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ONSITE WASTEWATER TREATMENT SYSTEM DESIGN

Date: April 30, 2015

Prepared by: Thomas A. Cronk, P.E.
Cronk Construction Inc.
1129 -24- Road
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245-0577

Type of Design: residential

Client: Ruvin Lerman
17136 Ashland Drive
Anchorage, AK 99516
907-868-2828

Property address: 2984 Black Canyon Road, Crawford, CO 81415

Tax schedule No.: 3501-273-00-043

Legal Descript.:

1.0 Site History

The site consists of approximately 40 acres of uncultivated native soil. Drainage is approximately 6% to the east. A percolation test/soils evaluation was conducted on the property of reference on 06/21/11 by Tom A. Cronk, registered professional engineer (R.P.E.). The *perc* excavation trench (excavation A) was located approximately 350' north of the south property line and approximately 190' east of the west property line. Additional *perc* holes were located 20' east of the trench (excavation B) and 20' west of the trench (excavation C).

The owners wish to construct a three bedroom residence and two bedroom garage/apartment at the site. The 06/21/11 site investigation was conducted to provide subsurface design parameters for an onsite wastewater treatment system (OWTS) to serve the proposed residential structures. An OWTS design was prepared for the property on July 10, 2011. The 2011 design was never implemented and Montrose County has requested the 2011 OWTS design be modified to afford compliance with the new OWTS requirements adopted in 2014.

Based on results from the 06/21/11 site investigation, a revised engineered OWTS design has been prepared for the property. A discussion of developed subsurface design parameters and the engineered OWTS design follows. The site layout and location of the 06/21/11 *perc* test/soils evaluations are shown on the attached plot plan. Results of the perc test/soils evaluations are attached for reference as Appendix A.

2.0 Development of Design Parameters

A *perc* excavation trench (excavation A) was extended to a depth of 96" below ground surface (BGS). There was no evidence of ground water or high seasonal water table in the open excavation to a depth of 96" BGS. The soils evaluation indicates two distinct soil horizons underlie the site. A lithological description follows:

depth (in.)	description
0" - 72"	sandy clay/clayey sand, light reddish brown; blocky; smeared
72" - 96"	clayey sand, reddish tan; grainy and friable; minor sandstone cobble to boulders

As based on the results from the 06/21/11 site investigations (Appendix A), a design *perc* rate of 45 min/in. and corresponding long term acceptance rate (LTAR) of 0.35 are chosen for overall system sizing for an infiltrator trench absorption field designed to discharge to subsoils below the 36" depth.

3.0 System Design

An *INFILTRATOR* absorption trench is proposed for discharge of septic effluent at the site. Construction of the system will consist of excavating level trenches in the area comprising the absorption field. As shown in the attached septic layout plan, the trenches will be oriented perpendicular to the natural slope to minimize the depth of excavation along the trench length. Each trench excavation shall be continued to a maximum depth of 36" BGS at the uphill side of the trench (see absorption field cross-section). After removal of surface soils, the open excavations will be disked or scarified to promote subsurface absorption.

Following completion of the initial push-outs, *QUICK4 STANDARD INFILTRATORS* will be used to construct a septic effluent distribution system in the open excavations. The *INFILTRATOR* effluent distribution system will be installed in accordance with the "Infiltrator Technical Manual", available from Infiltrator Systems Inc., 123 Elm Street, Suite 12, Old Saybrook, Connecticut 06475. Adjacent *INFILTRATORS* shall be fastened with a minimum of four (4) 3/4" x #8 self-tapping sheet metal or bright brass deck screws to prevent movement and separation during backfilling.

Septic effluent will be transferred from the upper trench to each of the adjacent downhill trenches through a serial distribution network as shown in the attached construction details. The serial distribution connections between adjacent trenches will facilitate the saturation of the uphill trench before septic effluent is allowed to flow to each of the adjacent downhill trenches. As shown in the attached Absorption Field Cross Section, the bottom of the *STANDARD INFILTRATOR* seepage trenches will be located a maximum of 36" below ground level.

After the *INFILTRATORS* are installed, the absorption field will be covered with a soil cap. The soil cap will consist of approximately 24" of native soil. A minimum of 5% slope will be maintained to promote surface run off away from the absorption fields.

The installer should confirm the feasibility of gravity discharge of sewage effluent from the existing septic tank to the absorption field by field verification of assumed design parameters. Assumed design parameters with respect to gravity discharge include:

- distance from the sewage pipe at exit from the foundation line to the absorption field - 300' or less,
- elevation of the ground surface at entry to the absorption field shall be at least 42" below the invert elevation of the sewage pipe at exit from the foundation line.

If field measurements do not confirm these design assumptions, gravity discharge of septic effluent from the proposed structure cannot be assured and a lift station may be required. Please contact the design engineer to address any design modifications necessary if these design assumptions are not upheld.

The installer must also confirm the setbacks from property lines, building envelopes, and existing easements shown in the attached graphics are maintained. Four inch clean outs shall be provided at maximum 100' intervals in all effluent lines exceeding 100' in length. Vehicle traffic and parking is to be prevented over the absorption and repair area. Provide minimum schedule 40 PVC under all traffic areas. Additionally, effluent piping in traffic areas with less than 24" of cover shall be encased in 6" CMP or flow fill and covered with minimum 2" high density blue board insulation. Finally, any unknown utility

lines, easements, or other adverse conditions disclosed during construction must maintain the required setbacks listed on page 5 of this document.

The absorption area will be designed to accept sewage from a 2 bedroom garage/guest cottage and a 3 bedroom home (i.e., total of 5 bedroom design capacity). Two 1,000 gallon, two compartment, septic tanks will be used to serve the absorption area. As shown on the attached Septic Layout Plan, one tank will be utilized by the two bedroom garage/guest cottage and one tank will serve the 3 bedroom residence. The two 1,000 gallon septic tanks will be installed to provide a minimum of 48 hours retention time for sewage effluent from the two residential structures. A non-corrodible Orenco filter (model # FTW0444-36) shall be installed at the final outlet Tee of each septic tank or in the effluent line between the septic tanks and the absorption field to limit the size of solids and sludge passing into the absorption field. The filters must be accessible for cleaning and replacement from the ground surface.

As discussed above, *INFILTRATOR* absorption trenches are proposed to discharge septic effluent to the underlying sub-soils. As shown in the attached graphics, the absorption trenches will consist of five (5) trenches 3' wide x 3' deep x 100' long with twenty five (25) STANDARD *INFILTRATOR* (or equivalent) units each for a total of one hundred twenty five (125) units. The absorption field will encompass an effective area of 2142.86 sq. ft.

Calculations and design parameters used to size the absorption field follow.

DESIGN CALCULATIONS

DESIGN LOADING RATE OF 750 GAL./DAY

DESIGN PERCOLATION RATE = 45 MIN./INCH

DESIGN LONG TERM ACCEPTANCE RATE (LTAR) = 0.35 GAL./DAY-SQ. FT.

$$A = \frac{Q}{LTAR}, \text{ WHERE,}$$

A = ABSORPTION FIELD AREA (SQ. FT.)
Q= DESIGN FLOW (GAL./DAY)
LTAR = LONG TERM ACCEPTANCE RATE (GAL./DAY-SQ. FT.)

$$A = \frac{750}{0.35} = 2142.86$$

ABSORPTION FIELD AREA ADJUSTMENT FACTOR FOR GRAVITY TRENCH DESIGN = 1.0

ABSORPTION FIELD AREA ADJUSTMENT FACTOR FOR USE OF CHAMBERS = 0.7

ADJUSTED ABSORPTION FIELD AREA = 2142.86 X 1.0 X 0.7 = 1500 SQ. FT.

USE 125 QUICK4 STANDARD INFILTRATORS AS 5 TRENCHES OF 25 UNITS EACH CONFIGURED IN SERIAL DISTRIBUTION

ABSORPTION FIELD ADDITION SIZED AT 5 TRENCHES 3 FT. X 100 FT = 1500 SQ. FT.

4.0 Site Specific Installation/Operation Requirements

The owner and system contractor shall be aware and comply with the following installation and system operation requirements.

4.1 Installation - Setbacks, Notifications, and Inspections

- All installation activities shall be conducted in accordance with current Montrose County *OWTS Regulations*. If at any time during construction, subsurface site conditions are encountered which differ from the design parameters developed in Section 2.0, construction activities will stop and the design engineer and Montrose County will be contacted to address any necessary design modifications.

- Installation procedures including grade, location, setbacks, septic tank size, and absorption field size shall conform with the attached graphic details. Construction activities and system components will not encroach upon existing easements or utility corridors. A minimum of 6 ft of undisturbed soil shall be maintained between individual absorption elements and the septic tank and/or adjacent absorption elements. Minimum site specific setbacks for system components are:

Source	Septic Tank	Absorption Field	Building Sewer
domestic water line	10'	25'	10'
domestic well	50'	100'	
domestic water cistern	25'	25'	
dwelling	5'	20'	
property lines	10'	10'	
unoccupied structure	5'	5'	
occupied structure	5'	20'	
irrigation ditch			
open	50'	50'	
intermittent irrigation	10'	25'	
gated	10'	25'	
solid pipe/lined	10'	10'	

- To avoid surface flow infiltration and saturation of the new absorption system, abandonment of irrigation in the vicinity of the disposal system is required. Diversion ditches necessary to divert surface flows around the new absorption bed must maintain the minimum setbacks listed above.

- All gravity flow sewer lines and effluent distribution piping shall be 4 inches in diameter and have glued joints. All lines discharging sewage from the residence to the septic tank shall maintain fall of between 1/8 in. and 1/4 in. per foot and shall employ sweep 90's or 2-45's at all turns. Sewer lines from the dwelling to the septic tank and at least 6 ft from the septic tank outlet must meet minimum standard ASTM-3034. Sewer lines under driveways shall always meet minimum Schedule 40 PVC standards. Additionally, effluent piping in traffic areas with less than 24" of cover shall be encased in 6" CMP or flow fill and covered with minimum 2" high density blue board insulation.

- A minimum of 10" of soil cover (18" recommended) shall be maintained over all gravity draining ISDS components to prevent freezing of septic effluent (excepting septic tank acess manholes must extend to the ground surface).

- The installer shall not place the Infiltrators in the open excavation until inspected and approved by the design engineer. Additionally, the final cover shall not be placed on sewer lines, septic tank, or the absorption area until the system has been inspected and approved by the design engineer and the Montrose County. The installer shall provide 48 hour notice for all required inspections.

- Four inch clean outs shall be installed at maximum 100' intervals in all gravity flow effluent lines exceeding 100' in length.

- A non-corrodible Orenco filter (model # FTW0444-36) shall be installed at the final outlet tee of the OWTS septic tank or in the effluent line between the septic tank and the absorption field to limit the size of solids and sludge passing into the absorption field. The filter must be accessible for cleaning and replacement from the ground surface.

- The effluent distribution system shall be constructed in accordance with the "Infiltrator Technical Manual" available from Infiltrator Systems Inc., 123 Elm Street, Suite 12, Old Saybrook, Connecticut 06475.

- Adjacent absorption field trenches shall be connected by a serial distribution system to assure saturation of the upgradient trench before effluent is passed to the adjacent downgradient trench (see attached absorption field plan view and cross section details).

- The surface cap shall be mounded 5% over the absorption field to promote surface runoff.

- The system contractor shall be aware of the potential for construction activities to reduce soil permeabilities at the site through compaction, smearing, and shearing. The following precautions and construction procedures should be employed during installation to minimize disturbance to native soils:
    i. Excavation should proceed only when the moisture content of the soil is below the plastic limit. If a sample of soil forms a rope instead of crumbling when rolled between the hands it is too wet and should be allowed to dry before excavation continues.
    ii. Excavation and backfill equipment should work from the surface where at all practical to avoid compaction of the soils at depth.
    iii. The bottom and sidewalls of the excavation should be left with a rough, open surface. The appearance should be that of broken or ripped soil as opposed to a sheared, smeared, or troweled surface. Any smoothed or smeared surfaces should be removed with a toothed rake or shallow ripper taking care to remove loose residues from the bottom of the excavation by hand if necessary.
    iv. Care should be taken in placing fill materials in the excavation to avoid damaging the exposed soil surfaces.

4.2 Operation - Maintenance and Inspections

- The owner shall install a structural barrier if necessary and take precautions to prevent vehicular traffic, excessive surface watering, accidental flooding, or other activities in the vicinity of the absorption field which may compact, saturate, or otherwise alter the subsurface soil parameters used in designing the septic system.

- The owner will plant and maintain grass or other shallow rooted cover crop to prevent erosion and promote evapotranspiration over the absorption field.

- The owner will inspect and maintain the required mounding and drainage away from the absorption field to prevent saturation from precipitation and surface flows.

- To mitigate the generation of preferential flow channels which may compromise the operation of the system, the owner will inspect and prevent intrusion of burrowing animals and deep rooted plants into the absorption field.

- The septic effluent filter shall be inspected and cleaned as necessary every six (6) months.

- The owner will conduct periodic maintenance of the septic system by removing accumulated sludge from the septic tank every 3-4 years to prevent clogging of the absorption field.

- The owner will conduct periodic maintenance and cleaning of the septic system in accordance with the following schedule at a minimum:

Type of Component	**Inspection and Maintenance**	**Cleaned or Pumped**	**Effluent Testing**
septic tank	every 4 years	every 4 years	experimental only

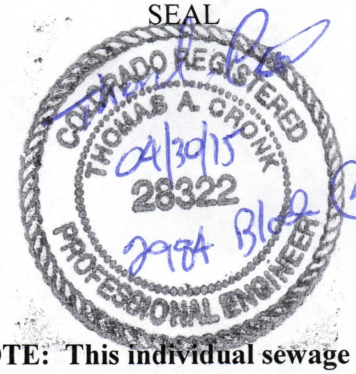
5.0 Limitations

This report is a site specific design for installation of an onsite wastewater treatment system and is applicable only for the client for whom our work was performed. Use of this report under other circumstances is not an appropriate application of this document. This report is a product of CCI Engineering/Cronk Construction Incorporated and is to be taken in its entirety. Excerpts from this report may be taken out of context and may not convey the true intent of the report. It is the owner's and owner's agent's responsibility to read this report and become familiar with the recommendations and design guidelines contained herein.

The recommendations and design guidelines outlined in this report are based on: 1) the proposed site development and plot plan as furnished to CCI Engineering/Cronk Construction Incorporated by the client, and 2) the site conditions disclosed at the specific time of the site investigation of reference. CCI Engineering/Cronk Construction Incorporated assumes no liability for the accuracy or completeness of information furnished by the client. Site conditions are subject to external environmental effects and may change over time. Use of this plan under different site conditions is inappropriate. If it becomes apparent that current site conditions vary from those anticipated, the design engineer and Montrose County should be contacted to develop any required design modifications. CCI Engineering/Cronk Construction Incorporated is not responsible and accepts no liability for any variation in assumed design parameters.

CCI Engineering/Cronk Construction Incorporated represents this report has been prepared within the limits prescribed by the owner and in accordance with the current accepted practice of the civil engineering profession in the area. No warranty or representation either expressed or implied is included or intended in this report or in any of our contracts.

SEAL

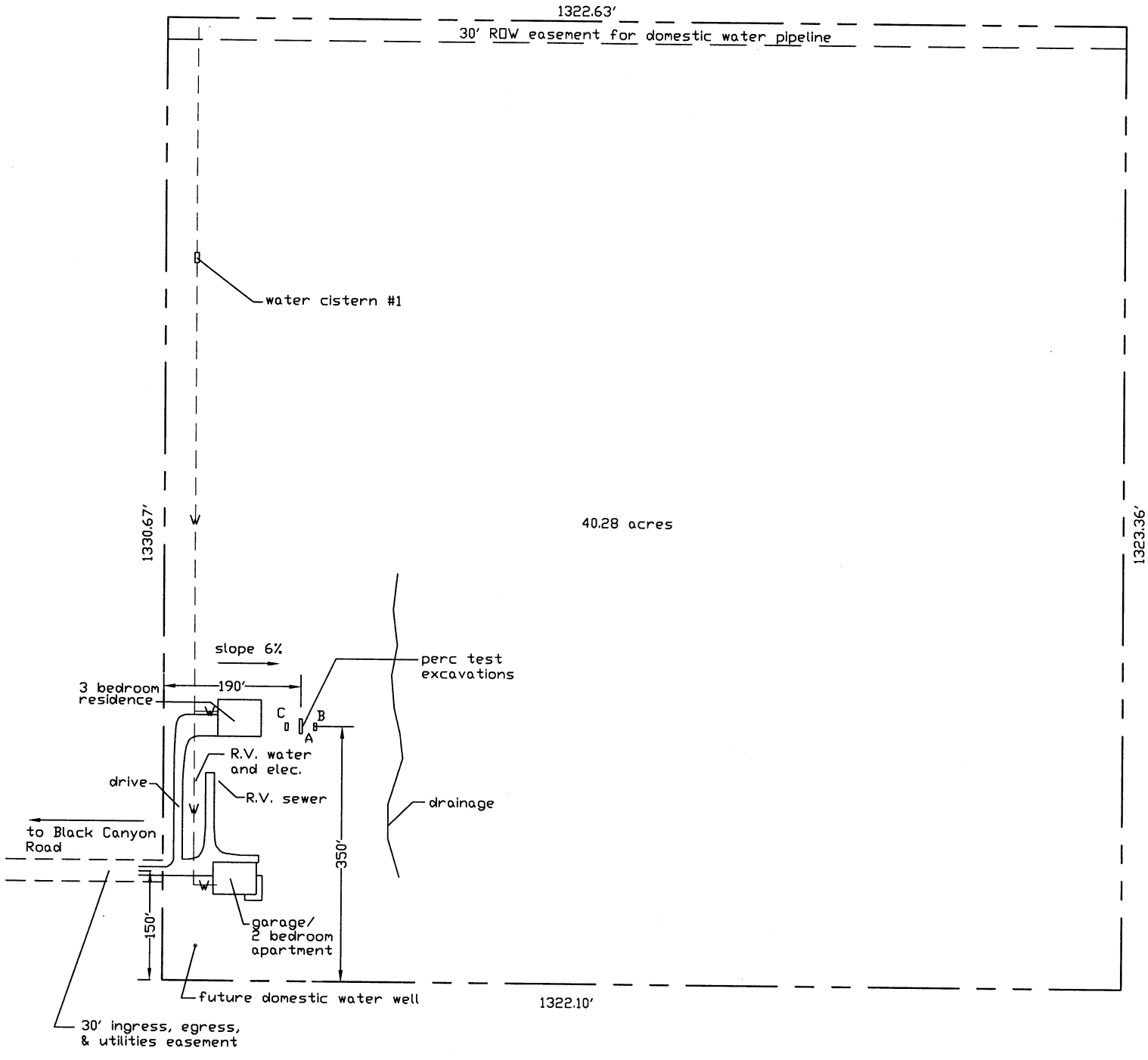


Thomas A. Cronk, P.E.

April 30, 2015

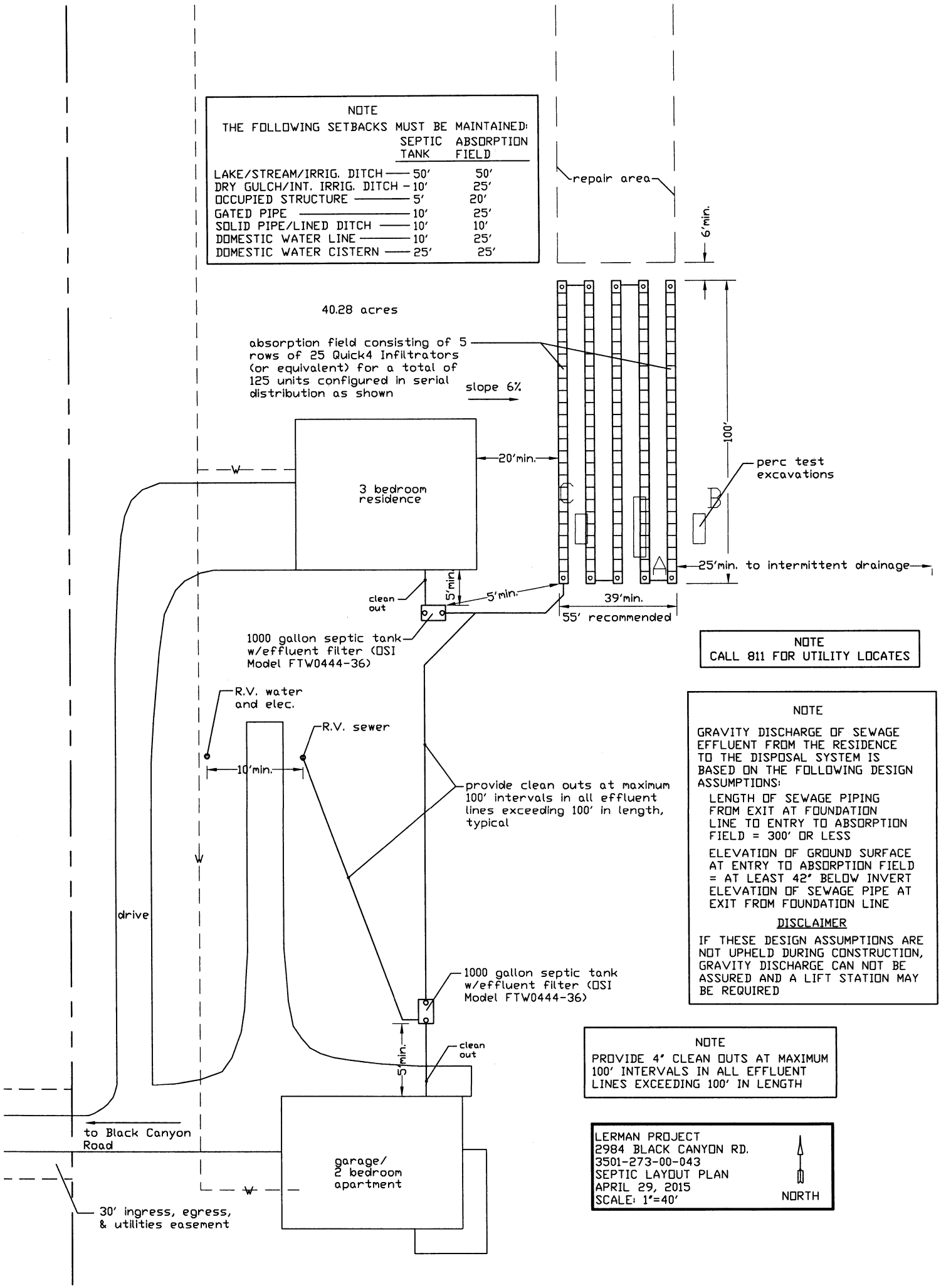
Date

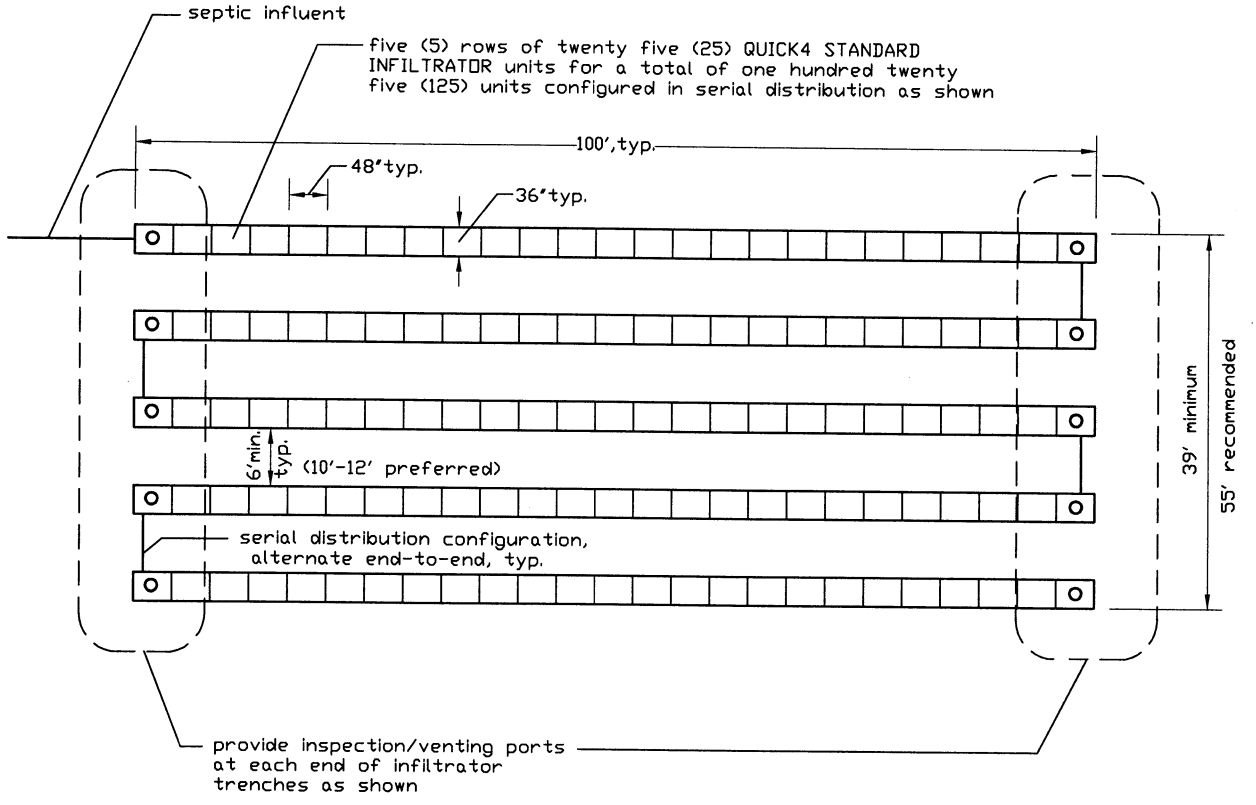
NOTE: This individual sewage disposal plan is meant to include the following four pages of graphics including: 1) plot plan, 2) septic layout plan, 3) absorption field plan view, and 4) absorption field cross section. The plan is not to be implemented in the absence of these related graphics. In addition, results from the percolation test and soils evaluation are included for reference as Appendix A.



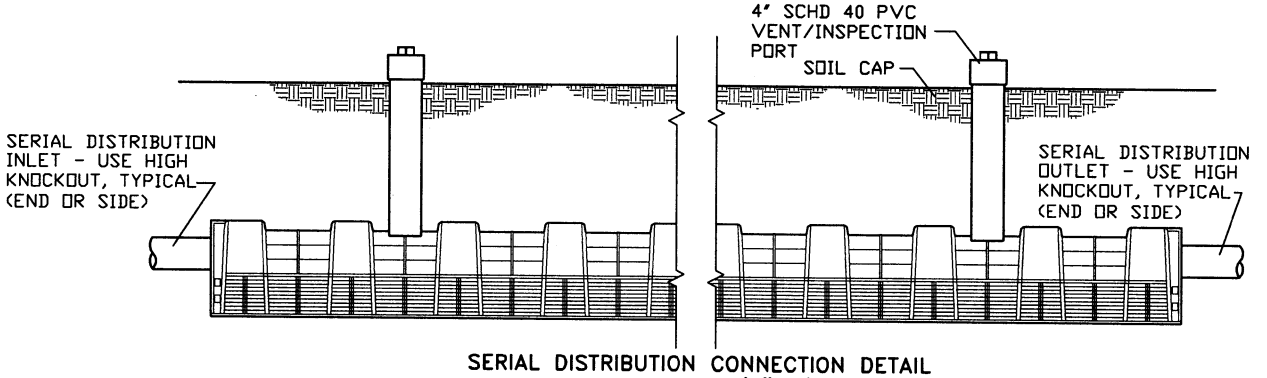
LERMAN PROJECT
2984 BLACK CANYON RD.
3501-273-00-043
PLOT PLAN
APRIL 29, 2015
SCALE: 1"=200'

NORTH


NOTE
THE FOLLOWING SETBACKS MUST BE MAINTAINED:
SEPTIC TANK
ABSORPTION FIELD
LAKE/STREAM/IRRIG. DITCH — 50′ 50′
DRY GULCH/INT. IRRIG. DITCH — 10′ 25′
OCCUPIED STRUCTURE — 5′ 20′
GATED PIPE — 10′ 25′
SOLID PIPE/LINED DITCH — 10′ 10′
DOMESTIC WATER LINE — 10′ 25′
DOMESTIC WATER CISTERN — 25′ 25′
repair area
6′min.
40.28 acres
absorption field consisting of 5 rows of 25 Quick4 Infiltrators (or equivalent) for a total of 125 units configured in serial distribution as shown
slope 6%
100′
perc test excavations
20′min.
3 bedroom residence
25′min. to intermittent drainage
clean out
5′min.
5′min.
39′min.
55′ recommended
1000 gallon septic tank w/effluent filter (OSI Model FTW0444-36)
NOTE
CALL 811 FOR UTILITY LOCATES
R.V. water and elec.
R.V. sewer
10′min.
provide clean outs at maximum 100′ intervals in all effluent lines exceeding 100′ in length, typical
NOTE
GRAVITY DISCHARGE OF SEWAGE EFFLUENT FROM THE RESIDENCE TO THE DISPOSAL SYSTEM IS BASED ON THE FOLLOWING DESIGN ASSUMPTIONS:
LENGTH OF SEWAGE PIPING FROM EXIT AT FOUNDATION LINE TO ENTRY TO ABSORPTION FIELD = 300′ OR LESS
ELEVATION OF GROUND SURFACE AT ENTRY TO ABSORPTION FIELD = AT LEAST 42″ BELOW INVERT ELEVATION OF SEWAGE PIPE AT EXIT FROM FOUNDATION LINE
DISCLAIMER
IF THESE DESIGN ASSUMPTIONS ARE NOT UPHELD DURING CONSTRUCTION, GRAVITY DISCHARGE CAN NOT BE ASSURED AND A LIFT STATION MAY BE REQUIRED
drive
1000 gallon septic tank w/effluent filter (OSI Model FTW0444-36)
5′min.
clean out
NOTE
PROVIDE 4″ CLEAN OUTS AT MAXIMUM 100′ INTERVALS IN ALL EFFLUENT LINES EXCEEDING 100′ IN LENGTH
to Black Canyon Road
garage/ 2 bedroom apartment
30′ ingress, egress, & utilities easement
LERMAN PROJECT
2984 BLACK CANYON RD.
3501-273-00-043
SEPTIC LAYOUT PLAN
APRIL 29, 2015
SCALE: 1″=40′
NORTH

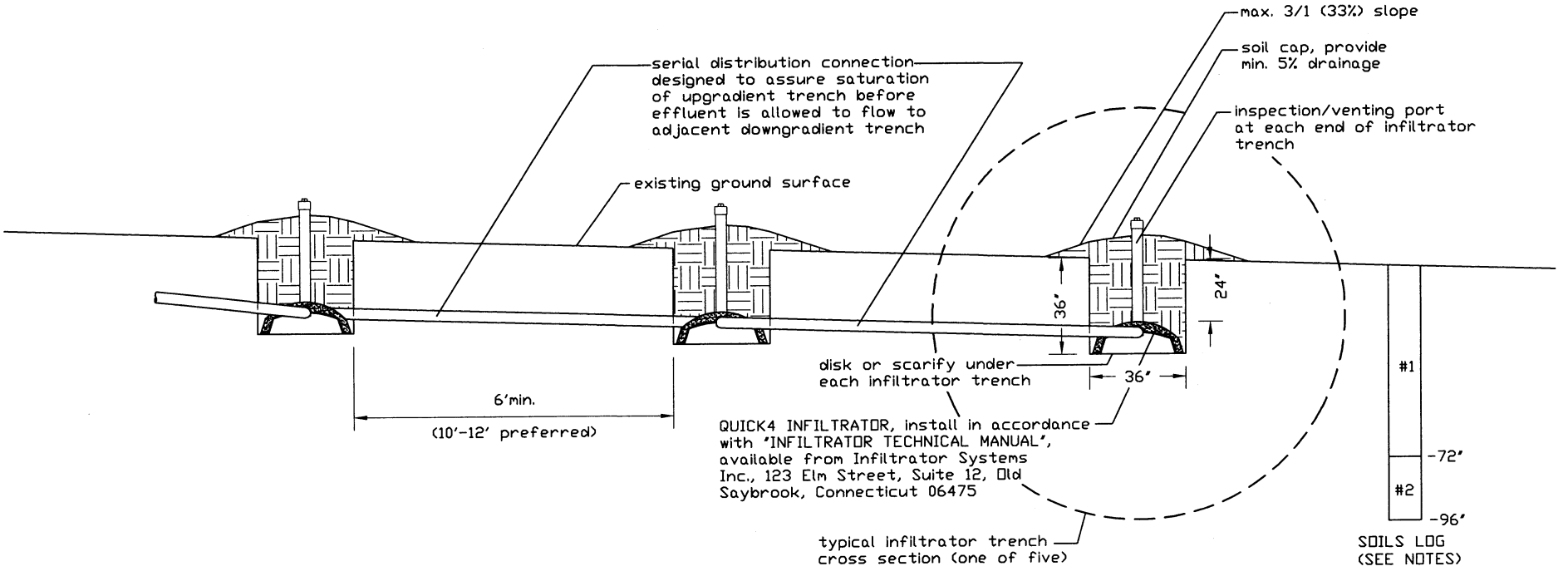


ABSORPTION FIELD - PLAN VIEW
SCALE: 1"=20'



SERIAL DISTRIBUTION CONNECTION DETAIL
SCALE: 1/2"=1'

LERMAN PROJECT
2984 BLACK CANYON ROAD
3501-273-00-043
ABSORPTION FIELD - PLAN VIEW
APRIL 30, 2015
SCALE: 1"=20'



ABSORPTION FIELD - CROSS SECTION (TYP. THREE OF FIVE)
SCALE: 1"=5'

ELEVATION DESIGN SPECIFICATIONS
DESIGN DISTANCE FROM FOUNDATION LINE TO SEPTIC TANK = 25'
DESIGN DISTANCE FROM SEPTIC TANK TO SOIL TREATMENT AREA = 170'
ASSUMED ELEVATION OF GROUND SURFACE AT ENTRY TO SOIL TREATMENT AREA = 100.00'
ELEVATION OF INFILTRATIVE SURFACE OF SOIL TREATMENT AREA = 97.00'
INVERT ELEVATION OF SEWAGE LINE AT EXIT FROM SEPTIC TANK = 100.90'
INVERT ELEVATION OF SEWAGE LINE AT EXIT FROM FOUNDATION LINE = 101.65'

LERMAN PROJECT
2984 BLACK CANYON ROAD
3501-273-00-043
ABSORPTION FIELD - CROSS SECTION
APRIL 30, 2015
SCALE: 1"=5'

SOILS LOG NOTES

#1 - LIGHT REDDISH BROWN SANDY CLAY/CLAYEY SAND, BLOCKY, SMEARED
#2 - REDDISH TAN CLAYEY SAND, GRAINY AND FRIABLE, MINOR SANDSTONE COBBLE TO BOULDERS

NO GROUNDWATER OR HIGH SEASONAL WATER TABLE TO 96' BELOW GROUND SURFACE (BGS)

APPENDIX A

SOILS AND PERCOLATION REPORT

CCI ENGINEERING/CRONK CONSTRUCTION INCORPORATED

CCI ENGINEERING 1129 -24- Road
Cronk Construction Inc. Grand Junction, CO 81505
Grand Junction (970) 245-0577 • Glenwood Springs/Aspen (970) 640-5029 • Montrose/Delta (970) 640-5029
Email: ccigj@msn.com

SOILS AND PERCOLATION REPORT

Date: June 21, 2011

Prepared by: Thomas A. Cronk, P.E.
1129 -24- Road
Grand Junction, CO 81505
245-0577

Client: Ruvin Lerman
17136 Ashland Drive
Anchorage, AK 99516
907-868-2828

Property address: 2984 Black Canyon Road, Crawford, CO 81415

Tax schedule No.: 3501-273-00-043

Legal Descript.: SW1/4, SW1/4, S27, T51N, R7W, N.M.P.M.

1.0 Soils Evaluation

The site consists of approximately 40 acres of uncultivated native soil. Drainage is approximately 6% to the east. A percolation test/soils evaluation was conducted on the property of reference on 06/21/11 by Tom A. Cronk, registered professional engineer (R.P.E.). The *perc* excavation trench (excavation A) was located approximately 350' north of the south property line and approximately 190' east of the west property line. Additional *perc* holes were located 20' east of the trench (excavation B) and 20' west of the trench (excavation C).

A *perc* excavation trench (excavation A) was extended to a depth of 96" below ground surface (BGS). There was no evidence of ground water or high seasonal water table in the open excavation to a depth of 96" BGS. The soils evaluation indicates two distinct soil horizons underlie the site. A lithological description follows:

depth (in.)	description
0" - 72"	sandy clay/clayey sand, light reddish brown; blocky; smeared
72" - 96"	clayey sand, reddish tan; grainy and friable; minor sandstone cobble to boulders

Perc holes were constructed in excavation A at a depth of approximately 36 in. Additional *perc* holes were constructed in excavation B at a depth of 30 in. and in excavation C at a depth of 24 in. The holes appeared to be well saturated at the time of the test. Results of the percolation test are shown in Table 1.

TABLE 1

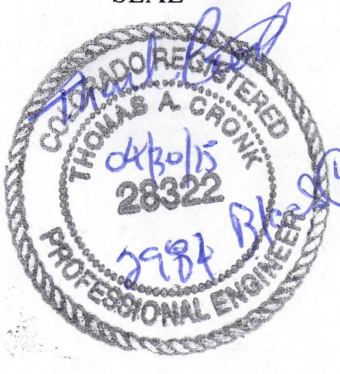
Percolation Test Results 2984 Black Canyon Road										
Depth	Time on 06/21/11								Time Drop	*Perc* Rate min/in
	14:03	14:18	14:33	14:48	15:41					
(A) 24"-36"	3.875	4.375	4.875	5.125	6.25				98/2.375	41
(B) 30"-42"	3.375	3.625	4.0	4.25	5.25				98/1.875	52
(C) 36"-48"	3.375	3.875	4.375	4.875	5.75				98/2.375	41

2.0 Limitations

This document is representative of the site conditions disclosed at the specific time of the site investigation. Site conditions are subject to change from external events both manmade (irrigation or water feature construction) and naturally occurring (flooding or excessive precipitation). CCI Engineering/Cronk Construction Incorporated is not responsible and accepts no liability for any future variation in site conditions.

CCI Engineering/Cronk Construction Incorporated represents this report has been prepared within the limits prescribed by the owner and in accordance with the current accepted practice of the civil engineering profession in the area. No warranty or representation either expressed or implied is included or intended in this report or in any of our contracts.

SEAL



Thomas A. Cronk, P.E.

April 30, 2015

Date