



January 16, 2020

Steamboat Ski and Resort Corp.
Lance Miles
2305 Mt. Werner Circle
Steamboat Springs, CO 80487

Job Number: 19-11550

Subject: Geotechnical Investigation,
Greenhorn Ranch/Wildblue, New Boulevard
Road, Steamboat Ski Resort, Routt County,
Colorado.

Lance,

As requested, NWCC, Inc. (NWCC) has prepared this Geotechnical Investigation report for the proposed construction of the New Boulevard Road to occur in the proposed Greenhorn Ranch area of the Steamboat Ski and Resort in Routt County, Colorado. The approximate location of the project site is shown in Figure #1.

The scope of our work included obtaining data from cursory observations made at the site, logging of nine (9) test pits, sampling of the soils and laboratory testing of the samples obtained. This report presents results of the investigation and grading recommendations.

Proposed Construction: Based on conversations with the client and review of the provided Bashor grading plans, NWCC understands that the proposed construction will consist of the following:

- Regrading and widening of the existing Boulevard Road.
- Relocation of a portion Boulevard Road further uphill in the area of the proposed ski lift.
- Regrading of the slopes for ski runs.

NWCC understands that grading will consist of a combination of cuts and fills on the order of 10 to 30 feet in depth.

Site Conditions: The project site is located south of Burgess Creek Road, near the existing Bashor and Thunderhead Express lifts at the Steamboat Ski Resort in Steamboat Springs, Colorado. Boulevard Road, an unpaved, two-track road, provides vehicle access in the summer and is a ski run in the winter. Several other ski runs, a terrain park and poma surface lift, also exist at the site.

Topography at the site is variable and generally slopes strongly to moderately down to the north. Previous site grading includes both cuts and fills of unknown depth. Several rock outcrops are visible along the existing Boulevard Road.

Vegetation at the site consists of deciduous bushes, grasses, pine trees and aspen trees.

Subsurface Conditions: To investigate subsurface conditions, nine (9) test pits were advanced at the site on October 8, 2019 with a CAT 336F trackhoe provided by the client. A site plan showing approximate test pit locations is presented in Figure #2.

Subsurface conditions encountered in the test pits were variable and generally consisted of a layer of natural topsoil and organic materials overlying natural sands and gravels, clays and sands and decomposed granite overlying crystalline or sandstone bedrock. The maximum depth excavated was 12 feet beneath the existing ground surface (bgs). Graphic logs of the exploratory test pits are presented in Figure #3, and associated Legend and Notes are presented in Figure #4.

A layer of natural topsoil and organic materials, approximately 4 to 10 inches in thickness, was encountered at the ground surface in all test pits. Sands and gravels were encountered beneath the topsoil and organic materials in Test Pits 1, 2 and 5, extending to depths ranging from 3 to 11 feet bgs. The sands and gravels were slightly silty to silty, fine to coarse grained with occasional cobbles and boulders, very low to non-plastic, medium dense to dense, slightly moist to dry and brown to gray in color. A sample of the sands and gravels classified as an SM soil in accordance with the Unified Soil Classification System (USCS).

Decomposed granite was encountered beneath the sands and gravels in Test Pits 2 and 5 and beneath the topsoil and organic materials in Test Pits 3, 4 and 6. The decomposed granite extended to the maximum depths excavated in Test Pits 2, 4, 5 and 6, and to a depth of 3 feet bgs in Test Pit 3. The decomposed granite was slightly silty to silty, fine to coarse grained with occasional cobble-sized granite fragments, very low to non-plastic, dense to very dense, moist and brown to dark gray in color. Samples of the decomposed granite classified as SM soils in accordance with the USCS. A standard Proctor test was conducted in accordance with ASTM D698 on a large disturbed sample of the decomposed granite to determine the remolded maximum density and optimum moisture content of these materials. The standard Proctor test results are shown in Figure #5.

Crystalline bedrock was encountered beneath the decomposed granite in Test Pit 3 and extended to a depth of 4 feet bgs, where refusal was encountered on the hard bedrock. The crystalline bedrock consisted of schist and gneissic granite, was fine to coarse-textured, non-plastic, slightly weathered to very hard, slightly moist, brown to reddish brown to gray to black and white in color.

Sands and clays were encountered beneath the topsoil and organic materials in Test Pits 7, 8 and 9, and extending to depths ranging from 2 ½ to 4 feet bgs. The sands and clays were slightly silty to silty, fine to coarse grained with occasional sandstone and schist bedrock fragments, low to moderately plastic, medium dense to stiff, slightly moist to moist and brown to tan in color. A sample of the sands and clays classified as an SC soil in accordance with the USCS.

Sandstone bedrock of the Brown's Park Formation was encountered beneath the sands and clays in Test Pits 7, 8 and 9 and extended to the maximum depths investigated in each test pit. The sandstone bedrock was silty to clayey, fine to coarse grained with occasional gravel-sized clasts, low to moderately plastic, weathered to hard and tan in color. Samples of the sandstone bedrock classified as SC soils in accordance with the USCS.

Groundwater was not encountered in the test pits at the time of the investigation. It should be noted that groundwater levels at the site are expected to fluctuate with seasonal changes in runoff and precipitation.

Site Grading Recommendations: Slopes on which construction is proposed could become unstable as a result of the proposed construction. Design and construction considerations must be addressed to avoid and/or limit the potential for slope instability at the site. Although a detailed slope stability analysis is beyond the scope of this report, some general guidelines are provided below for initial planning and design. Our office should review the construction plans as they are being prepared so that we can verify that our recommendations are being properly incorporated into the plans.

1. Overburden materials, decomposed granite and the upper 2 to 3 feet of sandstone bedrock materials can likely be excavated with large dozers with ripper teeth. However, deeper cuts in the sandstone bedrock materials and cuts into the crystalline bedrock materials will most likely require blasting or other rock-breaking techniques to remove these materials.
2. Temporary cuts for foundation construction should be constructed to OSHA standards for temporary excavations. Permanent, unretained cuts should be kept as shallow as possible and should not exceed a 1.5(Horizontal) to 1(Vertical) configuration for the overburden soils and decomposed granite. Cuts made into stable bedrock materials can potentially be made nearly vertical, depending on bedrock competency and potential for rock fall hazard. The risk of slope instability and rock fall will be significantly increased if groundwater seepage is encountered in the cuts. NWCC office should be notified immediately to evaluate the site, if seepage is encountered or deeper cuts are planned and determine if additional investigations and/or stabilization measures are warranted.
3. Excavating during periods of low runoff at the site can reduce potential slope instability during excavation. Excavations should not be attempted during the spring or early summer when seasonal runoff and groundwater levels are typically high.
4. Embankment fills should be constructed to a 2(Horizontal) to 1(Vertical) or flatter configuration.
5. The fill areas should be prepared by stripping any existing topsoil fill materials and/or natural topsoil and organics, and then scarification and recompaction of the exposed soils to at least 95% of the maximum standard Proctor density and within 2% of optimum moisture content, as determined by ASTM D698. The fills should be properly benched/keyed into the natural hillsides after all of the natural topsoil and organic materials and any topsoil fill materials have been removed.

6. The fill materials should consist of the on-site soils (exclusive of topsoil or organics) and be uniformly placed and compacted in 6 to 8-inch loose lifts to the minimum density value and moisture content range indicated above.
7. Proper surface drainage features should be provided around all permanent cuts and fills and steep natural slopes to direct surface runoff away from these areas. Cuts, fills and other stripped areas should be protected against erosion by revegetation or other methods. Areas of concentrated drainage should be avoided and may require the use of riprap for erosion control. NWCC recommends that a maximum of 4 inches of topsoil be placed over the new cut and fill slopes. It should be noted that the newly placed topsoil materials may slough/slide off the slopes during the spring runoff seasons until the root zone in the vegetated cover establishes.
8. A qualified engineer experienced in this area should prepare site grading and drainage plans. The contractor must provide a construction sequencing plan for excavation, wall construction and bracing and backfilling for the steeper and more sensitive portions of the site prior to starting the excavations or construction.

Limitations: The recommendations provide in this report are based on the subsurface conditions encountered at the site and our understanding of the proposed construction. NWCC believes this information gives a high degree of reliability for anticipating subsurface conditions; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soils profiles beneath those or adjacent to those observed. No warranties expressed or implied are given on the content of this report.

This report is based on the investigation at the described sites and on the specific anticipated construction as stated herein. If either of these conditions is changed, the results would also most likely change. Therefore, we strongly recommend that our firm be contacted prior to finalizing the construction plans so that we can verify that our recommendations are being properly incorporated into the construction plans. Man-made or natural changes in the conditions of a property can also occur over time. In addition, changes in requirements due to state-of-the-art knowledge and/or legislation can occur. As a result, the findings of this report may become invalid due to these changes. Therefore, this report is subject to review and not considered valid after a period of 3 years or if conditions as stated above are altered.

It is the responsibility of the owner or their representative to ensure the information in this report is incorporated into the plans and/or specifications and construction of the project. It is advisable that a contractor familiar with construction details typically used to dealing with the local subsoils and climatic conditions be retained to build the structures.

If you have any questions regarding this report or if we may be of further service, please do not hesitate to contact us.

Sincerely,
NWCC, Inc.

Erika K. Hill, P.E.
Project Engineer

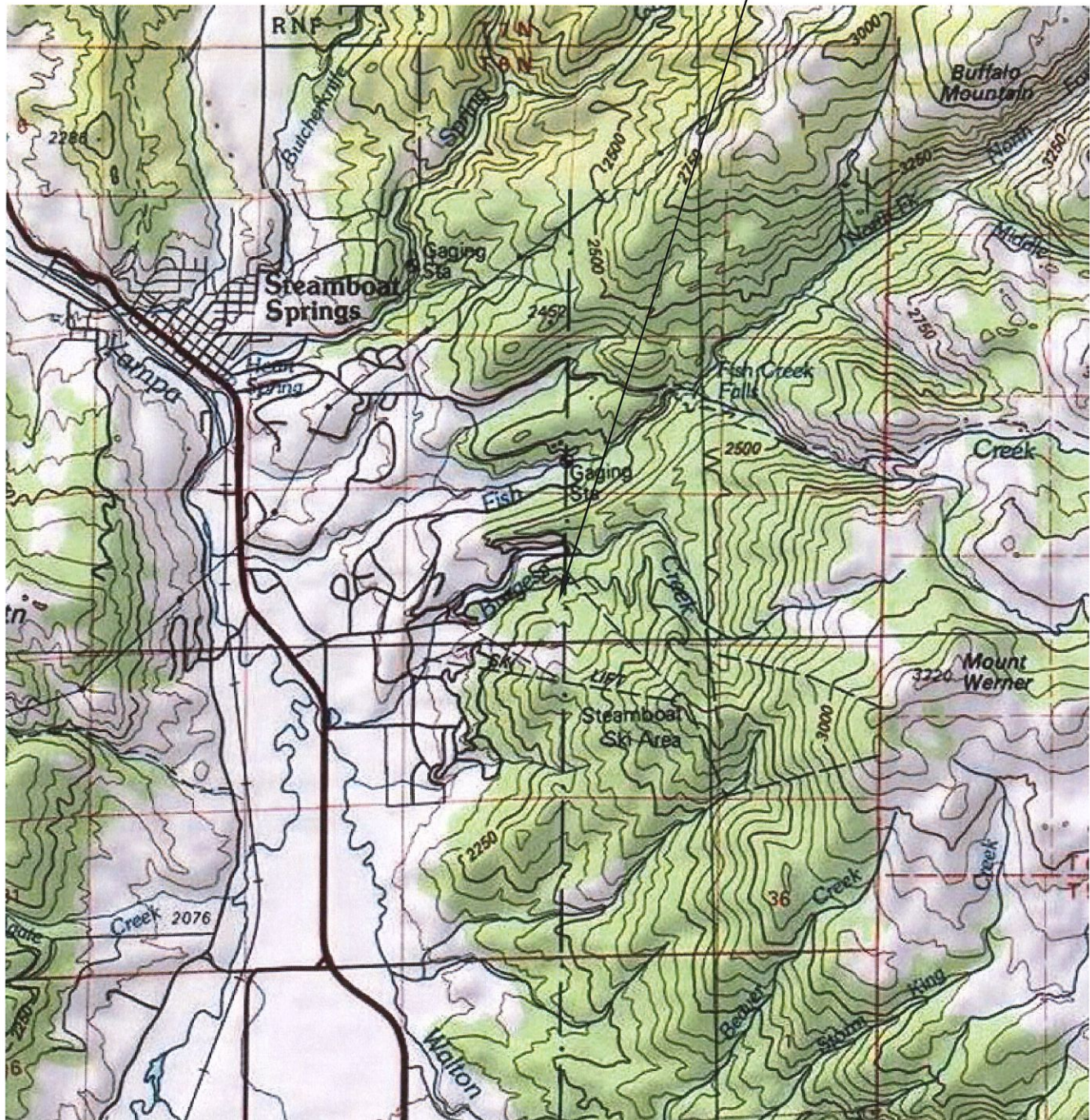
Reviewed by Brian D. Len, P.E.
Principal Engineer





NOT TO SCALE

PROJECT SITE



Title: VICINITY MAP

Date: 1/13/20

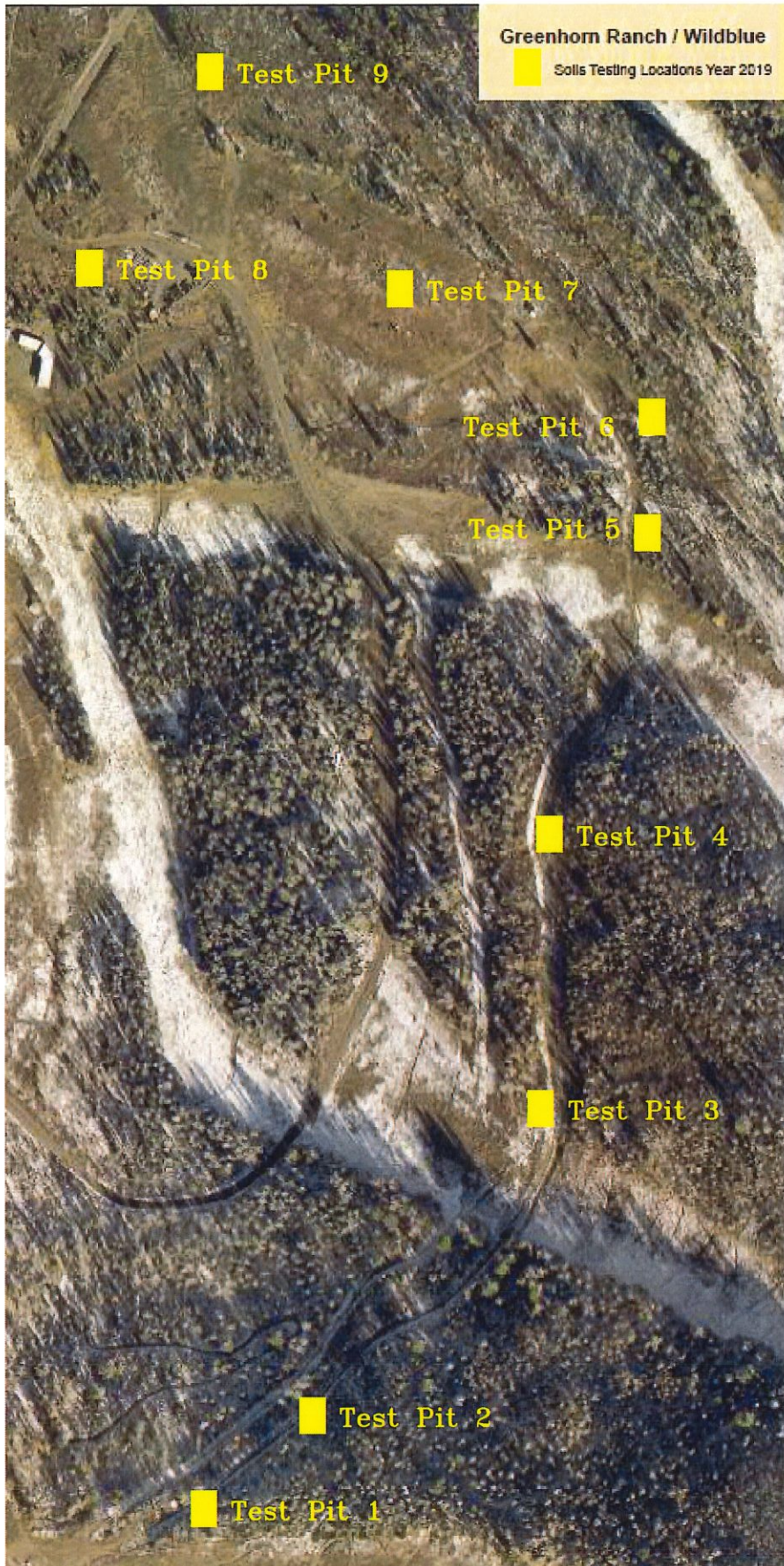
Job Name: Greenhorn Ranch/Wildblue-New Boulevard Road

Job No. 19-11550

Location: Steamboat Ski Resort, Steamboat Springs, CO

Figure #1





Title: SITE PLAN-LOCATION OF TEST PITS

Job Name: Greenhorn Ranch/Wildblue-New Boulevard Road

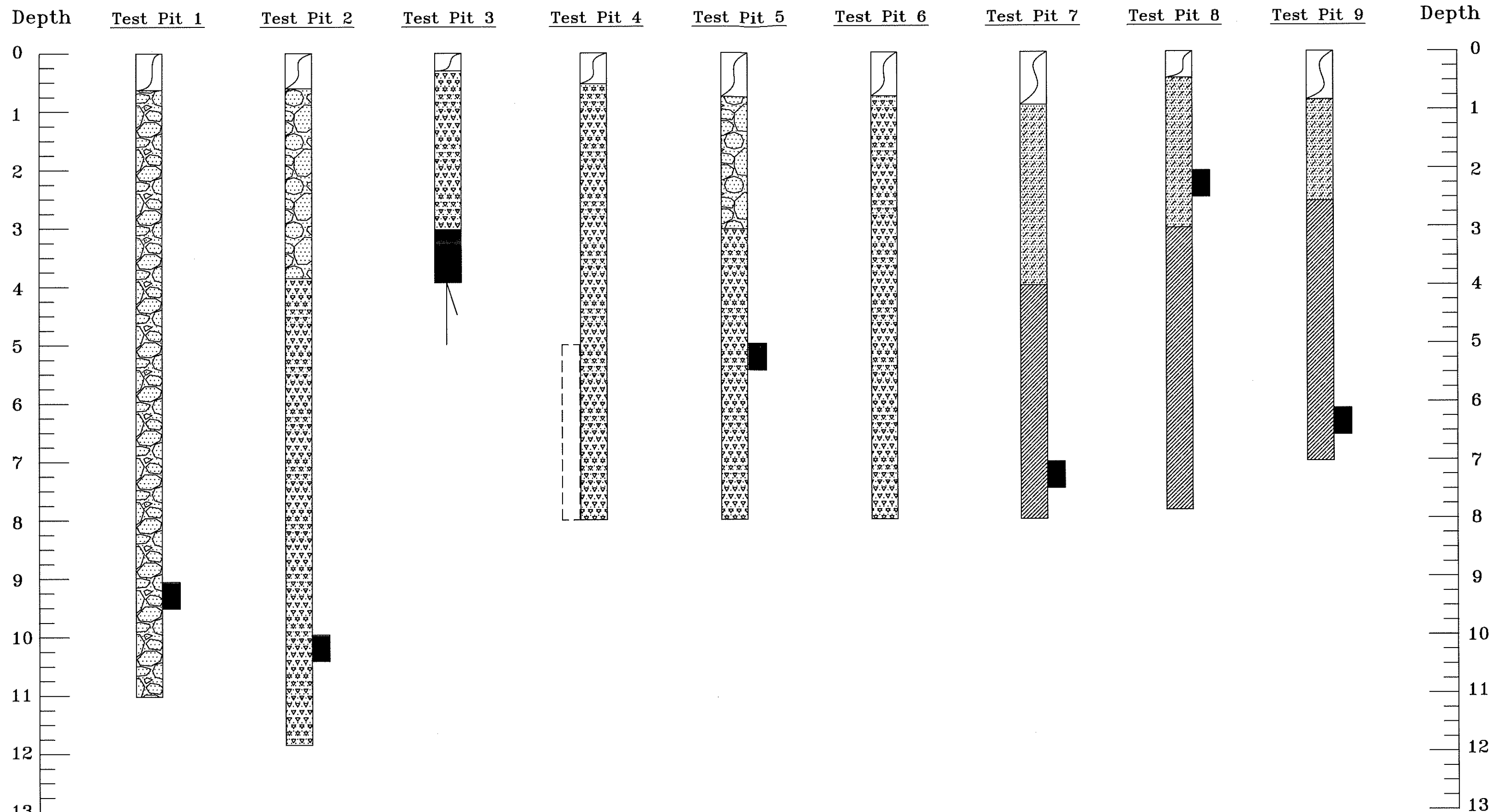
Location: Steamboat Ski Resort, Steamboat Springs, CO

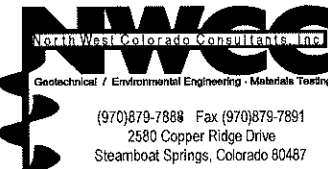
Date: 1/13/20

Job No. 19-11550

Figure #2





 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	Title: Logs of Exploratory Test Pits		
	Job Name: Greenhorn Ranch/ The Wild Blue		
	Location: New Boulevard Road, Steamboat Ski Resort, Steamboat Springs, CO		
	Job No.: 19-11550	Date: 1/13/20	Fig. # 3

LEGEND:



NATURAL TOPSOIL AND ORGANICS: Silty and sandy, very low plastic, dry to moist and dark brown.



SANDS AND GRAVELS: Slightly silty to silty, fine to coarse grained with occasional cobbles and boulders, very low to non-plastic, medium dense to dense, slightly moist to dry and brown to gray.



DECOMPOSED GRANITE: Slightly silty to silty, fine to coarse grained with occasional cobbles, very low to non-plastic, dense to very dense, moist and brown to dark gray.



CRYSTALLINE BEDROCK: Schist and gneissic granite, fine to coarse-textured, non-plastic, slightly weathered to very hard, slightly moist, brown to reddish brown to gray to black and white.



SANDS AND CLAYS: Silty, fine to coarse grained with occasional sandstone and schist bedrock fragments, low to moderately plastic, medium dense to stiff, slightly moist to moist and brown to tan.



SANDSTONE BEDROCK: Browns Park Formation, silty to clayey, fine to coarse grained with occasional gravel-sized clasts, low to moderately plastic, weathered to hard and tan.



Small Disturbed Bag Sample




Large Disturbed Sample

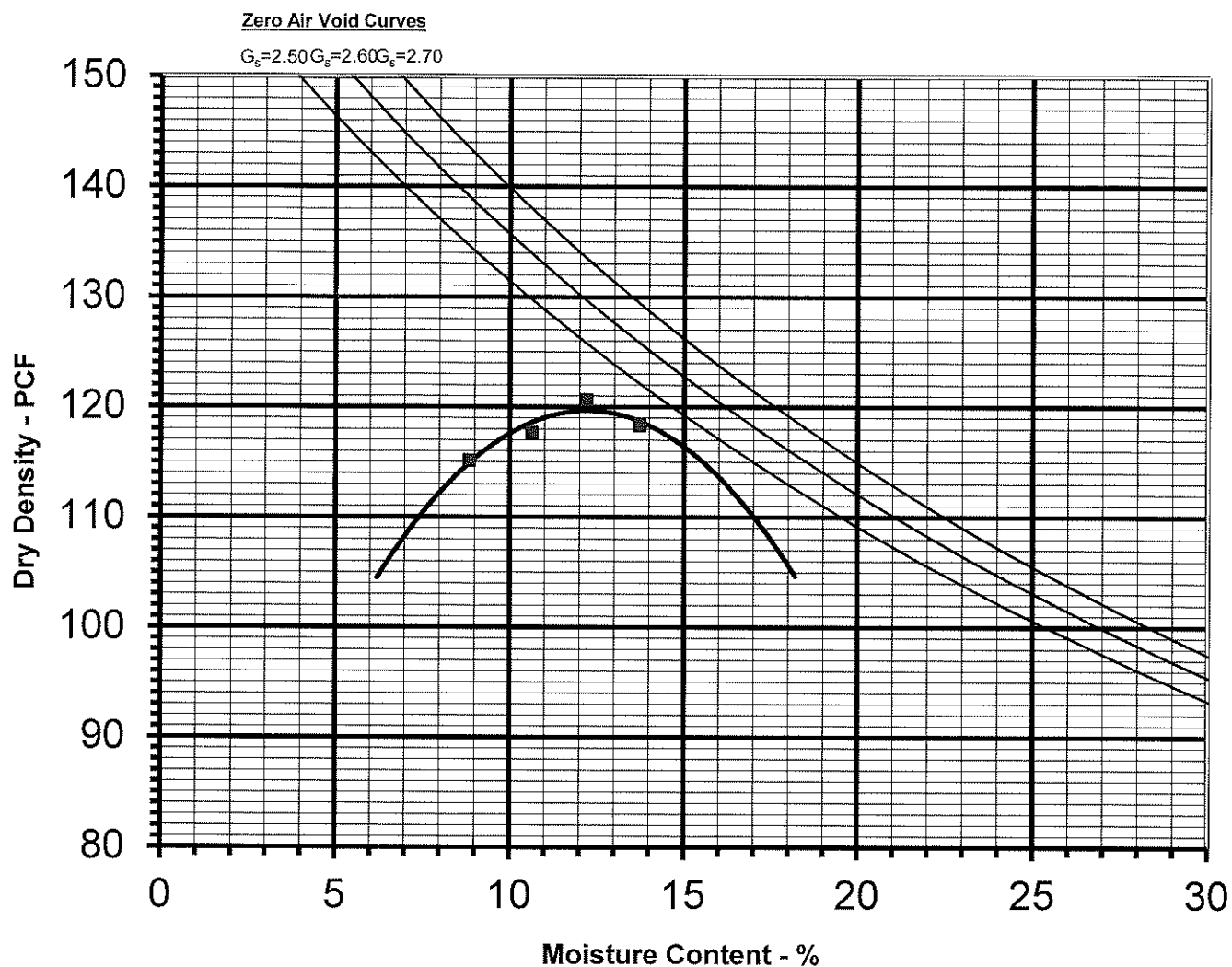


Indicates trackhoe refusal on hard bedrock.

NOTES:

- 1) Test pits were excavated on October 8, 2019 with a CAT 336F trackhoe provided by the client.
- 2) Locations of the test pits were determined in the field by pacing from existing topographic features.
- 3) Elevations of the test pits were not measured and logs are drawn to the depths investigated.
- 4) The lines between materials shown on the logs represent the approximate boundaries between material types and transitions may be gradual.

Title: LEGEND AND NOTES	Date: 1/13/20	 NWCC NorthWestColoradoConsultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80477
Job Name: Greenhorn Ranch/Wildblue-New Boulevard Road	Job No. 19-11550	
Location: Steamboat Ski Resort, Steamboat Springs, CO	Figure #4	



Job Name: Greenhorn Ranch/ Wildblue - New Boulevard Road	
Sample Location: Test Pit 4 @ 5-8'	
Soil Description: Decomposed Granite - Silty Gravelly Sand	
Maximum Dry Density: 119.7 pcf	Opt. Moisture Content: 12.2 %
Liquid Limit: 27 %	Plasticity Index: 2
Gravel: 14 %	Sand: 73 % Silt & Clay (-200): 13 %

**PROCTOR TEST
RESULTS**

Sample No.:	1P
Procedure:	ASTM D698
Date:	7/22/2019
Job No:	19-11550

Figure #5



NWCC, Inc.

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS
NEW BOULEVARD ROAD

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRADATION		PERCENT PASSING No. 200 SIEVE	UNCONFINED COMPRESSIVE STRENGTH (PSF)	SOIL or BEDROCK DESCRIPTION	UNIFIED SOIL CLASS.
TEST HOLE	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
1	9	9.0		NV	NP	17	71	12		Silty Gravelly Sand	SM
2	10	5.5		25	2	35	56	9		Decomposed Granite: Slightly Silty Gravelly Sand	SM
4	5-8			27	2	14	73	13		Decomposed Granite: Silty Gravelly Sand	SM
5	6	5.4		24	2	7	76	17		Decomposed Granite: Slightly Gravelly Silty Sand	SM
7	7	10.8		29	8	3	65	32		Sandstone Bedrock	SC
8	2	10.0		33	15	4	62	34		Clayey Sand	SC
9	6	10.7		34	15	6	62	32		Sandstone Bedrock	SC

NV = No Value

NP = Non Plastic