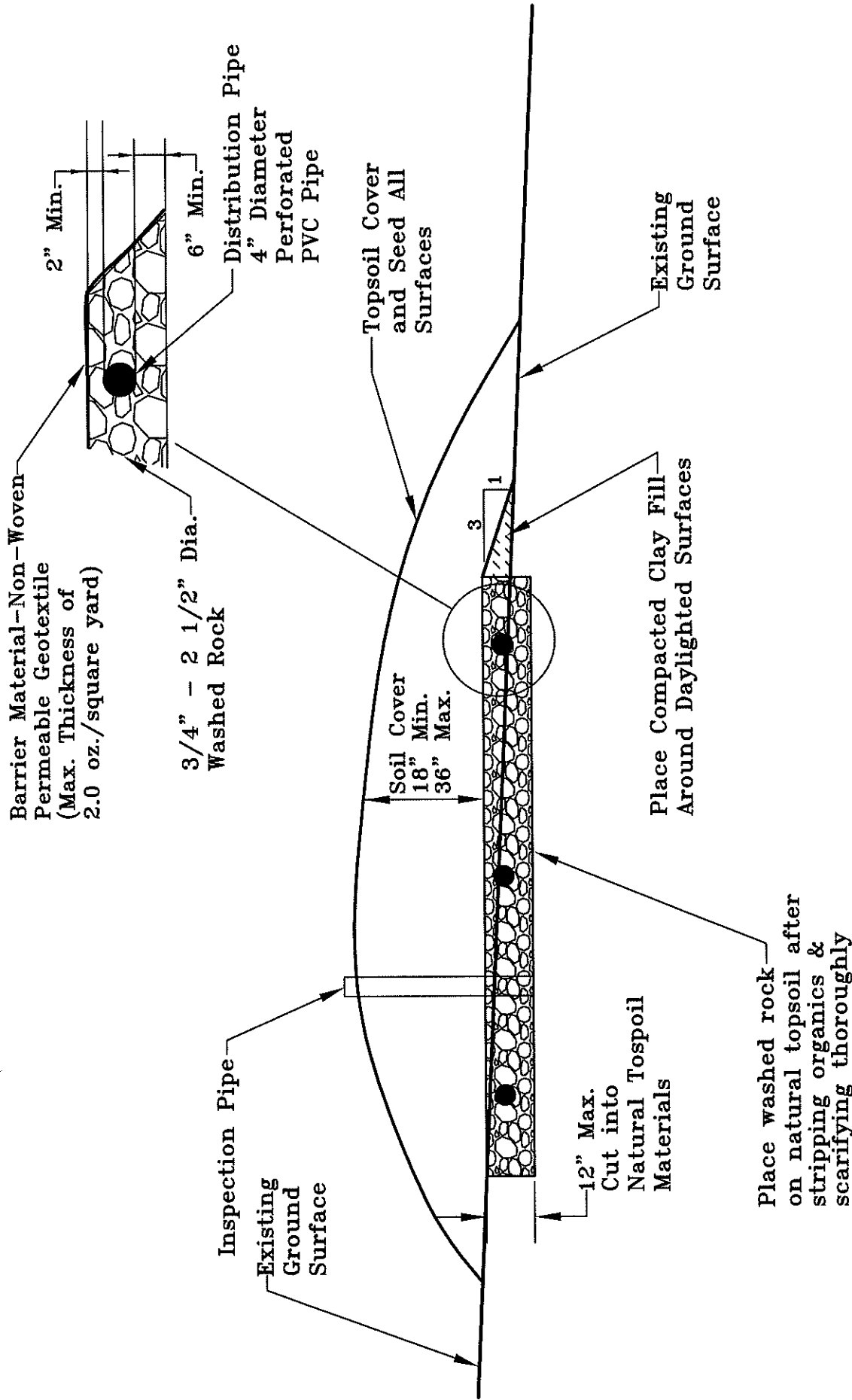





Title:	OWTS - GRAVEL BED PLAN		
	Date:	11/19/18	
	Job No.	17-10928	
Job Name:	Lucky 8 Ranch-Manager's Residence		
LOCATION:	23850 Tobiano Trail, Routt County, Colorado		
		Figure	#3

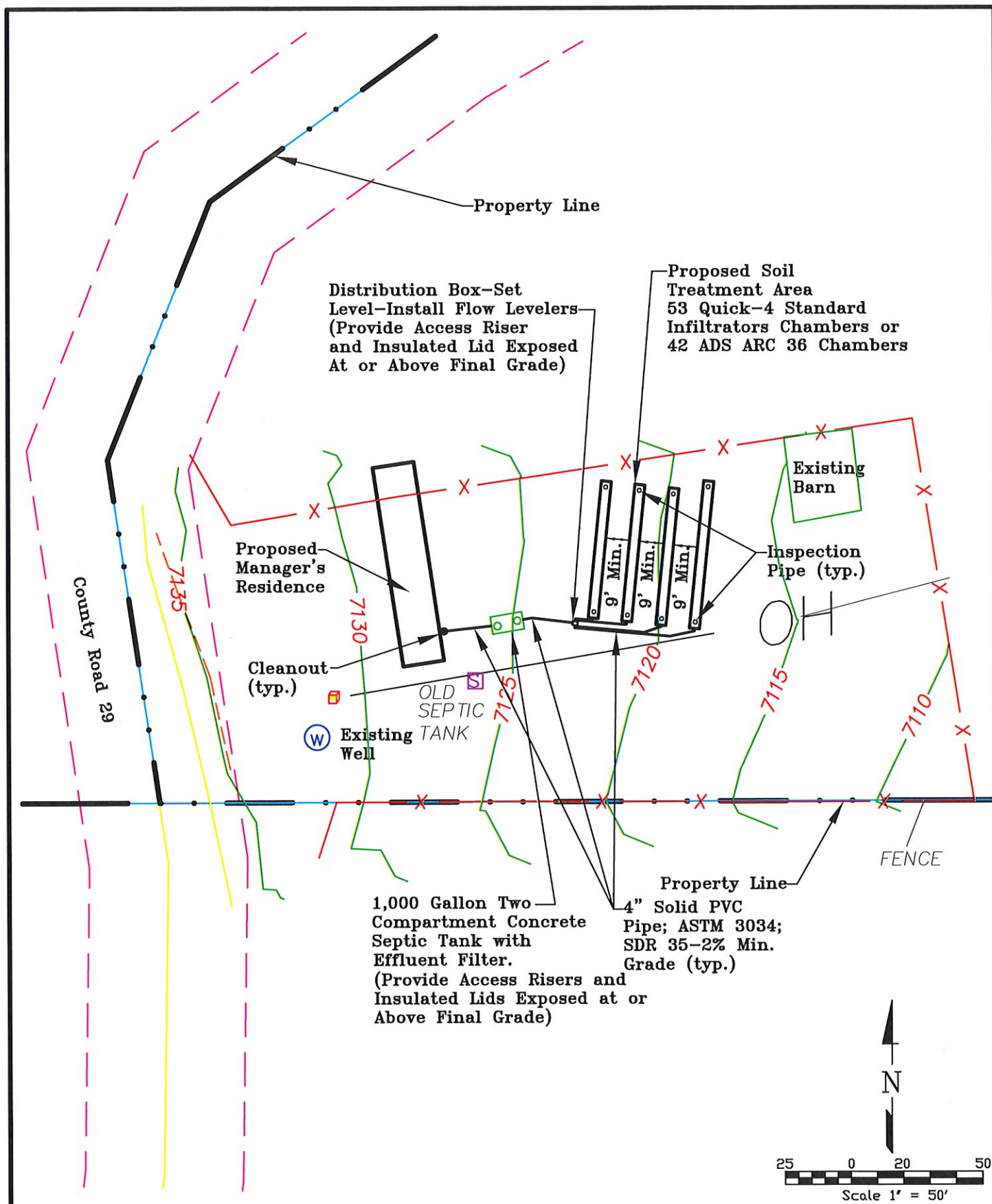



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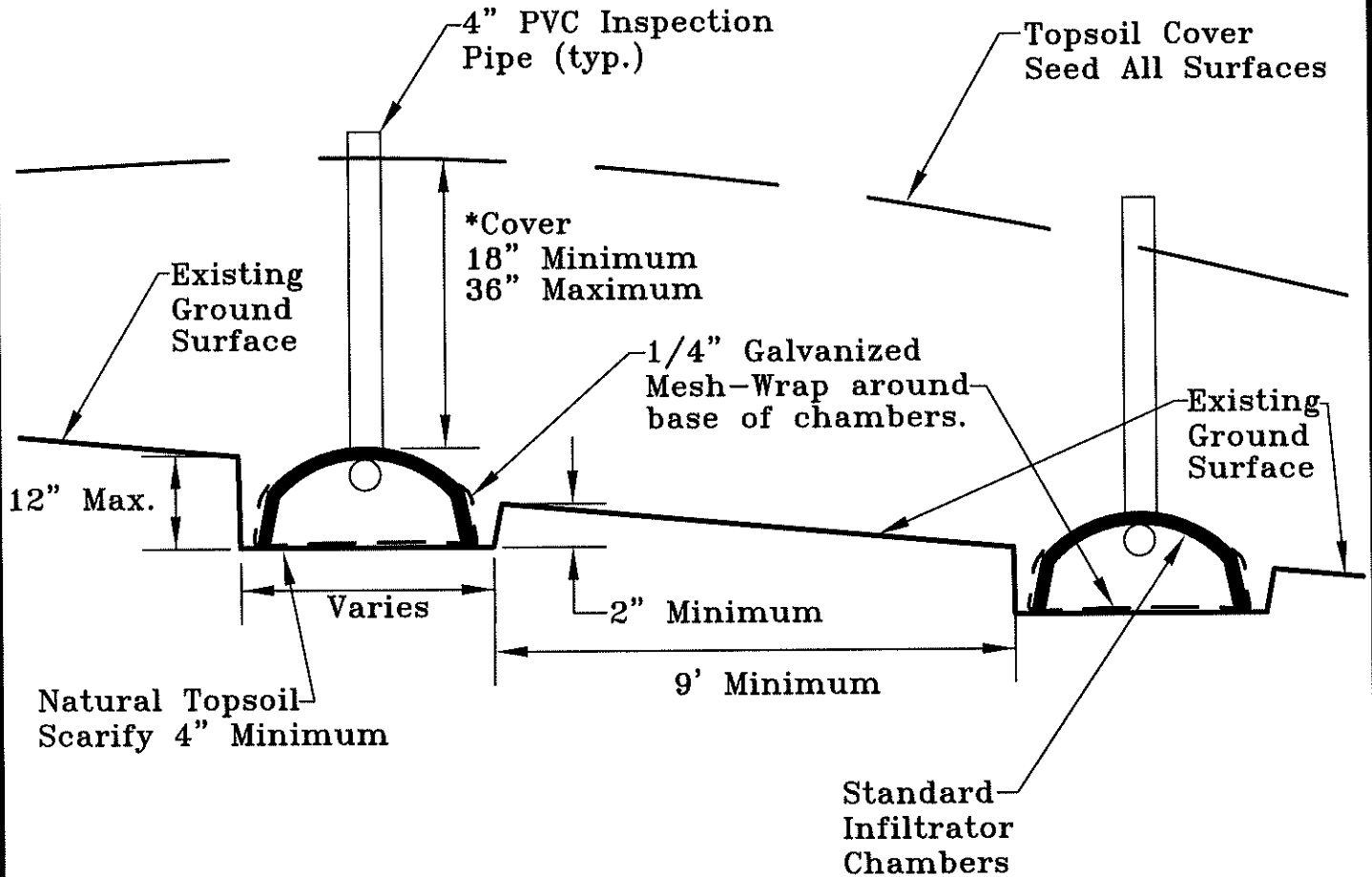
OWTS-GRAVEL BED CROSS SECTION	Title:	Date: 11/19/18	
Lucky 8 Randh-Manager's Residence	Job Name:	Job No. 17-10928	Figure # 4
23850 Tobiano Trail, Routt County, Colorado	LOCATION:		

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 2580 Copper Ridge Drive
 Steamboat Springs, Colorado 80487



Title: OWTS-TRENCH/CHAMBERS SITE PLAN	Date: 11/19/18	 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: Lucky 8 Ranch-Manager's Residence	Job No. 17-10928	
Location: 23850 Tobiano Trail, Routt County, Colorado	Figure #5	

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



Title: TRENCH SYSTEM CROSS SECTION

Job Name: Lucky 8 Ranch-Manager's Residence

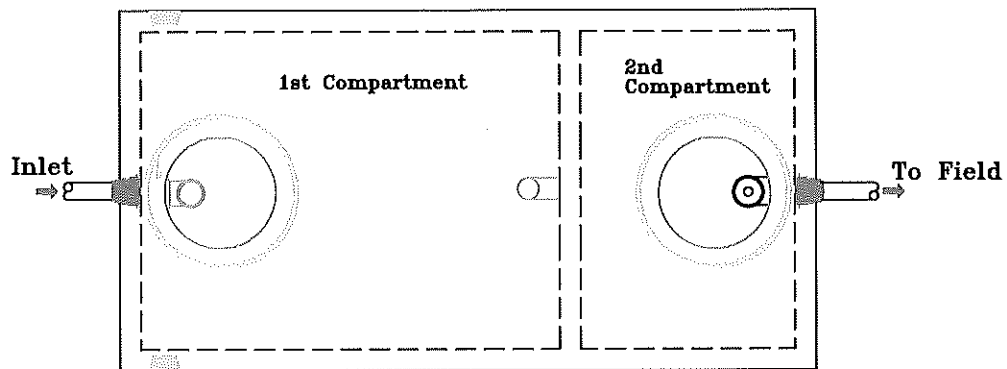
Location: 23850 Tobiano Trail, Routt County, Colorado

Date: 11/19/18

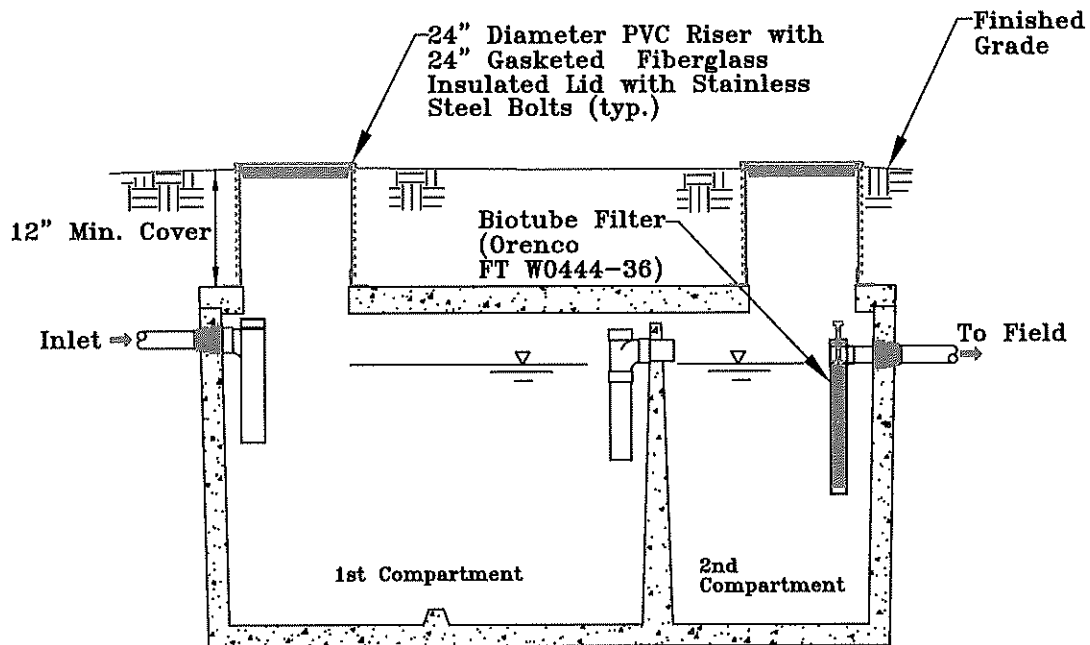
Job No. 17-10928

Figure #6






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: 11/19/18	
Job Name: Lucky 8 Ranch-Manager's Residence	Job No. 17-10928	
Location: 23850 Tobiano Trail, Routt County, Colorado	Figure #7	

APPENDIX A

SUMMARY OF DESIGN CALCULATIONS

A. Sewage Volume Calculations

- 1) Proposed Manager's Residence:3 Bedrooms
- 2) Design Flow (Regulations Table 6-1) Q = 450 gpd

B. System Sizing

- 1) Soil Type 2A (Table 10-1)
- 2) Minimum soil treatment area = $Q/LTAR = 450\text{gpd}/0.5\text{gpd}/\text{ft}^2 = 900\text{ ft}^2$
- 3) Gravel bed area = $900\text{ ft}^2 \times 1.2$ (Gravity Bed-Table 10-2) $\times 1.0$ (Rock-Table 10-3) = $1,080\text{ ft}^2$.
- 4) Designed gravel bed area (2 beds $\times 12'\times 45'$ bed) = $2 \times 12' \times 45' = 1,080\text{ ft}^2$.
- 5) Infiltrator Area = $900\text{ ft}^2 \times 1.0$ (Gravity Trench-Table 10-2) $\times 0.7$ (Chambers-Table 10-3) = 630 ft^2 .
- 6) Number of Quick-4 Standard. Infiltrator Chambers: $630\text{ ft}^2/12.0\text{ ft}^2/\text{chamber} = 52.5$ chambers => use 53 Standard Quick-4 chambers.
- 6a) Number of ADS ARC 36 Chambers: $630\text{ ft}^2/15.0\text{ ft}^2/\text{chamber} = 42.0$ chambers => use 42 ADS ARC 36 chambers.
- 7) Minimum well or spring setback, per Table 7-2 = 100 feet
- 8) Minimum water body (Pond, Wetlands, Irrigation Ditch) setback, per Table 7-2 = 50 feet
- 9) Minimum cistern, water supply line, dry drainage setback, per Table 7-2 = 25 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, 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. 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 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 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 with the portion of the pipe penetrating the gravel being perforated. Inspection pipes must be extended to infiltrative surface at bottom of gravel or 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' 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.