Soils and Geology
And Wastewater Treatment System
Evaluation

For

Walker Reserve

June 27, 2019

Julia M. Murphy MS, PG
Principal, Professional Geologist

PROFESSIONAL GEOLOGIST
JULIA M. MURPHY
12/31/19
No. 6964
STATE OF CALIFORNIA

GWI
Groundwater Investigations LLC
11590 Black Forest Road Ste 15
Colorado Springs, CO 80908
(719) 338-1805

PROJECT DESCRIPTION

The following presents Soils and Geology for the proposed Walker Reserve Minor Subdivision (Project Site) located at 3980 Walker Road, Colorado Springs CO 80908, in the County of El Paso (Figure 1).

The Project Site is 40.77 acres of land to be subdivided into 3 single- family residential RR-5 (Figure 2). Lot 1 is comprised of 5.10 acre, Lot 2 is 5.12 ACRES and Lot 3 which includes an existing home, will be 28.52 acres. The water supply for lots 1 and 2 will be from individual wells, and wastewater will be treated by individual non-evaporative septic systems. There is an existing well and individual non-evaporative septic system on Lot 3.

GEOLOGY and HYDROLOGY

The Project Site is located within the Monument and Black Forest Quadrangle in the NE1/4 of the SW1/4 Section 11 Township 11S Range 66W near the southeastern portion of the Denver Basin, a geologic structural depression (Thorson 2003a, b). This asymmetrical structural basin is shallow-dipping toward the northeast. The uppermost materials are that of the Dawson Formation deposited during the early to possibly middle Eocene. Historically, braided streams eastwardly carried and deposited gravel, sand, silt and clays derived from weathered Precambrian Pike Peak Granite from the uplifted areas to the west.

Facies Unit 5 (TKda5) is the uppermost facies of the Dawson Formation and is mapped over the Project Site (Figure 3). Facies Unit 5 is described as generally permeable, well drained, with good foundation characteristics. In the southwest portion of the Project site are stream channel deposits (Qa) which is defined as being subject to frequent flooding. Although the Project Site is not with in a FEMA 100-year floodplain, seasonal drainage collects and ponds in the southwest portion of the Project Site (NRCS 2007).

The elevation across the Project Site ranges from 7350 to 7440 feet above mean sea level (Figure 4). Surface drainage is to the southwest from the northeast portion of the Project Site and to the northeast at the southeastern portion of the Project site; flow is towards towards a drainage channel that crosses the southwest portion of the Project Site. This drainage directs

surface water runoff to the northwest to the West Cherry Creek Detention Number 5 Reservoir which subsequently drains into West Cherry Creek (Figure 3).

SOILS NRCS

The National Resource Conservation Service (NRCS) identified two soil types with a northwest trend on the Property.

Type	Description	Percent Coverage
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	22
92	Tomah-Crowfoot Loamy sands 3 to 8 percent	78

Attachment 1 provides a complete description of the soils. All buildable land for vacant lots 1 and 2 is located within the area identified as the Tomah-Crowfoot Loamy Sands. This drainage class is described as well drained and in Hydrologic Soil Group B which is defined as having a moderate infiltration rate and moderately fine to course textures. Runoff potential is medium. Samples discussed low indicate the upper eight feet of soils is comprised of interbedded sandy clay and sandy clay loam.

FIELD INVESTIGATIONS

OTWS and Foundation Design

Field soils investigation at the Project Site occurred on April 29, 2019 and consisted of excavating two profile pits at lots 1 and 2 (4 total) to evaluate suitability for Onsite Wastewater Treatment System (OWTS) (Attachment 1, Parr 2019). Two soil test borings, one on each of Lots 1 and 2, were drilled for foundation design (Attachment 2). The OWTS profile pits were excavated to a maximum depth of 8.5 feet below ground surface. Samples were collected from select intervals and were classified according to the U.S. Department of Agriculture soil classification system. Results at Lot 1 identified a type 4 layer of sandy clay from 1 to 3 feet in one of the 2 test pits (Table 1). A conventional OWTS is feasible at this site by going deeper than this layer. At Lot 2, Type 4 sandy clay and Type 4A, a massive sandy clay, was encountered in one or both test pits at a depth within the treatment zone. An Engineered OWTS is identified by Parr Engineering as being required at this location. Attachment 1 presents the signed Engineering Reports and the details of the test pit results for the evaluation of OWTS suitability.

TABLE 1
Onsite Wastewater Treatment System Soil Pit Results

Lot 1, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
Lot 1	Pit 1	Topsoil						
2		Sandy Clay	Granular	Moderate	No	Type 4 (LTAR = 0.20) Treatment Level 1	<35%	2.5Y 4/4 (Moist)
4		Sandy Loam	Granular	Strong	No	**Type 2 (LTAR = 0.60) Treatment Level 1**	<35%	10YR 5/6 (Moist)
6								
8		**Total Depth= 8'-0"**						
Lot 1	Pit 2	Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 2/2 (Moist)
4								
6								
8		**Total Depth= 8'-0"**						
10								
Evidence of Groundwater:		**Not Reached**						
Depth to Bedrock:		**Not Reached**						

Lot 2, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
Lot 2	Pit 1	Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 5/4 (Moist)
4		Sandy Clay	Granular	Moderate	No	Type 4 (LTAR = 0.20) Treatment Level 1	<35%	2.5Y 6/4 (Moist)
6		Sandy Clay Loam	Granular	Strong	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 6/3 (Moist)
8		**Total Depth= 8'-6"**						
Lot 2	Pit 2	Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35)**	<35%	10YR 5/4 (Moist)
		Sandy Clay	Massive	Structure-less	No	Type 4A (LTAR =	<35%	10YR 4/2 (Moist)
4		Sandy Clay	Granular	Moderate	No	Type 4 (LTAR = 0.20) Treatment Level 1	<35%	2.5Y 6/4 (Moist)
6								
8		**Total Depth= 8'-0"**						
10								
Evidence of Groundwater:		**Not Reached**						
Depth to Bedrock:		**Not Reached**						

REF: Parr Engineering, 2019 Attacment 1

One 4- inch test boring was drilled on each Lot 1 and 2 at depths 12 and 20 feet below grade, respectively. The locations were selected based on the proposed area of construction. Soil samples were collected at intervals and testing included standard property tests, natural water content, Atterberg limits and Expansion Index tests (Attachment 3). Soils encountered in the boring at Lot 1 was clayey sand with low clay content and low plasticity. Lot 2 soils were classified as clayey sand with low to medium clay content and low to medium plasticity.

Based on the soil pit results and natural site constraints including the drainage channel setbacks, two viable onsite wastewater treatment system locations at vacant lots 1 and 2 were identified (PARR 2019). Figure 4 shows the primary OWTS site (location of the test pits) and an alternative location for lots 1 and 2. If one of the alternate locations for the OWTS is selected, additional soils testing will be needed for septic design.

GEOLOGIC HAZARDS

The Project Site was evaluated for geologic hazards that may impact development. Hazards identified in the El Paso County Land Development Code including: Mining, wildfire, polluted water, landfills, fill areas in buildable areas, contamination; airports and major utility facilities, and landslides were not identified on the Project Site. The National Flood Hazard map delineated the Property and surrounding area an "area of Minimal Flood Hazard" (FEMA 2018). The Project Site is not located in a flood plain (Figure 5).

Erosion

The soils at the Project Site are susceptible to erosion. The steepest areas occur on the western portion of the Project Site reflecting historic erosion forming the existing drainage channel. Construction activities will enhance erosion potential. Setbacks from the drainage channel and controlling onsite generated runoff from irrigation of landscaping will be needed to minimize erosion.

Expansive Soils

Based on regional mapping, the Project Site is identified as an area of low swell potential (Hart 1974). Site specific sampling results indicate that within the four, 8- foot profile pits to evaluate suitability for OWTS design, expansive potential of the soils was determined to be low at less than 12 feet at Lot 1. The expansive potential of the soils was determined to be low at less than 10 feet and moderate from 10 to 20 feet below grade at Lot 2. Due to potential variability, soils will need to be re-evaluated upon completion of the foundation excavation and prior to the placement of any framework.

Groundwater and Surface Water

A shallow Dawson aquifer well (200-foot depth) is located just east of the Project Site (Attachment 4). Water level measurements are measured regularly, and data are available from 1972 to 2018. Depth to water ranges from about 74 to 105 feet below ground surface therefor shallow permanent groundwater is not likely.

However, there is a possibility for periodic high moisture conditions and frost heave from shallow perched water and water collected in the drainage area. All the soil samples were moist and areas of seasonal ponded water are evident along the drainage pathway that crosses a central portion of Lot 1, the southwester corner of Lot 2 the western edge of Lot 3. Notably there is a 0.6 acre pond on Lot 2 in line with the drainageway bounded on the north by an earthen berm. Historic aerial photographs indicate this pond is filled seasonally. Water that occurs in the drainage and may result in laterally moist/wet conditions at depth should be accounted for in design and during construction.

MINERAL RESOURCES

The Project Site is not included in the maps of aggregate deposits or known mineral resources. Colorado Geological Mineral Resources Derivative Map indicates a low potential to contain economically viable mineral resources.

CONCLUSION

The Project Site is compatible with the proposed development of single-family residential lots. The primary OWTS for lot 2 (Figure 4) was identified as requiring an engineered individual wastewater treatment system. The primary OTWS location at Lot 1 may be suitable for a conventional system provided trenching is past the low permeability layer at 3 feet bgs. Geologic hazards include erosion potential, possible expansive soils, and high moisture/shallow water from the drainage channel particularly at Lot 1. The identified constraints can be mitigated by standard engineering practices.

REFERENCES AND RESAOURCES

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Federal Emergency Management Agency (FEMA). December 12, 2018. https://www.fema.gov/national-flood-hazard-layer-nfhl; nfhl Viewer.

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National Resource Conservation Service, (NRCS) Jun 20, 2007. Web Soil Survey. United States Department of Agriculture, https://websoilsurvey.nrcs.usda.gov

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Thorson, Jon P., 2003a. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*. Colorado Geological Survey Open -File Report 03-06. Map Scale 1:24,000.

Thorson, Jon P., 2003b and Richard F. Madole, *Geologic Map of the Monument Quadrangle, El Paso County, Colorado*. Colorado Geological Survey Open -File Report 02-4. Map Scale 1:24,000.

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Colorado Active Water Level Network.

CDSS
Colorado's Decision Support Systems

Figure 1 Location Walker Reserve

Legend

- Source Water Route Framewo
- State Border
- Line - Large Scale
  - Line
  - Tunnel

Location

Notes

2,339 0 1,169 2,339 Feet

1: 14,032

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Date Prepared: 6/26/2019 5:36:24 PM

Figure 2 Walker Reserve Proposed Subdivision

Monument and Black Forest Quadrangle (Thorson, 2003)

NE1/4 SW ¼ S11 T11S R66W

ALLUVIAL DEPOSITS

Qa	Channel and flood-plain alluvium (late Holocene)
QTa	Alluvium of Palmer Divide (early? Pleistocene or Pliocene?)

BEDROCK DEPOSITS

$TKda_5$	Facies unit five (early to middle? Eocene)

Figure 3: Geology at Walker Reserve

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-495-0404

OWTS SITE MAP

S1 OF 01

Figure 4
Onsite Wastewater Treatment Locations

National Flood Hazard Layer FIRMette

Figure 5 Walker Reserve Proposed Subdivision

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/25/2019 at 12:47:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 1

SOILS

VICINITY MAP

Soil Map—El Paso County Area, Colorado
(Walker Reserve)

Map Scale: 1:3,090 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	8.6	21.6%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	31.0	78.4%
Totals for Area of Interest		**39.5**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

El Paso County Area, Colorado

40—Kettle gravelly loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 368g
Elevation: 7,000 to 7,700 feet

Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b9

Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand

E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

ATTACHMENT 2

Onsite Wastewater Treatment Locations and

Soil Pit Profiles

OWTS LOCATION PROVIDED BY PARR ENGINEERING & CONSULTING, INC. SITE MAP PROVIDED BY ALESSI AND ASSOCIATES, INC.

1 01 - OWTS Locations
1" = 100'-0"

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

OWTS SITE MAP

S1 OF 01

PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908
Office: 719-494-0404 Cell: 719-659-1313

PROFILE PIT EVALUATION

Date: May 13, 2019 **Job:** JN: 19.141A

Site Location: Lot 1, Walker Reserve, Walker Road, Colorado Springs, CO 80908

COLORADO LICENSED JARED ROBERT DUMKE 54410 PROFESSIONAL ENGINEER 05/13/19

Purpose of Investigation: To determine general subsurface soil conditions at the site location & to formulate design criteria for the proposed On-Site Wastewater Treatment system (OWTS)

Field Procedure: *The materials in the various strata of the soil profile pit were visually classified in accordance with the U.S. Department of Agriculture (USDA) standards.*

Profile Pit	Yes
Perc Test	-

Date: (Profile Eval) April 29, 2019
Excavator Down to Earth
Evaluator R.Jaquet

Depth to Groundwater (permanent or seasonal) Pit #1: Not Reached
Depth to Groundwater (permanent or seasonal) Pit #2: Not Reached

Depth to Bedrock - Pit #1: Not Reached
Depth to Bedrock - Pit #2: Not Reached

Other Terrain Features or Soil Conditions: See Attached Site Map

Endorsement: Jared R. Dumke, P.E.

Profile Pit 1	
Latitude:	**39° 6'14.44"N**
Longitude:	**104°45'6.10"W**
Layer	Soil Type & LTAR
0 - 1'-0"	Topsoil
1'-0" - 3'-0"	Type 4 (LTAR=0.20)
3'-0" - 8'-0"	**Type 2 (LTAR=0.60)**
-	-

Profile Pit 2	
Latitude:	**39° 6'13.76"N**
Longitude:	**104°45'5.32"W**
Layer	Soil Type & LTAR
0 - 1'-6"	Topsoil
1'-6" - 8'-0"	**Type 3 (LTAR=0.35)**
-	-
-	-

			Location	
			Latitude:	**Longitude:**
Perc #1	N/A	Min./In.	-	-
Perc #2	N/A	Min./In.	-	-
Perc #3	N/A	Min./In.	-	-
	Average: N/A	Min./In.		

Recommendations:

PARR ENGINEERING
& CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908
Office: 719-494-0404 Cell: 719-659-1313

Google Site Map

Walker Reserve

Preliminary

The Northeast Quarter of the Southwest Quarter of Section 11,
Township 11 South, Range 66 West of the 6th P.M.
County of El Paso, State of Colorado

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

Profile Pit - Log	
Job Number:	19.141A
Date Evaluated:	04/29/19
Profile Pit#:	Pit #1

Excavator:	Down to Earth	Total Depth:	8'-0"
Logged By:	R.Jaquet	STA Slope & Direction:	N 60° W @ 10%
Method:	Profile Pit	Latitude:	39° 6'14.44"N
Auger & Size:	Mini Excavator	Longitude:	104°45'6.10"W

Lot 1, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay	Granular	Moderate	No	Type 4 (LTAR = 0.20) Treatment Level 1	<35%	2.5Y 4/4 (Moist)
4, 6, 8		Sandy Loam	Granular	Strong	No	**Type 2 (LTAR = 0.60) Treatment Level 1**	<35%	10YR 5/6 (Moist)
10		**Total Depth= 8'-0"**						

Evidence of Groundwater:	**Not Reached**
Depth to Bedrock:	**Not Reached**

Additional Notes:

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

Profile Pit - Log

Job Number:	19.141A
Date Evaluated:	04/29/19
Profile Pit#:	Pit #2

Excavator:	Down to Earth	Total Depth:	8'-0"
Logged By:	R.Jaquet	STA Slope & Direction:	N 60° W @ 10%
Method:	Profile Pit	Latitude:	39° 6'13.76"N
Auger & Size:	Mini Excavator	Longitude:	104°45'5.32"W

Lot 1, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 2/2 (Moist)
4								
6								
8								
		Total Depth= 8'-0"						
10								

Evidence of Groundwater:	**Not Reached**
Depth to Bedrock:	**Not Reached**

Additional Notes:

PARR ENGINEERING
& CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908
Office: 719-494-0404 Cell: 719-659-1313

PROFILE PIT EVALUATION REPORT - General Notes, Regulations & Limitations

General Notes:

This report presents the data obtained pertaining to a Profile Pit Evaluation conducted at the locations indicated on the included Site Map. The purpose of this investigation was to evaluate subsurface soil-profile(s) in the area of the proposed Soil Treatment Area (STA) and to establish design criteria for an On-Site Wastewater Treatment system (OWTS).

Board of Health Regulations & Regulation No. 43 - Engineered Systems:

At proposed soil treatment area locations where any of the following conditions are present, the system shall be designed by a professional engineer and approved by the Health Department:

1. For soil types 3A, 4, 4A, 5, R-0, R-1 and R-2, and Treatment Levels TL2, TL2N, TL3, and TL3N as specified in Tables 10-1 and 10-1A of this regulation;

2.The maximum seasonal ground water surface is less that four feet below the bottom of the proposed absorption system.

3. A restrictive layer exists less that four feet below the bottom of the proposed absorption system

4. The ground slope is in excess of thirty percent

5. Pressure distribution is used.

Limitations:

The data presented in this report is specific to the locations of the Profile Pit locations evaluated. It must be understood and accepted that subsurface conditions can, and often do vary across any given area. These variations may not become evident until the time of system installation. If the subsurface conditions are discovered to vary anywhere across the system footprint, Parr Engineering AND the Design Engineer must be notified immediately for further evaluation. If another individual or party relies on this report, they shall indemnify and hold Parr Engineering & Consulting, Inc. harmless for any damages, losses, or expenses that may incur as a result of its use, except as allowed by law.

PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908
Office: 719-494-0404 Cell: 719-659-1313

PROFILE PIT EVALUATION

Date: May 16, 2019 **Job:** JN: 19.141B

Site Location: Lot 2, Walker Reserve, Walker Road, Colorado Springs, CO 80908

COLORADO LICENSED JARED R. DUMKE 54410 PROFESSIONAL ENGINEER 05/16/19

Purpose of Investigation: To determine general subsurface soil conditions at the site location & to formulate design criteria for the proposed On-Site Wastewater Treatment system (OWTS)

Field Procedure: The materials in the various strata of the soil profile pit were visually classified in accordance with the U.S. Department of Agriculture (USDA) standards.

Profile Pit	Yes
Perc Test	-

Date: (Profile Eval) April 29, 2019
Excavator Down to Earth
Evaluator R.Jaquet

Depth to Groundwater (permanent or seasonal) Pit #1: Not Reached
Depth to Groundwater (permanent or seasonal) Pit #2: Not Reached

Depth to Bedrock - Pit #1: Not Reached
Depth to Bedrock - Pit #2: Not Reached

Other Terrain Features or Soil Conditions: See Attached Site Map

Endorsement: Jared R. Dumke, P.E.

Profile Pit 1	
Latitude:	**39° 6'13.98"N**
Longitude:	**104°44'56.80"W**
Layer	Soil Type & LTAR
0 - 1'-0"	Topsoil
1'-0" - 3'-0"	**Type 3 (LTAR=0.35)**
3'-0" - 5'-0"	Type 4 (LTAR=0.20)
5'-0" - 8'-6"	**Type 3 (LTAR=0.35)**

Profile Pit 2	
Latitude:	**39° 6'14.50"N**
Longitude:	**104°44'56.43"W**
Layer	Soil Type & LTAR
0 - 1'-0"	Topsoil
1'-0" - 2'-6"	**Type 3 (LTAR=0.35)**
2'-6" - 3'-6"	Type 4A (LTAR=0.20)
3'-6" - 8'-0"	Type 4 (LTAR=0.20)

			Location	
			Latitude:	**Longitude:**
Perc #1	N/A	Min./In.	-	-
Perc #2	N/A	Min./In.	-	-
Perc #3	N/A	Min./In.	-	-
	Average: N/A	Min./In.		

Recommendations: (1) An Engineered On-Site Wastewater Treatment system (OWTS) is required for this location due to:
(a) Soil Type 4 & 4A identified in the treatment zone of Profile Pit #1 & Profile Pit #2.

PARR ENGINEERING
& CONSULTING, INC.

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Site Map

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Colorado Springs, Colorado 80908
Phone: 719-494-0404

Profile Pit - Log

Job Number:	19.141B
Date Evaluated:	04/29/19
Profile Pit#:	Pit #1

Excavator:	Down to Earth	Total Depth:	8'-6"
Logged By:	R.Jaquet	STA Slope & Direction:	W @ 5%
Method:	Profile Pit	Latitude:	39° 6'13.98"N
Auger & Size:	Mini Excavator	Longitude:	104°44'56.80"W

Lot 2, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 5/4 (Moist)
4		Sandy Clay	Granular	Moderate	No	**Type 4 (LTAR = 0.20) Treatment Level 1**	<35%	2.5Y 6/4 (Moist)
6		Sandy Clay Loam	Granular	Strong	No	**Type 3 (LTAR = 0.35) Treatment Level 1**	<35%	10YR 6/3 (Moist)
8								
10		**Total Depth= 8'-6"**						

Evidence of Groundwater:	**Not Reached**
Depth to Bedrock:	**Not Reached**

Additional Notes:

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

Profile Pit - Log

Job Number:	19.141B
Date Evaluated:	04/29/19
Profile Pit#:	Pit #2

Excavator:	Down to Earth	Total Depth:	8'-0"
Logged By:	R.Jaquet	STA Slope & Direction:	W @ 5%
Method:	Profile Pit	Latitude:	39° 6'14.50"N
Auger & Size:	Mini Excavator	Longitude:	104°44'56.43"W

Lot 2, Walker Reserve, Walker Road, 80908

Depth (ft.)	Sample Interval	USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay Loam	Granular	Moderate	No	**Type 3 (LTAR = 0.35)**	<35%	10YR 5/4 (Moist)
		Sandy Clay	Massive	Structure-less	No	Type 4A (LTAR = 0.15)	<35%	10YR 4/2 (Moist)
4, 6, 8		Sandy Clay	Granular	Moderate	No	Type 4 (LTAR = 0.20) Treatment Level 1	<35%	2.5Y 6/4 (Moist)
10		**Total Depth= 8'-0"**						

Evidence of Groundwater:	**Not Reached**
Depth to Bedrock:	**Not Reached**

Additional Notes:

PARR ENGINEERING
& CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908
Office: 719-494-0404 Cell: 719-659-1313

PROFILE PIT EVALUATION REPORT - General Notes, Regulations & Limitations

General Notes:

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Limitations:

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ATTACHMENT 3

Subsurface Soil Reports for Foundation Design

PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Office: 719-494-0404

Structural Engineering & Consulting
Geotechnical Engineering
On-Site Wastewater Treatment Design
Inspections & Technical Reports

May 16, 2019

JN 19.141A

Project: **Subsurface Soil Investigation**
Lot 1, Walker Reserve, Walker Road,
Colorado Springs, CO 80908

Attached is a formal soils report for the project referenced above. Included in this report is a review of the soils investigation and analysis for this location. The purpose of our investigation was to evaluate the conditions of the subsurface soil in order to establish design and construction criteria for the proposed structure(s). A discussion of the results of our investigation with construction recommendations is also included. If revisions to the design of the proposed structure take place, it is advised that our firm be contacted immediately to review the changes and to determine if the revised plans are acceptable.

If you have any questions concerning this report, please feel free to contact our office at 719-494-0404.

Sincerely,

Jared R. Dumke, P.E.

COLORADO LICENSED
JARED ROBERT DUMKE
54410
PROFESSIONAL ENGINEER
05/16/19

Table of Contents

Table of Contents 2
Purpose and Scope of Study 3
Proposed Construction 3
Field Investigation 3
Laboratory Investigation 3
Subsurface Conditions 4
Foundation Recommendations 4
Foundation Walls 4
Open Excavation Observation 5
Floor System Recommendations 5
Surface Drainage 5
Subsurface Drainage 6
Limitations 6
Site Map 7
Laboratory Analysis – Sieve Analysis 8
Laboratory Analysis – Atterberg Limits 9
Laboratory Analysis – Liquid Limit Plot 10
Laboratory Analysis – Grain Size Distribution 11
Drill Log – Test Bore #1 12

Purpose and Scope of Study

This report presents the results of a subsurface exploration program to provide foundation recommendations for the proposed structure to be located on the parcel of land referenced above.

The exploration program was conducted in order to obtain information regarding the subsurface conditions. Soil samples were retrieved from a soil boring(s) and analyzed to provide data on the classification and engineering characteristics of the on-site soils. The results of the field and laboratory investigation are presented herein.

This report has been prepared to summarize the data obtained and to present our conclusion and recommendations based on the proposed construction and the subsurface conditions encountered. Design criteria and a discussion of the geotechnical engineering considerations related to the construction of the proposed structure are included.

The information presented in this report is NOT intended to be used as a design. The foundation design requirements and all inspections associated with the foundation design is the responsibility of the Structural Engineer of Record.

Proposed Construction

Based on the information provided, the proposed construction will consist of a wood framed, single family residential structure supported on a reinforced concrete foundation system. We anticipate maximum structural loadings of 3000 pounds per lineal foot for distributive wall loads and 15 kips for concentrated column loads.

If the project features or loadings differ significantly from those above, our firm should be contacted to reevaluate the recommendations contained herein.

Field Investigation

The field investigation for this project was conducted on April 29, 2019.

A 4" diameter exploratory boring was drilled to approximately 12 feet below grade in the area of the proposed construction. The representative samples obtained are saved for subsequent laboratory examination and testing.

Laboratory Investigation

The field samples obtained were analyzed and classified in the laboratory. Laboratory testing included standard property tests, natural water content, Atterberg limits and Expansion Index tests.

The laboratory testing was conducted in general accordance with ASTM specifications.

Subsurface Conditions

The following tables summarize information obtained about the subsurface conditions encountered:

Soil Classification	Sample Depth	Gravel	Sand	Fines	LL[1]	PI[2]	EI[3]	Expansive Potential
Clayey Sand (SC)	10 ft.	0.3%	55.2%	44.4%	25	8	**20**	**Low**

LL – Liquid Limit [1] PI – Plasticity Index [2] EI – Expansion Index [3] NP[4] – Non Plastic

Soil Classification	Sample Depth	SPT N-Value	Relative Density	Moisture Content	Clay Content	Expansive Index	Expansion Potential
Clayey Sand (SC)	5 ft.	N/A	Medium Dense	5.9%	Low	N/A	N/A
Clayey Sand (SC)	10 ft.	N/A	Medium Dense	7.2%	Low	**20**	**Low**

Ground water was not encountered during the time of our investigation. This may be due to lack of moisture received in the area and subsequently may rise due to seasonal changes, degree of irrigation and/or other factors.

Foundation Recommendations

Considering the subsurface conditions encountered on-site and the nature of the proposed construction, we recommend that the proposed structure be founded on a reinforced concrete shallow foundation system with footings placed on native undisturbed soil. **Foundation elements shall be designed for a maximum allowable bearing pressure of 2000 lb/ft^2.**

Existing topsoil, silt or deleterious materials if encountered below the foundation must be removed.

Foundation Walls

Foundation walls which are laterally supported and can be expected to undergo a minimal amount of deflection ("at-rest condition") may be designed for a lateral earth pressure computed on the basis of an **equivalent fluid unit weight of 65 pcf for onsite material**.

All foundation walls should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials and equipment. The pressures recommended above assume a relatively horizontal backfill surface.

The onsite excavated materials may be used as foundation wall backfill. Backfill shall be carefully placed in uniform lifts and properly compacted near optimum moisture content. Care should be taken not to over compact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill will occur even if the material is placed correctly.

Open Excavation Observation

It is assumed that the results in this report are representative of the subsurface conditions throughout the site. However, variations across the site are a possibility and will not become evident until the foundation excavation is complete.

A representative of Parr Engineering & Consulting shall be contacted to inspect the completed foundation excavation prior to the placement of any formwork. Please contact our office a minimum of 24 hours prior to the requested site visit. This report may be rendered null and void if the open excavation observation is not completed.

The Open Excavation Observation Report will be billed additionally at the time services are complete and prior to the release of any documentation (either electronically or hard copy).

Floor System Recommendations

Floor Slabs should be provided with control joints to reduce damage that may occur as a result of shrinkage cracking. We suggest the spacing of the joints to be no more than 15 feet centers. The actual joint spacing should be based on the slab reinforcing design.

Surface Drainage

The following drainage precautions should be observed during the construction and maintained at all times after the residence has been completed.

1) Excessive wetting and drying of the foundation excavations and under slab areas should be avoided during construction.
2) The ground surface surrounding the exterior of the building should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 12 inches in the first 10 feet.
3) Roof downspouts and drains should discharge well beyond the limits of the backfill.
4) Landscaping which requires excessive watering should be located at least 10 feet from the house.
5) Plastic membranes should not be used to cover the ground surface adjacent to the foundation walls.

Subsurface Drainage

A subsurface foundation drain or equivalent protection measure is required around the perimeter of all habitable or storage spaces located below grade (including crawlspace areas).

A subsurface drain is designed to redirect moisture around and away from the foundation system. However, it should be noted that a properly functioning drain does not completely eliminate the potential for foundation movement if exposed to subsurface moisture.

Limitations

This report has been prepared with generally accepted soil and foundation engineering practices in this area for use by the client for design purposes. The conclusions and recommendations presented are based on data obtained from the exploratory boring. The nature and extent of variation from the boring may not become evident until excavation is performed. If during construction, soil, rock and groundwater conditions appear to be different from those described herein, our office should be advised immediately so that reevaluation of the recommendations may be made.

Although all laboratory procedures were performed under optimal conditions, it should be noted that precautions should be taken to accommodate for certain sources of failure such as inconsistencies in the properties/characteristics of the on-site soil, variations in groundwater levels due to seasonal changes, etc.

This report DOES NOT address the potential for geologic hazards or constraints (i.e., slope stability, landslides). It must be emphasized that such hazards and constraints are outside the scope of this investigation and must be investigated independently.

Site Map

Job Number: 19.141A
Lot 1, Walker Reserve, Walker Road, 80908

Laboratory Analysis – Sieve Analysis

SOIL CLASSIFICATION

Location of Site	Lot 1, Walker Reserve, Walker Road, 80908	Tested By:	R.Jaquet
		Date Tested	05/07/19
Legal Description	N/A	Collected By	R.Jaquet
Job Number	19.141A	Date Collected	04/29/19

SITE INVESTIGATION

Test Hole Depth	12'-0"	Groundwater Table	N/A
Surface Layer Thickness	-	Volume of Soil Sample	1/2 cu.ft.
Soil System	Uniform	Visual Moisture Observation	Moist

Layer	Soil Type/Depth
Surface	-
No. 1	SC/0 - 12'-0"
No. 2	-
No. 3	-

Critical Layer	No. 1
Coloration	Tan
Gravel	Trace
Organic Content	Little-None

SIEVE ANALYSIS

Test Bore #:	TB #1
Layer	No. 1
Depth of Sample	10'-0"

Bulk	Wet Weight of Soil (g)	486.0
	Dry Weight of Soil (g)	453.4
	Natural Moisture Content	7.2%

Sieve #	Thickness (mm)	Mass Ret. (g)	% Ret.	%Pass	
4	4.750	1.6	0.3%	99.7%	Gravel
10	2.000	22.9	5.1%	94.6%	Sand
40	0.425	73.7	16.3%	78.3%	
60	0.250	39.4	8.7%	69.6%	
100	0.150	42.3	9.3%	60.3%	
200	0.075	71.9	15.9%	44.4%	
Pan	0.000	201.5	44.4%	0.0%	Fines
Pan	0.000		0.0%	0.0%	Organic

Totals	453.4	100.0%

% Gravel	0.3%	Retained on #200
% Sand	55.2%	
% Fines	44.4%	Passes #200
% Organic	0.0%	
Check	100.0%	

$C_u = D_{60}/D_{10} =$ N/A

$C_c = D_{30}^2/(D_{10})(D_{60}) =$ N/A

Laboratory Analysis – Atterberg Limits

ATTERBERG LIMITS

LIQUID LIMIT - LL

Cup #	Tin Mass(g) Empty	Wet Soil	Dry Soil	# Drops	Water Mass (g)	Solids Mass (g)	Water Content
1	13 7	68 0	56 7	8	11 3	43 0	0 26
2	13 6	61 1	51 8	28	9 3	38 3	0 24
3	13 6	65 1	54 6	15	10 5	41 0	0 26

Liquid Limit (from plot)	0.25

PLASTIC LIMIT - PL

Cup #	Tin Mass(g) Empty	Wet Soil	Dry Soil	Water Mass (g)	Solids Mass (g)	Plastic Limit (PL)
1	13 5	18 1	17 4	0 66	3 85	0 17
2	13 5	19 2	18 4	0 82	4 88	0 17
					Average	0 17

Plastic Limit	0.17

Note: Liquid Limit Plastic Limit and Plasticity Index values have been rounded to nearest whole number when expressing as a percentage

PLASTICITY INDEX - PI

Plasticity Index = Liquid Limit - Plastic Limit

Plasticity Index	0.08

MOISTURE CONTENT

Depth	Tin Mass(g) Empty	Wet Soil	Dry Soil	Water Mass (g)	Solids Mass (g)	Water Content
5'-0"	13 6	82 3	78 5	3 8	64 9	5 9%

CLASSIFICATION

Plasticity	Low Plasticity
Group Symbol	SC
Group Name	Clayey Sand

Laboratory Analysis – Liquid Limit Plot

Laboratory Analysis – Grain Size Distribution

Drill Log – Test Bore #1

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

BORING LOG

Job Number:	19.141A
Date Drilled:	04/29/19
Boring #:	TB #1

Driller:	R.Jaquet	Total Depth:	12'-0"
Logged By:	R.Jaquet	Groundwater Elevation:	N/A
Method:	Boring	Latitude:	39° 6'13.57"N
Auger & Size:	4" Solid Stem	Longitude:	104°45'6.59"W

Depth (ft.)	Sample Interval	SPT Blows/12"	Lot 1, Walker Reserve, Walker Road, 80908	Additional Notes
			Sand, Fine-Grained, Clay, Silt, Trace Gravel, Medium Dense, Brown, Low Plasticity, Moist, (SC)	
5		Grab		
			Sand, Coarse-Grained, Clay, Silt, Trace Gravel, Medium Dense, Tan, Low Plasticity, Moist, (SC)	
10		Grab		
			Total Depth= 12'-0"	
15				
20				
25				

Page 1

PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Office: 719-494-0404

Structural Engineering & Consulting
Geotechnical Engineering
On-Site Wastewater Treatment Design
Inspections & Technical Reports

May 16, 2019

JN 19.141B

Project: **Subsurface Soil Investigation**
Lot 2, Walker Reserve, Walker Road,
Colorado Springs, CO 80908

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Sincerely,

Jared R. Dumke, P.E.

COLORADO LICENSED
JARED ROBERT DUMKE
05/16/19
54410
PROFESSIONAL ENGINEER

Table of Contents

Table of Contents 2
Purpose and Scope of Study 3
Proposed Construction 3
Field Investigation 3
Laboratory Investigation 3
Subsurface Conditions 4
Foundation Recommendations 4
Foundation Walls 5
Open Excavation Observation 5
Floor System Recommendations 5
Surface Drainage 5
Surface Drainage (Cont.) 6
Subsurface Drainage 6
Limitations 6
Site Map 7
Laboratory Analysis – Sieve Analysis 8
Laboratory Analysis – Atterberg Limits 9
Laboratory Analysis – Liquid Limit Plot 10
Laboratory Analysis – Grain Size Distribution 11
Drill Log – Test Bore #1 12

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Field Investigation

The field investigation for this project was conducted on April 29, 2019.

A 4" diameter exploratory boring was drilled to approximately 20 feet below grade in the area of the proposed construction. The representative samples obtained are saved for subsequent laboratory examination and testing.

Laboratory Investigation

The field samples obtained were analyzed and classified in the laboratory. Laboratory testing included standard property tests, natural water content, Atterberg limits and Expansion Index tests.

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Soil Classification	Sample Depth	Gravel	Sand	Fines	LL[1]	PI[2]	EI[3]	Expansive Potential
Clayey Sand (SC)	10 ft.	4.8%	74.8%	20.5%	26	9	2	**Low**

LL – Liquid Limit [1] PI – Plasticity Index [2] EI – Expansion Index [3] NP[4] – Non Plastic

Soil Classification	Sample Depth	SPT N-Value	Relative Density	Moisture Content	Clay Content	Expansive Index	Expansion Potential
Clayey Sand (SC)	5 ft.	N/A	Medium Dense	7.4%	Low	N/A	N/A
Clayey Sand (SC)	10 ft.	N/A	Medium Dense	6.8%	Low	2	**Low**
Clayey Sand (SC)	15 ft.	N/A	Medium Dense	8.0%	Medium	N/A	N/A
Clayey Sand (SC)	20 ft.	N/A	Medium Dense	9.5%	Medium	N/A	N/A

Ground water was not encountered during the time of our investigation. This may be due to lack of moisture received in the area and subsequently may rise due to seasonal changes, degree of irrigation and/or other factors.

Foundation Recommendations

Considering the subsurface conditions encountered on-site and the nature of the proposed construction, we recommend that the proposed structure be founded on a reinforced concrete shallow foundation system with footings placed on native undisturbed soil. **Foundation elements shall be designed for a maximum allowable bearing pressure of 2000 lb/ft^2.**

Existing topsoil, silt or deleterious materials if encountered below the foundation must be removed.

Foundation Walls

Foundation walls which are laterally supported and can be expected to undergo a minimal amount of deflection ("at-rest condition") may be designed for a lateral earth pressure computed on the basis of an **equivalent fluid unit weight of 65 pcf for onsite material.**

All foundation walls should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials and equipment. The pressures recommended above assume a relatively horizontal backfill surface.

The onsite excavated materials may be used as foundation wall backfill. Backfill shall be carefully placed in uniform lifts and properly compacted near optimum moisture content. Care should be taken not to over compact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill will occur even if the material is placed correctly.

Open Excavation Observation

It is assumed that the results in this report are representative of the subsurface conditions throughout the site. However, variations across the site are a possibility and will not become evident until the foundation excavation is complete.

A representative of Parr Engineering & Consulting shall be contacted to inspect the completed foundation excavation prior to the placement of any formwork. Please contact our office a minimum of 24 hours prior to the requested site visit. This report may be rendered null and void if the open excavation observation is not completed.

The Open Excavation Observation Report will be billed additionally at the time services are complete and prior to the release of any documentation (either electronically or hard copy).

Floor System Recommendations

Floor Slabs should be provided with control joints to reduce damage that may occur as a result of shrinkage cracking. We suggest the spacing of the joints to be no more than 15 feet centers. The actual joint spacing should be based on the slab reinforcing design.

Surface Drainage

The following drainage precautions should be observed during the construction and maintained at all times after the residence has been completed.

1) Excessive wetting and drying of the foundation excavations and under slab areas should be avoided during construction.
2) The ground surface surrounding the exterior of the building should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 12 inches in the first 10 feet.
3) Roof downspouts and drains should discharge well beyond the limits of the backfill.
4) Landscaping which requires excessive watering should be located at least 10 feet from the house.

Surface Drainage (Cont.)

5) Plastic membranes should not be used to cover the ground surface adjacent to the foundation walls.

Subsurface Drainage

A subsurface foundation drain or equivalent protection measure is required around the perimeter of all habitable or storage spaces located below grade (including crawlspace areas).

A subsurface drain is designed to redirect moisture around and away from the foundation system. However, it should be noted that a properly functioning drain does not completely eliminate the potential for foundation movement if exposed to subsurface moisture.

Limitations

This report has been prepared with generally accepted soil and foundation engineering practices in this area for use by the client for design purposes. The conclusions and recommendations presented are based on data obtained from the exploratory boring. The nature and extent of variation from the boring may not become evident until excavation is performed. If during construction, soil, rock and groundwater conditions appear to be different from those described herein, our office should be advised immediately so that reevaluation of the recommendations may be made.

Although all laboratory procedures were performed under optimal conditions, it should be noted that precautions should be taken to accommodate for certain sources of failure such as inconsistencies in the properties/characteristics of the on-site soil, variations in groundwater levels due to seasonal changes, etc.

This report DOES NOT address the potential for geologic hazards or constraints (i.e., slope stability, landslides). It must be emphasized that such hazards and constraints are outside the scope of this investigation and must be investigated independently.

Site Map

Walker Reserve

Preliminary

Job Number: 19.141B
Lot 2, Walker Reserve, Walker Road, 80908

Laboratory Analysis – Sieve Analysis

SOIL CLASSIFICATION

Location of Site	Lot 2, Walker Reserve, Walker Road, 80908	Tested By:	R.Jaquet
		Date Tested	05/07/19
Legal Description	N/A	Collected By	R.Jaquet
Job Number	19.141B	Date Collected	04/29/19

SITE INVESTIGATION

Test Hole Depth	20'-0"	Groundwater Table	N/A
Surface Layer Thickness	-	Volume of Soil Sample	1/2 cu.ft.
Soil System	Uniform	Visual Moisture Observation	Moist

Layer	Soil Type/Depth
Surface	-
No. 1	SC/0 - 20'-0"
No. 2	-
No. 3	-

Critical Layer	No. 1
Coloration	Tan
Gravel	Trace
Organic Content	Little-None

SIEVE ANALYSIS

Test Bore #:	TB #1
Layer	No. 1
Depth of Sample	10'-0"

Bulk	Wet Weight of Soil (g)	501.5
	Dry Weight of Soil (g)	469.4
	Natural Moisture Content	6.8%

Sieve #	Thickness (mm)	Mass Ret. (g)	% Ret.	%Pass	
4	4.750	22.3	4.8%	95.2%	Gravel
10	2.000	124.7	26.6%	68.7%	Sand
40	0.425	148.4	31.6%	37.1%	
60	0.250	28.8	6.1%	30.9%	
100	0.150	24.5	5.2%	25.7%	
200	0.075	24.6	5.2%	20.5%	
Pan	0.000	96.2	20.5%	0.0%	Fines
Pan	0.000		0.0%	0.0%	Organic

Totals	469.5	100.0%

% Gravel	4.8%	Retained on #200
% Sand	74.8%	
% Fines	20.5%	Passes #200
% Organic	0.0%	
Check	100.0%	

$C_u = D_{60}/D_{10} =$ N/A

$C_c = D_{30}^2/(D_{10})(D_{60}) =$ N/A

Laboratory Analysis – Atterberg Limits

ATTERBERG LIMITS

LIQUID LIMIT - LL

Cup #	Tin Mass(g) Empty	Wet Soil	Dry Soil	# Drops	Water Mass (g)	Solids Mass (g)	Water Content
1	13 5	59 4	49 7	16	9 8	36 1	0 27
2	13 6	49 9	42 3	20	7 7	28 7	0 27
3	13 7	60 4	50 9	30	9 5	37 3	0 25

Liquid Limit (from plot)	0.26

PLASTIC LIMIT - PL

Cup #	Tin Mass(g) Empty	Wet Soil	Dry Soil	Water Mass (g)	Solids Mass (g)	Plastic Limit (PL)
1	13 6	17 5	16 9	0 59	3 33	0 18
2	13 5	17 0	16 5	0 51	2 98	0 17
					Average	0 17

Plastic Limit	0.17

Note: Liquid Limit Plastic Limit and Plasticity Index values have been rounded to nearest whole number when expressing as a percentage

PLASTICITY INDEX - PI

Plasticity Index = Liquid Limit - Plastic Limit

Plasticity Index	0.09

MOISTURE CONTENT

Depth	Tin Mass(g) Empty	Wet Soil	Dry Soil	Water Mass (g)	Solids Mass (g)	Water Content
5'-0"	13 5	88 5	83 4	5 2	69 9	7 4%
15'-0"	13 4	87 6	82 1	5 5	68 7	8 0%
20'-0"	13 5	85 3	79 0	6 2	65 6	9 5%

CLASSIFICATION

Plasticity	Low Plasticity
Group Symbol	SC
Group Name	Clayey Sand

Laboratory Analysis – Liquid Limit Plot

Laboratory Analysis – Grain Size Distribution

Drill Log – Test Bore #1

Parr Engineering & Consulting, Inc.
11590 Black Forest Road, Suite 10
Colorado Springs, Colorado 80908
Phone: 719-494-0404

BORING LOG	
Job Number:	19.141B
Date Drilled:	04/29/19
Boring #:	TB #1

Driller:	R.Jaquet	Total Depth:	20'-0"
Logged By:	R.Jaquet	Groundwater Elevation:	N/A
Method:	Boring	Latitude:	39° 6'14.81"N
Auger & Size:	4" Solid Stem	Longitude:	104°44'55.27"W

Depth (ft.)	Sample Interval	SPT Blows/12"	Lot 2, Walker Reserve, Walker Road, 80908	Additional Notes
			Sand, Coarse-Grained, Clay, Silt, Trace Gravel, Medium Dense, Brown, Medium Plasticity, Moist, (SC)	
5		Grab		
			Sand, Coarse-Grained, Clay, Silt, Trace Gravel, Medium Dense, Tan, Low Plasticity, Moist, (SC)	
10		Grab		
			Sand, Coarse-Grained, Clay, Silt, Trace Gravel, Medium Dense, Tan, Medium Plasticity, Moist, (SC)	
15		Grab		
20		Grab		
			Total Depth= 20'-0"	
25				

Page 1

ATTACHMENT 4

Groundwater Monitoring

Near Walker Reserve

USGS Home
Contact USGS
Search USGS

Groundwater Watch

Latest News...

The operating system upgrade has been delayed for a day. It is expected to take from 4-6 hours. Service will resume as soon as possible.

In cooperation with...

Lower Fountain Water Quality Management Association

Trinchera Water Conservancy District

Colorado Active Water Level Network

Click site symbol to open information pop-up. Click Station ID in pop-up for county information and site selection.
Map loading slowly? Try a different browser. Web browser performance varies significantly.

Explanation - Percentile classes (symbol color based on most recent measurement)

Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	High	Not Ranked

Wells: Real-Time; Continuous; Periodic Measurements
Springs

Map generated 6/26/2019 11:51:50 AM

Groundwater Watch Help Page | Download Google Earth Version | Download Colorado water-level data NEW

Colorado Counties depicted on the state location map with active wells

Counties	Well Count	Real-Time	Continuous	Periodic
Alamosa County	68	1	-	67
Arapahoe County	6	-	1	5
Bent County	22	-	-	22
Chaffee County	10	-	-	10
Conejos County	24	-	-	24
Costilla County	39	-	-	39

USGS
science for a changing world

The operating system upgrade has been delayed for a day. It is expected to take from 4-6 hours. Service will resume as soon as possible.

DESCRIPTION:

Latitude 39°06'17", Longitude 104°44'41" NAD27
El Paso County, Colorado, Hydrologic Unit 10190003
Well depth: 200 feet
Land surface altitude: 7,460.00feet above NGVD29.
Well completed in "Denver Basin aquifer system" (S300DNVRBS) national aquifer.
Well completed in "Dawson Arkose" (124DWSN) local aquifer

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Field groundwater-level measurements	1972-03-14	2018-08-24	41

OPERATION:

Record for this site is maintained by the USGS Colorado Water Science Center
Email questions about this site to Colorado Water Science Center Water-Data Inquiries

Groundwater Watch Help Page

Most recent data value: 105.21 on 8/24/2018
Period of Record Monthly Statistics for 390617104444101
Depth to water level, feet below land surface
All Approved Continuous & Periodic Data Used In Analysis
Note: Highlighted values in the table indicate closest statistic to the most recent data value.

Month	Lowest Median	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	Highest Median	Number of Years
Mar	103.21	103.15	102.52	100.80	99.55	83.93	73.86	13
Apr	104.24	103.95	103.19	102.35	100.88	100.46	100.00	17

As of 6/21/2019 16:24-2

Statistics Options

View month/year statistics

Summary for Period of Record Periodic Water Levels
Depth to water level, feet below land surface
Approved Periodic Water Level Values

Begin Date	End Date	Number of Values
03/14/72	08/24/18	41

Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL

73.86	03/14/72	105.8	04/29/15

Groundwater Levels Options

USGS View latest data on NWISWeb

Download groundwater levels in text format

*References to non-Department of the Interior (DOI) products do not constitute an endorsement by the DOI.

U.S. Department of the Interior | U.S. Geological Survey
URL: https://groundwaterwatch.usgs.gov/AWLSites.asp
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