Intermountain GeoEnvironmental Services, Inc.
12429 South 300 East, Suite 100, Draper, Utah 84120
Phone (801) 748-4044 ~ F: (801) 748-4045
www.igesinc.com

GEOTECHNICAL AND GEOLOGIC HAZARD INVESTIGATION
The Overlook – Phases II &III
Summit Powder Mountain Resort
Weber County, Utah

IGES Project No. 01628-027

October 23, 2018

Prepared for:

Summit Mountain Holding Group

IGES® Intermountain GeoEnvironmental Services, Inc.
12429 South 300 East, Suite 100, Draper, Utah 84120 ~ T: (801) 748-4044 ~ F: (801) 748-4045

Prepared for:

Summit Mountain Holding Group
3632 North Wolf Creek Drive
Eden, Utah 84310
Attn: Mr. Rick Everson

Geotechnical and Geologic Hazard Investigation
The Overlook – Phases II & III
Summit Powder Mountain Resort
Weber County, Utah

IGES Project No. 01628-027

Prepared by:

David A. Glass, P.E.
Senior Geotechnical Engineer

Peter E. Doumit, P.G., C.P.G.
Senior Geologist

IGES, Inc.
12429 South 300 East, Suite 100
Draper, Utah 84120
(801) 748-4044

October 23, 2018

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF WORK

This report presents the results of a geotechnical and geologic hazards investigation conducted for *The Overlook – Phase II-III* development, part of the currently on-going expansion at the Powder Mountain Ski Resort in Weber County. The purpose of our investigation was to assess the nature and engineering properties of the subsurface soils at the project site and to provide recommendations for the design and construction of foundations, grading, and drainage. In addition, geologic hazards have been assessed for the property. The scope of work completed for this study included literature review, site reconnaissance, subsurface exploration, engineering analyses, and preparation of this report.

Our services were performed in accordance with our proposal to Summit Mountain Holding Group (Client), dated February 7, 2018. The recommendations presented in this report are subject to the limitations presented in the "Limitations" section of this report (Section 6.1).

1.2 PROJECT DESCRIPTION

Our understanding of the project is based primarily on our previous involvement with the Summit Powder Mountain resort project, which included two geotechnical investigations for the greater 200-acre Powder Mountain Resort expansion project (IGES, 2012a and 2012b) and subsequent geotechnical consulting for a number of other aspects of the project.

The Summit Powder Mountain Resort expansion project is located southeast of SR-158 (Powder Mountain Road), north and east of previously developed portions of Powder Mountain Resort, in unincorporated Weber County, Utah. The Summit Powder Mountain project area is accessed by Powder Ridge Road. *The Overlook* development will be located northeast of and adjacent to the Phase 1C area of Summit Powder Mountain (see *Site Vicinity Map,* Figure A-1 in Appendix A).

We understand that *The Overlook* development will include several assorted types of vacation homes, cabins and similar-type residential structures, and associated infrastructure including roadways and utilities over an approximately 25-acre site – a total of 49 residential lots are planned, along with as many as 42 ‘Neighborhood’ cabin units, four garages, and two skier bridges. The site is on a natural ridge, with sloping sides draining to the southeast and northeast at gradients ranging from about 2.5H:1V to 5H:1V. The project will include about 3,200 LF of new paved access road. Construction of the roadway is expected to require several moderate cuts and fills, and possibly the construction of rockeries of modest height. IGES previously completed a geotechnical and geologic hazard investigation for Phase I of *The Overlook* project last year (IGES, 2017); that investigation addressed approximately 2.5 acres of what was then defined as Phase I, which included the western portion of the property. Since that time, the layout of *The Overlook* has been heavily modified, and the Phase I nomenclature no longer applies. Data from the Phase I report (IGES, 2017) has been utilized for the current 25-acre *The Overlook* study. The focus of this geotechnical and geologic hazards study is Phase II and III of *The Overlook* project (see the *Geotechnical and Local Geology Map*, Figure A-2 in Appendix A).

2.0 METHODS OF STUDY

2.1 LITERATURE REVIEW

2.1.1 Geotechnical

The earliest geotechnical report for the area is by AMEC (2001), which was a reconnaissance-level geotechnical and geologic hazard study. IGES later completed a geotechnical investigation for the Powder Mountain Resort expansion in 2012 (2012a, 2012b). Our previous work included twenty-two test pits and one soil boring excavated at various locations across the 200-acre development; as a part of this current study, the logs from relevant nearby test pits and other data from our reports were reviewed. This includes the five test pits excavated at representative locations across *The Overlook Phase I* property (IGES, 2017).

2.1.2 Geological

Several pertinent publications were reviewed as part of this assessment. Sorensen and Crittenden, Jr. (1979) provides 1:24,000 scale geologic mapping of the Huntsville Quadrangle, and Crittenden, Jr. (1972) provides 1:24,000 scale geologic mapping of the Brown's Hole Quadrangle. Coogan and King (2001) provide more recent geologic mapping of the area, but at a 1:100,000 scale. An updated Coogan and King (2016) regional geologic map (1:62,500 scale) provides the most recent published geologic mapping that covers the project area. Western Geologic (2012) conducted a reconnaissance-level geologic hazard study for the greater 200-acre Powder Mountain expansion project, including *The Overlook* area. The Western Geologic (2012) study modified some of the potential landslide hazard boundaries that had previously been mapped at a regional scale (1:100,000) by Coogan and King (2001) and Elliott and Harty (2010). The corresponding United States Geological Survey (USGS) topographic maps for the Huntsville and Brown's Hole Quadrangles (2014) provide physiographic and hydrologic data for the project area. Regional-scale geologic hazard maps pertaining to landslides (Elliott and Harty, 2010; Colton, 1991), faults (Christenson and Shaw, 2008a; USGS and Utah Geological Survey (UGS), 2006), debris-flows (Christenson and Shaw, 2008b), and liquefaction (Christenson and Shaw, 2008c; Anderson et al., 1994) that cover the project area were also reviewed. The Quaternary Fault and Fold Database (USGS and UGS, 2006) was reviewed to identify the location of proximal faults that have had associated Quaternary-aged displacement.

Stereo-paired aerial imagery for the project site and recent and historic Google Earth imagery was also reviewed to assist in the identification of potential adverse geologic conditions. The aerial photographs reviewed are documented in the *References* section of this report.

2.2 FIELD INVESTIGATION

Site reconnaissance and site-specific geologic mapping was performed across the site prior to identifying the test pit locations, such that suspect geologic hazard areas could be appropriately investigated with Subsurface soils were investigated by excavating 23 test pits at representative locations across the site. The approximate location of the test pits are illustrated on the *Geotechnical and Local Geology Map* (Figure A-2 in Appendix A). The soil types were visually logged at the time of our field work in general accordance with the *Unified Soil Classification System* (USCS). Soil classifications and descriptions are included on the test pit logs, Figures A-3 through A-25 in Appendix A. A key to USCS symbols and terminology is included as Figure A-26, and a key to physical rock properties is presented as Figure A-27.

2.3 LABORATORY TESTING

Samples retrieved during the subsurface investigation from this study were transported to the IGES laboratory for evaluation of engineering properties. In addition, previous laboratory results from our 2017 study for Phase I were also incorporated into our database for this project. Specific laboratory tests included:

- Grain-Size Distribution (ASTM D6913)
- Atterberg Limits (ASTM D4318)
- Fines Content (ASTM D1140)
- In situ Moisture Content & Dry Unit Weight (ASTM D7263, D2216)
- Direct Shear (ASTM D3080)
- Ring Shear Test
- Corrosion Suite (soluble sulfate, soluble chlorite, pH, and resistivity).

Results of the laboratory testing are discussed in this report and presented in Appendix B. Some test results, including moisture content and grain size distribution, have been incorporated into the test pit logs (Figures A-3 through A-30).

3.0 GEOLOGIC CONDITIONS

3.1 GENERAL GEOLOGIC SETTING

The Overlook property is situated in the western portion of the northern Wasatch Mountains, approximately 5 miles northeast of Ogden Valley. The Wasatch Mountains contain a broad depositional history of thick Precambrian and Paleozoic sediments that have been subsequently modified by various tectonic episodes that have included thrusting, folding, intrusion, and volcanics, as well as scouring by glacial and fluvial processes (Stokes, 1987). The uplift of the Wasatch Mountains occurred relatively recently during the Late Tertiary Period (Miocene Epoch) between 12 and 17 million years ago (Milligan, 2000). Since uplift, the Wasatch Front has seen substantial modification due to such occurrences as movement along the Wasatch Fault and associated spurs, the development of the numerous canyons that empty into the current Salt Lake Valley and Utah Valley and their associated alluvial fans, erosion and deposition from Lake Bonneville, and localized mass-movement events (Hintze, 1988).

The Wasatch Mountains, as part of the Middle Rocky Mountains Province (Milligan, 2000), were uplifted as a fault block along the Wasatch Fault (Hintze, 1988). Ogden Valley itself is a fault-bounded trough that was occupied by Lake Bonneville (Sorensen and Crittenden, Jr, 1979) before being cut through by the Ogden River and subsequently dammed to form the Pineview Reservoir.

The Wasatch Fault and its associated segments are part of an approximately 230-mile long zone of active normal faulting referred to as the Wasatch Fault Zone (WFZ), which has well-documented evidence of late Pleistocene and Holocene (though not historic) movement (Lund, 1990; Hintze, 1988). The faults associated with the WFZ are all normal faults, exhibiting block movement down to the west of the fault and up to the east. The WFZ is contained within a greater area of active seismic activity known as the Intermountain Seismic Belt (ISB), which runs approximately north-south from northwestern Montana, along the Wasatch Front of Utah, through southern Nevada, and into northern Arizona. In terms of earthquake risk and potential associated damage, the ISB ranks only second in North America to the San Andreas Fault Zone in California (Stokes, 1987).

The WFZ consists of a series of ten segments of the Wasatch Fault that each display different characteristics and past movement, and are believed to have movement independent of one another (UGS, 1996). The subject property is located approximately 10.4 miles to the northeast of the Weber Segment of the Wasatch Fault, which is the closest documented Holocene-aged (active) fault to the property and trends north-south along the Wasatch Front (USGS and UGS, 2006).

3.2 SURFICIAL GEOLOGY

According to Crittenden, Jr. (1972), the property is entirely underlain by the undivided Tertiary/Cretaceous Wasatch and Evanston Formations (TKwe), described as "unconsolidated pale-red to greenish-red pebble, cobble, and boulder conglomerate. Forms boulder-covered slopes but does not crop out anywhere. Clasts are mainly Precambrian quartzite and are tan, gray, or purple; matrix is mainly poorly consolidated sand and silt." A generalized bedding attitude shows this unit striking due north and dipping 10 degrees to the east; this map forms the basemap for the *Regional Geology Map 1* (Figure A-28). Coogan and King (2001) produced a regional-scale geologic map that covered the property; this map shows the property to be entirely underlain by the Wasatch Formation. Western Geologic (2012) identified a number of landslide deposits contained within the Powder Mountain Resort expansion area, though none of these were shown underlying the *The Overlook* area (Figure A-29). A large Pleistocene landslide lobe is mapped approximately 330 feet northeast of the northern margin of the property. Finally, Coogan and King (2016) updated their 2001 map, which shows the property to be situated entirely upon Wasatch Formation bedrock (unit Tw), though the property is within 500 feet of mapped landslide deposits (unit Qms) and undivided mass-movement and glacial deposits (unit Qmg) (Figure A-30). Wasatch Formation bedrock in the area is shown to be striking approximately to the north-northeast, and dipping between 3 and 6 degrees to the east-southeast; additionally, according to this map, the property straddles a north-south trending concealed syncline[1].

3.3 HYDROLOGY

The USGS topographic maps for the Huntsville and Brown's Hole Quadrangles (2017) show that *The Overlook* project area is situated partially on a ridge top and partially on a slope, with the topographic gradient down to the southeast towards Lefty's Canyon (see Figure A-1). An ephemeral stream drainage that was actively flowing was observed in the northernmost portion of the property, and several small, dry gullies were observed on the property during the site reconnaissance. No springs are known to occur on the property, though it is possible that springs may occur on various parts of the property during peak runoff.

Baseline groundwater depths for the subject property are currently unknown, but are anticipated to fluctuate both seasonally and annually. Groundwater was not encountered in the 23 test pits excavated in this investigation, nor in the 5 test pits excavated for Phase I (IGES, 2017).

3.4 GEOLOGIC HAZARDS FROM LITERATURE

Based upon the available geologic literature, regional-scale geologic hazard maps that cover *The Overlook* project area have been produced for landslide, fault, debris-flow, and liquefaction hazards. The following is a summary of the data presented in these regional geologic hazard maps.

---

[1] Syncline: A fold of which the core contains the stratigraphically younger rocks; it is generally concave upward. (AGI, 2005)

3.4.1 Landslides

Two regional-scale landslide hazard maps have been produced that cover the project area. Colton (1991) does not show the property to be underlain by or adjacent to landslide deposits, though landslides are mapped near the northeastern and southern margins of the property. Consistent with Colton (1991), Elliott and Harty (2010) shows deposits mapped as "Landslide and/or landslide undifferentiated from talus, colluvial, rock-fall, glacial, and soil-creep deposits" near the northeastern and southeastern margins of the property. Most recently and more site-specific, Western Geologic (2012) used the Elliott and Harty (2010) map as a base map, which shows Pleistocene landslide deposits northeast of the property, though the landslide deposits shown to the southeast of the property on Elliott and Harty (2010) are not present (see Figure A-29).

3.4.2 Faults

Neither Christenson and Shaw (2008a) nor the Quaternary Fault and Fold Database of the United States (USGS and UGS, 2006) show any Quaternary-aged (~2.6 million years ago to the present) faults to be present on or projecting towards the subject property. The Weber County Natural Hazards Overlay Districts defines an active fault to be "a fault displaying evidence of greater than four inches of displacement along one or more of its traces during Holocene time (about 11,000 years ago to the present)" (Weber County, 2015). The closest active fault to the property is the Weber Segment of the Wasatch Fault Zone, located approximately 10.4 miles southwest of the property (USGS and UGS, 2006).

3.4.3 Debris Flows

Christenson and Shaw (2008b) do not show the project area to be located within a debris-flow hazard special study area, and no alluvial fan deposits are mapped on the property (Coogan and King, 2016).

3.4.4 Liquefaction

Anderson, et al. (1994) and Christenson and Shaw (2008c) both show the project area to be located in an area with very low potential for liquefaction.

3.5 REVIEW OF AERIAL IMAGERY

A series of aerial photographs that cover project area were taken from the UGS Aerial Imagery Collection (UGS, 2018) and analyzed stereoscopically for the presence of adverse geologic conditions across *The Overlook* property. This included a review of photos collected from the years 1946, 1952, and 1963. A table displaying the details of the aerial photographs reviewed can be found in the *References* section at the end of this report.

No geologic lineaments, fault scarps, landslide headscarps, or landslide deposits were observed in the aerial photography on the subject property.

Google Earth imagery of the property from between the years of 1993 and 2017 was also reviewed. The property was observed to contain some surficial gravel, cobbles, and boulders, and a small northeast-trending ephemeral drainage was observed in the northernmost portion of the property. Immediately west of the property is an area where multiple north-south trending gullies and an abundance of surficial gravel, cobbles, and boulders are found. Most of the project area was found to be covered in various forms of vegetation, predominantly low-lying shrubs and bushes; no bedrock exposures were observed on the property. Much of the north-central part of the property is densely covered in aspen and some pine trees, and dense tree patches are also found along the southern margin of the property.

A few suspicious features potentially related to landsliding were observed in the northwest portion of the property and adjacent to the property. A scar in the hillside was observed approximately 250 feet to the northwest of the northwestern corner of the property that appeared to be a small landslide headscarp. Along the northern margin of the property, a distinct break in slope down to the north coincided with bowl-shaped geomorphology, conspicuously less tree vegetation, and possibly hummocky surface topography. Each of these suspicious areas were later assessed first-hand during the site reconnaissance.

At the time of this report, no LiDAR data for the project area was available to be reviewed.

3.6 SEISMICITY

Following the criteria outlined in the 2015 International Building Code (IBC, 2015), spectral response at the site was evaluated for the *Maximum Considered Earthquake* (MCE) which equates to a probabilistic seismic event having a two percent probability of exceedance in 50 years (2PE50). Spectral accelerations were determined based on the location of the site using the *U.S. Seismic "DesignMaps" Web Application* (USGS, 2012/15); this software incorporates seismic hazard maps depicting probabilistic ground motions and spectral response data developed for the United States by the U. S. Geological Survey as part of NEHRP/NSHMP (Frankel et al., 1996). These maps have been incorporated into both *NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures* (FEMA, 1997) and the *International Building Code* (IBC) (International Code Council, 2015).

To account for site effects, site coefficients that vary with the magnitude of spectral acceleration and *Site Class* are used. Site Class is a parameter that accounts for site amplification effects of soft soils and is based on the average shear wave velocity of the upper 100 feet; based on our field exploration and our understanding of the geology in this area, the subject site is appropriately classified as Site Class C (*very dense soil/soft rock*). Based on IBC criteria, the short-period (F_a) coefficient is 1.076 and the long-period (F_v) site coefficient is 1.532. Based on the design spectral response accelerations for a *Building Risk Category* of I, II or III, the site's *Seismic Design Category* is D. The short- and long-period *Design Spectral Response Accelerations* are presented in Table 3.6; a summary of the *Design Maps* analysis is presented in Appendix B. The *peak ground acceleration* (PGA) may be taken as 0.4*S_{MS}.

Table 3.6
Short- and Long-Period Spectral Accelerations for MCE

Parameter	Short Period (0.2 sec)	Long Period (1.0 sec)
MCE Spectral Response Acceleration (g)	$S_S = 0.810$	$S_1 = 0.268$
MCE Spectral Response Acceleration Site Class C (g)	$S_{MS} = S_sF_a = 0.871$	$S_{M1} = S_1F_v = 0.411$
Design Spectral Response Acceleration (g)	$S_{DS} = S_{MS}*{}^2/_3 = 0.581$	$S_{D1} = S_{M1}*{}^2/_3 = 0.274$

3.7 GEOLOGIC HAZARD ASSESSMENT

Geologic hazard assessments are necessary to determine the potential risk associated with particular geologic hazards that are capable of adversely affecting a proposed development area. As such, they are essential in evaluating the suitability of an area for development and provide critical data in both the planning and design stages of a proposed development. The geologic hazard assessment discussion below is based upon a qualitative assessment of the risk associated with a particular geologic hazard, based upon the data reviewed and collected as part of this investigation.

A “low” hazard rating is an indication that the hazard is either absent, is present in such a remote possibility so as to pose limited or little risk or is not anticipated to impact the project in an adverse way. Areas with a low-risk determination for a particular geologic hazard do not require additional site-specific studies or associated mitigation practices with regard to the geologic hazard in question. A “moderate” hazard rating is an indication that the hazard has the capability of adversely affecting the project at least in part, and that the conditions necessary for the geologic hazard are present in a significant, though not abundant, manner. Areas with a moderate-risk determination for a particular geologic hazard may require additional site-specific studies, depending on location and construction specifics, as well as associated mitigation practices in the areas that have been identified as the most prone to susceptibility to the particular geologic hazard. A “high” hazard rating is an indication that the hazard is very capable of or currently does adversely affect the project, that the geologic conditions pertaining to the particular hazard are present in abundance, and/or that there is geologic evidence of the hazard having occurred at the area in the historic or geologic past. Areas with a high-risk determination always require additional site-specific hazard investigations and associated mitigation practices where the location and construction specifics are directly impacted by the hazard. For areas with a high-risk geologic hazard, simple avoidance is often considered.

The following is a summary of the geologic hazards assessment for *The Overlook-Phase II and III* property.

3.7.1 Landslides/Mass-Movement/Slope Stability

The property is situated on Wasatch Formation bedrock, according to the most recent geologic map covering the property (Coogan and King, 2016). The property is near several deposits mapped as landslide or colluvial deposits to the northeast, southwest, and southeast of the property (Western Geologic (2012); Elliott and Harty (2010)). Potential landslide deposits and headscarps were observed in the aerial imagery evaluation in the northernmost portion of the property, and these areas were confirmed to be potential areas of landsliding during the site reconnaissance and subsequent subsurface investigation (see Figure A-2). However, most of the property was found to be underlain by Wasatch Formation bedrock, as shear planes, slickensides, and other evidence indicative or potentially indicative of landsliding was only observed in TP-3, TP-7, and TP-23 of the 23 test pits excavated on the property in this investigation (and none of the five test pits excavated in IGES (2017) for Phase I).

Landslide deposits were found to be associated with highly weathered Calls Fort Shale bedrock, and these were most conspicuous in TP-3, observed to be a highly heterogeneous mixture of sandy fat clay with gravel containing clasts of quartzite, sandstone, and chert. This unit appeared to consist of Wasatch Formation cobbles and sand in a matrix of weathered Calls Fort Shale clay that was commonly slickensided. In general, the landslide deposits were observed to be shallow (less than 8 feet thick) and the product of both translational and rotational failures relating to the highly weathered fat clay derived from the highly weathered Calls Fort Shale. Definitive evidence of landsliding was restricted to the northernmost portion of the property, and is likely only to potentially adversely affect the northwestern lots north of Meridian Avenue (see Figure A-2).

TP-3 and TP-23 were spotted in an area that was observed during the site reconnaissance to have irregular, hummocky topography, though the irregular topography is possibly due to multiple small drainages/gullies passing through the property in this area. Highly weathered Calls Fort Shale was observed at a shallow depth in TP-23, though no definitive slide plane was observed in this test pit and the overlying materials (possible landslide deposits) were limited in thickness (approximately 1.5 feet thick). No surficial evidence of landsliding was observed around TP-7, though subsurface conditions exhibited a highly irregular character with several different contorted units and a chaotic appearance. Slickensides were observed in potential slide plane clay overlying the Wasatch Formation weathered bedrock, which was observed at the bottom of the test pit. The absence of surficial morphology indicative of recent sliding in the TP-7 area, combined with the lack of landslide evidence in the nearest test pits (TP-6, TP-18, and TP-19) indicate that these potential landslide deposits are older (at least Pleistocene-aged) and limited in area.

Given that the majority of the property is underlain by Wasatch Formation bedrock on slopes that average approximately 4:1 H:V (horizontal:vertical), the landslide and slope instability hazard risk is considered to be low for all parts of the property south of the northern part of Meridian Avenue. This is supported by the slope stability analysis, which shows that the slopes which grade downslope to the south, and are outside of mapped landslide areas, are stable (see Section 4.3.1). Landslide hazard risk is considered to be high for the lots in the northwestern portion of the property north of Meridian Avenue within the mapped Qls or Qls? deposits on Figure A-2, moderate for the ski bridge near TP-7, low to moderate for the units north of the landslide deposits near TP-21 and TP-22 and the units 1 through 3 north of the ski bridge, and low for the remaining lots north of Meridian Avenue not located within mapped landslide deposits.

3.7.2 Rockfall

The central part of the property is at the top of the ridge, and though the remaining northern and southern portions of the property are on a slope, no bedrock outcrops are exposed upslope of the property. As such, the rockfall hazard associated with the property is considered to be low.

3.7.3 Surface-Fault Rupture and Earthquake-Related Hazards

No faults are known to be present on or project across the property, and the closest active fault to the property is the Weber Segment of the Wasatch Fault Zone, located approximately 10.4 miles to the southwest of the property (USGS and UGS, 2006). Given this information, the risk associated with surface-fault-rupture on the property is considered low.

The entire property is subject to earthquake-related ground shaking from a large earthquake generated along the active Wasatch Fault. Given the distance from the Wasatch Fault, the hazard associated with ground shaking is considered to be moderate. Proper building design according to appropriate building code and design parameters can assist in mitigating the hazard associated with earthquake ground shaking.

3.7.4 Liquefaction

The site is underlain by Wasatch Formation, a poorly consolidated sedimentary rock unit (conglomerate) and clays of the weathered Calls Fort Shale. Rock units such as these are not considered susceptible to liquefaction; as such, the potential for liquefaction occurring at the site is considered low.

3.7.5 Debris-Flows and Flooding Hazards

The property contains a small ephemeral drainage that trends east to west in the northernmost portion of the property that was observed to have flowing water during site reconnaissance in the spring but was dry during the subsurface investigation in August. This drainage is strictly the product of snowmelt, as snow is known to pile up in this area and remain present for longer into the spring than other areas around Powder Mountain. There are no debris-flow source areas upslope of the property, and the property is on and near the top of a ridge. Given these conditions, the debris-flow and flooding hazard associated with the property is considered to be low.

3.7.6 Shallow Groundwater

Groundwater was not encountered in any of the 23 test pits excavated as part of this investigation, nor in any of the 5 test pits excavated for Phase I (IGES, 2017). The test pits were excavated in mid-August, and the groundwater level was likely to be on its way down towards its seasonal low. No springs were observed on the property, and no plants indicative of shallow groundwater conditions were observed on the property. It should be noted, however, that groundwater seeps are known to emanate from the road cut along Powder Ridge Road during the spring.

Given the existing data, it is expected that groundwater levels will fluctuate both seasonally and annually, and the risk associated with shallow groundwater hazards is considered to be low. Spring thaw and runoff are likely to significantly contribute to elevated groundwater conditions. However, shallow groundwater issues (if encountered) can be mitigated through appropriate grading measures and/or the avoidance of the construction of basement levels or constructing basements with foundation drains.

4.0 GENERALIZED SITE CONDITIONS

4.1 SITE RECONNAISSANCE

Mr. Bill Bragdon, P.G., of IGES conducted reconnaissance of the entire *The Overlook* site and the immediate adjacent properties on May 22, 2018. The site reconnaissance was conducted with the intent to assess the general geologic conditions present across the property, with specific interest in those areas identified in the geologic literature and aerial imagery reviews as potential geologic hazard areas. Additionally, the site reconnaissance provided the opportunity to geologically map the surficial geology of the area. Figure A-2 is a site-specific geologic map of *The Overlook* property and adjacent areas.

At the time of the site reconnaissance, *The Overlook* property was observed to be located on a topographic high with consistent slopes downhill to the north-northeast and south-southwest, with little irregular topography. Patchy low-lying vegetation, including shrubs and bushes and some grasses, were most common across the property, though a highly dense patch of aspen trees was present in the north-central part of the property. The aspens displayed evidence of low to moderate shallow soil creep to the northeast. Along the southeastern margin of the property, additional dense patches of aspens and pine trees were observed to exhibit moderate to strong shallow soil creep to the south.

Variously-sized boulders and cobbles were found scattered across the property, as part of a surficial geologic unit considered to be either weathered Wasatch Formation or colluvial deposits derived from weathered Wasatch Formation. These were typically subrounded and were found to be as large as 7 feet in diameter. The rock clasts[2] were found to be comprised of quartzite and conglomerate.

An ephemeral drainage containing actively flowing water and standing ponded water was observed in the northwesternmost portion of property at the time of the site visit. This drainage flows to the east before heading downslope to the northeast (see Figure A-2). In this same vicinity, hummocky topography was observed, which may correspond to shallow landslide deposits derived from a small landslide headscarp observed northwest of the property (Figure A-2). The larger possible landslide deposit mapped to the northeast of the property was observed to be less apparent as a landslide. The slope was found to be steep, but largely consistent, and most of the slope did not exhibit irregular topography. Some hummocky topography was observed approximately 1/3 of the way downslope into the adjacent drainage, but this was not common.

---

[2] Clast: An individual constituent, grain, or fragment of a sediment or rock, produced by the mechanical or chemical disintegration or a larger rock mass. (AGI, 2005)

Aside from shallow soil creep and hummocky topography caused by possible landsliding on the northern portion of the property, no evidence of other geologic hazards was observed on the property.

Immediately west of the property, a series of small gullies as much as 2 feet deep and 2 feet wide were observed to have carved through the underlying Wasatch Formation bedrock, causing a mix of alluvial and colluvial deposits to be exposed at the surface and much sparser vegetation than seen on the property (see Figure A-2).

4.2 SUBSURFACE CONDITIONS

Between August 8 and 13, 2018, 23 exploration test pits were excavated at representative locations across *The Overlook-Phase II and III* property (Figure A-2). The test pits were excavated to depths ranging between 7 and 12½ feet below existing grade with the aid of a Caterpillar 320 tracked excavator. Detailed logs for the test pits are displayed in Figures A-3 through A-25. In addition, five test pits were excavated within the project site in 2017 as a part of an earlier study; detailed logs are presented as Figures A-26 through A-30. Five distinct geologic units were encountered in the subsurface. The soil and moisture conditions encountered during our investigation are discussed in the following paragraphs.

4.2.1 Earth Materials

A/B Soil Horizon: This topsoil unit was found in all 28 test pits, being between approximately 6 inches and 3½ feet thick. In general, the unit was a light brown to pale yellowish brown, loose to medium stiff, dry to slightly moist, sandy lean CLAY with gravel (CL), with gravel and larger-sized quartzite clasts comprising between approximately 10 and 25% of the unit. The topsoil was largely found to be forming upon the underlying colluvial or weathered Wasatch Formation unit.

Colluvium: This unit was encountered in 19 of the test pits, found to be between approximately 6 inches and 2½ feet thick. In general, the unit consisted of a pale yellowish brown to light brown, loose to medium stiff, dry to slightly moist, sandy fat CLAY with gravel (CH) with a topsoil matrix. Gravel and larger-sized subrounded to subangular quartzite clasts comprised approximately 20-40% of the unit, with individual clasts up to 4 feet in diameter, though the mode clast size was approximately 2 to 5 inches in diameter.

Wasatch Formation: This unit was observed in all but TP-3 and TP-23 and was found to be more than 10½ feet thick. The unit consisted of moderate reddish brown to moderate reddish orange, medium dense to dense, slightly moist to moist, clayey SAND with gravel (SC) and sandy lean CLAY with gravel (CL). Gravel and larger-sized subrounded to subangular quartzite and sandstone clasts comprised between approximately 20% and 40% of the unit, with individual clasts up to 4 feet in diameter though most commonly between 2 and 3 inches in diameter. The sand component was commonly fine- to medium-grained, and the unit exhibited pinhole voids in places.

<u>Shallow Landslide</u>: This unit was found in TP-3, TP-7, and TP-23, being as much as 8 feet thick. The unit consisted of mottled moderate reddish brown to light gray, medium stiff to stiff, moist, sandy fat CLAY with gravel (CH). Gravel and larger-sized subrounded to subangular quartzite, sandstone and chert comprised approximately 5-10% of the unit, with individual clasts up to 8 inches in diameter. Slickensides observed within this unit could be as much as 18 inches long. The unit appeared to consist of Wasatch Formation sand and cobbles in a Calls Fort Shale clay matrix. Irregular sandy fat clay seams and sand pockets were also found in association with this unit.

<u>Weathered Calls Fort Shale?</u>: This unit was encountered in TP-3, TP-5, and TP-23, being greater than 10½ feet thick. In general, the unit consisted of mottled moderate reddish orange to light gray, medium stiff to stiff, moist, gravelly lean CLAY (CL) grading to fat CLAY (CH). Gravel and larger-sized subangular to angular highly weathered shale comprised approximately 5-40% of the unit, with individual clasts up to 2 inches in diameter. The shale clasts were typically soft and easily disintegrated. Mechanically-induced slickensides were commonly observed, and the clay commonly cracked and exhibited a blocky appearance when dried out.

4.2.2 Groundwater

Groundwater was not encountered in any of the 23 test pits excavated for this project, nor was groundwater encountered in any of the previous 5 test pits excavated in 2017.

4.2.3 Strength of Earth Materials

As a part of our initial geotechnical investigation, a direct shear test was completed under consolidated drained conditions on a remolded sample obtained from the Wasatch Formation deposits observed in TP-2-17 obtained from a depth of approximately 3½ feet. The test results indicate a friction angle of 29 degrees and cohesion of 180 psf (ultimate values).

For our current study, a second direct shear test was completed under consolidated drained conditions on an undisturbed tube sample obtained from the Calls Fort Shale deposits observed in TP-3 obtained from a depth of approximately 12 feet. The test results indicate a friction angle of 28 degrees and cohesion of 335 psf (ultimate values).

To assess the residual strength of clay soils observed within the shear zone of the landslides, two torsional ring shear tests were performed on samples of fat clay obtained from the shear zone of the basal shear of the landslides (TP-23 at a depth of 10 feet and TP-3 at a depth of 8 feet). The test results indicated a residual shear strength equivalent to secant friction angle of10.2 degrees and 6.0 degrees, respectively. The test results indicate a relatively low strength along existing landslide basal shear zones.

Detailed test results are presented in Appendix B.

4.3 SLOPE STABILITY

4.3.1 Gross Stability of Natural & Engineered Slopes

The stability of the proposed and existing natural slope have been assessed in accordance with methodologies set forth in Blake et al. 2002 and AASHTO LRFD for Bridge Design Specifications with respect to three representative cross-sections, illustrated on Figure D-1 in Appendix D (the sections are identified in plan-view on Figure A-2). The sections analyzed represent the following conditions:

Section A-A' – possible landslide deposits downslope of Lot 21
Section B-B' – cut slope below Units 9 and 5
Section C-C' – cut slope below Lot 36
It should be noted that geologic cross section D-D' did not identify any critical slopes or conditions that required slope stability analysis; the section does identify, however, an apparent retaining wall or rockery below Lot 10. The rockery or retaining wall appears to be on the order of 15 feet tall. IGES presumes that this wall will either be designed, with the design to be presented in a separate submittal, or the standard rockery construction guidelines previously prepared by IGES will be followed provided the rockery does not exceed the maximum heights allowed in that document.

The stability of the slopes was modeled using SLIDE, a computer application incorporating (among others) Spencer's Method of analysis. Calculations for stability were developed by searching for the minimum factor of safety for a circular-type failure, or a translational-type failure, as appropriate, occurring through surficial soils (alluvium, colluvium, landslide deposits) and the underlying conglomerate bedrock. Homogeneous earth materials and arcuate failure surfaces were assumed. Analysis was performed for both static and seismic (pseudo-static) cases.

Groundwater, e.g. a piezometric groundwater surface, was not encountered during our subsurface investigation. Accordingly, groundwater was not modeled in our limit-equilibrium analysis. Saturated parallel seepage, which could occur during spring run-off, has been modeled in a separate analysis (see Section 4.3.2).

Soil strength parameters were selected based on soil types observed, local experience, correlation with index properties (Atterberg Limits, clay content), strength testing for this project, and comparisons with soil strength laboratory data from a nearby site (IGES, 2018). Based on this assessment, the following soil strength parameters were selected for this analysis:

Table 4.3.1a
Soil Strength Parameters

Earth Materials	Friction angle (degrees)	Cohesion (psf)	Unit Weight (pcf)
Colluvium (Qac)	32	150	125
Bedrock (Tw)	40	100	135
Bedrock (Cbe)	22	3,000	145
Engineered Fill (Afc)	29	180	125
Landslide (Qls) mass	28	300	120
Landslide (Qls) *residual*	$\Phi r=6°$		120

Pseudo-static (seismic screening) analysis of the proposed slope was performed in general conformance with Blake et al. 2002, ASCE 7-10 and AASHTO LRFD for Bridge Design Specifications. The design seismic event was taken as the ground motion with a 2 percent probability of exceedance in 50 years (2PE50). Based on information provided on the USGS website ground motion calculator, the Peak Ground Acceleration (PGA) associated with a 2PE50 event is estimated to be 0.35g. Half of the PGA, (~0.17g), was taken as the horizontal seismic coefficient (k_h) (Hynes and Franklin, 1984), and used in the pseudo-static seismic screen analysis. The results of the analyses have been summarized in Table 4.3.1b.

Table 4.3.1b
Results of Slope Stability Analyses

Section	Static Factor of Safety	Pseudo-Static Factor of Safety
A-A’	n/a	n/a
B-B’ (cut slope)	2.41	1.61
B-B’ (landslide)	1.12	0.71
C-C’	2.23	1.53

The results of the analysis indicated the proposed cut critical cut slopes for Sections B-B’ and C-C’ meet the minimum required factors-of-safety of 1.5 and 1.0 for both the static and seismic (pseudo-static) case, respectively. For Section B-B’, the landslide deposits are shown to be marginally stable under static conditions and unstable under seismic conditions. For Section A-A’, the residual shear strength of the landslide deposits was so low as to provide an irrational answer using our slope stability software; however, considering the relatively low residual shear strength obtained by laboratory testing, any landslide deposits should be considered marginally stable. Therefore, within the landslide areas, remedial grading to remove the basal shear of the landslide is anticipated in order to maintain suitable safety factors for residential development. A summary of the slope stability analysis is presented in Appendix D.

4.3.2 Surficial Stability

Our subsurface investigation indicates that the near-surface soils generally consist of sandy clay with gravel (CL). Material identified as 'topsoil' (A/B Horizon) generally ranges in thickness from 1.5 to 2 feet; the topsoil has developed on the prevailing colluvial cover, and therefore consists largely of gravelly clay, but with a higher organic component (abundant roots).

IGES assessed the potential for the upper three feet to become mobilized under saturated parallel seepage conditions. Our assessment assumes three feet of clayey colluvium or topsoil, fully saturated, and a 3H:1V slope (this would be a transient condition that could occur during primary spring run-off and snowmelt). Our model assumes an estimated effective friction angle of 29 degrees and a cohesion of 150 psf, and a saturated unit weight of 135 pcf. Based on this model, a factor-of-safety of 1.82 results. Sample calculations are presented in Appendix D.

Our calculations do not take into account the beneficial effects of plant roots, which were commonly observed throughout the topsoil units. Many of the existing natural slopes are thickly vegetated, which is expected to reduce the likelihood of shallow surficial slope instability. This will not, however, be applicable to engineered cut slopes, at least until natural vegetation can be established.

Based on our infinite slope model, and the foregoing discussion, IGES considers the potential for surficial slope instability on this site to be low.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL CONCLUSIONS

Based on the results of the field observations, literature review, and previously completed geotechnical investigation (IGES, 2017), **the subsurface conditions are considered suitable for the proposed development, provided that the recommendations presented in this report are incorporated into the design and construction of the project.**

Supporting data upon which the following conclusions and recommendations are based have been presented in the previous sections of this report. The recommendations presented herein are governed by the physical properties of the earth materials encountered in the subsurface explorations. If subsurface conditions other than those described herein are encountered in conjunction with construction, and/or if design and layout changes are initiated, IGES must be informed so that our recommendations can be reviewed and revised as deemed necessary.

5.2 GEOLOGIC CONCLUSIONS AND RECOMMENDATIONS

Based upon the data collected and reviewed as part of the geologic hazard assessment, IGES makes the following conclusions regarding the geological hazards present at *The Overlook-Phase II and III* project area:

- ***The Overlook-Phase II and III* project area does not appear to have geological hazards that would adversely affect significant parts of the development as currently proposed.** However, landslide hazards are present for the northwestern lots north of Meridian Avenue that are anticipated to require remedial grading in order to reduce the landslide hazard risk to an acceptable level.

- Landslide hazard risk is considered to be high for all structures within the mapped landslide deposits in the northwestern part of the property (unit Qls or Qls? in Figure A-2). This includes Residential Lots 21 through 25, and the parking garage in the northwestern portion of the property. Landslide hazard risk is considered to be moderate for the ski bridge near TP-7, and low to moderate for the units north of the mapped landslide deposits near TP-21 and TP-22 due to proximity to the landslide deposits and the steep grade in this area, as well as for units 1 through 3 immediately north of the ski bridge. Landslide hazard risk is considered to be low for all other lots or proposed structures on the property.

- Earthquake ground shaking is the only other identified hazard that may potentially affect all parts of the project area and is considered to pose a moderate risk.

- Shallow groundwater conditions were not observed in any of the 28 test pits, though some ponded water was observed adjacent to the ephemeral stream drainage in the northwesternmost portion of the property. As such, shallow groundwater hazards are considered to be low to moderate for this part of the property, and low for all other parts of the property.

- Rockfall, surface-fault-rupture, liquefaction, debris-flow, and flooding hazards are considered to be low for the property.

Given the conclusions listed above, IGES makes the following recommendations:

- Foundations and roadways should be placed on competent bedrock (Wasatch Formation or Calls Fort Shale), or structural fill extending to competent bedrock. This will require over-excavating within the building envelope or roadway to below the base of the shallow landslide deposits and shear plane (where present). This applies to residential lots 21 through 25 and the ski bridge, and may apply to units 1 through 3 immediately north of the ski bridge. However, considering the anticipated depth of the skier bridge foundations (approximately 21 feet below existing grade), we anticipate the skier bridge foundations will extend well below any landslide deposits.

- An IGES geologist or geotechnical engineer should observe the foundation excavations to assess that the excavations have been taken to an appropriate depth, to further evaluate for adverse geologic conditions, and to assess whether the foundation subgrade has been prepared in accordance with our recommendations.

5.3 EARTHWORK

5.3.1 General Site Preparation and Grading

Below proposed structures, fills, and man-made improvements, all vegetation, topsoil, debris and undocumented fill (if any) should be removed. Any existing utilities should be re-routed or protected in place. The exposed native soils should then be proof-rolled with heavy rubber-tired equipment such as a scraper or loader*. Any soft/loose areas identified during proof-rolling should be removed and replaced with structural fill. All excavation bottoms should be observed by an IGES representative during proof-rolling or otherwise prior to placement of engineered fill to evaluate whether soft, loose, or otherwise deleterious earth materials have been removed, and to assess compliance with the recommendations presented in this report.

*not required where bedrock is exposed in the foundation subgrade

5.3.2 Excavations

Soft, loose, or otherwise unsuitable soils beneath structural elements, hardscape or pavements may need to be over-excavated and replaced with structural fill. If over-excavation is required, the excavations should extend ½ foot laterally for every foot of depth of over-excavation. Excavations should extend laterally at least two feet beyond flatwork, pavements, and slabs-on-grade. Structural fill should consist of granular materials and should be placed and compacted in accordance with the recommendations presented in this report.

Prior to placing structural fill, all excavation bottoms should be scarified to at least 6 inches, moisture conditioned as necessary at or slightly above optimum moisture content (OMC), and compacted to at least 90 percent of the maximum dry density (MDD) as determined by ASTM D-1557 (Modified Proctor). Scarification is not required where hard bedrock is exposed.

5.3.3 Excavation Stability

The contractor is responsible for site safety, including all temporary trenches excavated at the site and the design of any required temporary shoring. The contractor is responsible for providing the "competent person" required by Occupational Safety and Health (OSHA) standards to evaluate soil conditions. For planning purposes, Soil Type C is expected to predominate at the site (sands and gravels). Close coordination between the competent person and IGES should be maintained to facilitate construction while providing safe excavations.

Based on OSHA guidelines for excavation safety, trenches with vertical walls up to 5 feet in depth may be occupied. Where very moist soil conditions or groundwater is encountered, or when the trench is deeper than 5 feet, we recommend a trench-shield or shoring be used as a protective system to workers in the trench. As an alternative to shoring or shielding, trench walls may be laid back at one and one half horizontal to one vertical (1½H:1V) (34 degrees) in accordance with OSHA Type C soils. Trench walls may need to be laid back at a steeper grade pending evaluation of soil conditions by the geotechnical engineer; steeper excavations may be particularly feasible where hard, cemented Wasatch Formation (conglomerate bedrock) is exposed. Soil conditions should be evaluated in the field on a case-by-case basis. Large rocks exposed on excavation walls should be removed (scaled) to minimize rock fall hazards.

5.3.4 Structural Fill and Compaction

All fill placed for the support of structures, flatwork or pavements should consist of structural fill. Structural fill should consist of granular native soils, which may be defined as soils with less than 25% fines, 10-60% sand, and contain no rock larger than 4 inches in nominal size (6 inches in greatest dimension). Structural fill should also be free of vegetation and debris. All structural fill should be 1 inch minus material when within 1 foot of any base coarse material. Soils not meeting these criteria may be suitable for use as structural fill; however, such soils should be evaluated on a case by case basis and should be approved by IGES prior to use.

All structural fill should be placed in maximum 4-inch loose lifts if compacted by small hand-operated compaction equipment, maximum 6-inch loose lifts if compacted by light-duty rollers, and maximum 8-inch loose lifts if compacted by heavy duty compaction equipment that is capable of efficiently compacting the entire thickness of the lift. Additional lift thickness may be allowed by IGES provided the Contractor can demonstrate sufficient compaction can be achieved with a given lift thickness with the equipment in use. We recommend that all structural fill be compacted on a horizontal plane, unless otherwise approved by IGES. Structural fill underlying all shallow footings and pavements should be compacted to at least 95 percent of the MDD as determined by ASTM D-1557. **The moisture content should be at, or slightly above, the OMC for all structural fill**. Any imported fill materials should be approved prior to importing. Also, prior to placing any fill, the excavations should be observed by IGES to confirm that unsuitable materials have been removed. In addition, proper grading should precede placement of fill, as described in the General Site Preparation and Grading subsection of this report.

Specifications from governing authorities such as Weber County and/or special service districts having their own precedence for backfill and compaction should be followed where more stringent.

5.3.5 Oversize Material

Based on our observations, there is a significant potential for the presence of oversize materials (larger than 6 inches in greatest dimension). Large rocks, particularly boulders (up to 2 feet), may require special handling, such as segregation from structural fill, and disposal.

5.3.6 Utility Trench Backfill

Utility trenches should be backfilled with structural fill in accordance with Section 5.3.4 of this report. Utility trenches can be backfilled with the onsite soils free of debris, organic and oversized material. Prior to backfilling the trench, pipes should be bedded in and shaded with a uniform granular material that has a Sand Equivalent (SE) of 30 or greater. Pipe bedding may be water-densified in-place (jetting). Alternatively, pipe bedding and shading may consist of clean ¾-inch gravel, which generally does not require densification. Native earth materials can be used as backfill over the pipe bedding zone. All utility trenches backfilled below pavement sections, curb and gutter, and hardscape, should be backfilled with structural fill compacted to at least 95 percent of the MDD as determined by ASTM D-1557. All other trenches should be backfilled and compacted to approximately 90 percent of the MDD (ASTM D-1557). However, in all cases the pipe bedding and shading should meet the design criteria of the pipe manufacturer. Specifications from governing authorities having their own precedence for backfill and compaction should be followed where they are more stringent.

5.4 FOUNDATION RECOMMENDATIONS

Based on our field observations and considering the presence of relatively competent native earth materials, we recommend that the footings for proposed single-family homes and smaller cabin-type structures be founded either *entirely* on competent Wasatch Formation <u>or</u> *entirely* on a minimum of 2 feet of structural fill extending to competent Wasatch Formation. Native/fill transition zones are not allowed. The foundation subgrade should be prepared in accordance with the recommendations presented in Section 5.3.2.

Where landslide deposits are encountered, the entire building envelope (not just the footings) must be over-excavated to below the landslide shear plane and into competent bedrock (Wasatch Formation or Calls Fort Shale). This applies to residential lots 21 through 25 and the ski bridge, and may apply to units 1 through 3 immediately north of the ski bridge. A geologist or geotechnical engineer from IGES should observe the over-excavation to assess compliance with this recommendation. Once a sufficient over-excavation has been completed, the excavation may be brought back up to foundation subgrade elevation with structural fill as defined in Section 5.3.4 of this report.

Shallow spread or continuous wall footings constructed entirely on structural fill, or entirely on competent, uniform native earth materials (Wasatch Formation conglomerate) may be proportioned utilizing a maximum net allowable bearing pressure of **2,800 pounds per square foot (psf)** for dead load plus live load conditions. The net allowable bearing values presented above are for dead load plus live load conditions. The allowable bearing capacity may be increased by one-third for short-term loading (wind and seismic). The minimum recommended footing width is 20 inches for continuous wall footings and 30 inches for isolated spread footings.

All conventional foundations exposed to the full effects of frost should be established at a minimum depth of 42 inches below the lowest adjacent final grade. Interior footings, not subjected to the full effects of frost (i.e., *a continuously heated structure*), may be established at higher elevations, however, a minimum depth of embedment of 12 inches is recommended for confinement purposes.

Foundation drains should be installed around below-ground foundations (e.g., basement walls) to minimize the potential for flooding from shallow groundwater or seepage, which may be present at various times during the year, particularly spring run-off.

5.5 SETTLEMENT

5.5.1 Static Settlement

Static settlements of properly designed and constructed conventional foundations, founded as described in Section 5.4, are anticipated to be on the order of 1 inch or less. Differential settlement is expected to be half of total settlement over a distance of 30 feet.

5.5.2 Dynamic Settlement

Dynamic settlement (or seismically-induced settlement) consists of dry dynamic settlement of unsaturated soils (above groundwater) and liquefaction-induced settlement (below groundwater). During a strong seismic event, seismically-induced settlement can occur within loose to moderately dense sandy soil due to reduction in volume during, and shortly after, an earthquake event. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

Based on the subsurface conditions encountered, dynamic settlement arising from a MCE seismic event is expected to be low; for design purposes, settlement on the order of ½ inch over 40 feet may be assumed.

5.6 EARTH PRESSURES AND LATERAL RESISTANCE

Lateral forces imposed upon conventional foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footing and the supporting soils. In determining the frictional resistance against concrete, a coefficient of friction of 0.50 for sandy/gravelly native soils or structural fill should be used.

Ultimate lateral earth pressures from *granular* backfill acting against retaining walls, temporary shoring, or buried structures may be computed from the lateral pressure coefficients or equivalent fluid densities presented in Table 5.6. These lateral pressures should be assumed even if the backfill is placed in a relatively narrow gap between a vertical bedrock cut and the foundation wall. These coefficients and densities assume no buildup of hydrostatic pressures. The force of water should be added to the presented values if hydrostatic pressures are anticipated.

Table 5.6
Lateral Earth Pressure Coefficients

Condition	**Level Backfill**		**2H:1V Backfill**	
	Lateral Pressure Coefficient	**Equivalent Fluid Density (pcf)**	**Lateral Pressure Coefficient**	**Equivalent Fluid Density (pcf)**
Active (Ka)	0.33	35	0.53	56
At-rest (Ko)	0.50	55	0.80	85
Passive (Kp)	3.0	320	—	—

Clayey soils drain poorly and may swell upon wetting, thereby greatly increasing lateral pressures acting on earth retaining structures; therefore, clayey soils should not be used as retaining wall backfill. Backfill should consist of native granular soil with an Expansion Index (EI) less than 20.

Walls and structures allowed to rotate slightly should use the active condition. If the element is to be constrained against rotation (i.e., a basement wall), the at-rest condition should be used. These values should be used with an appropriate factor of safety against overturning and sliding. A value of 1.5 is typically used. Additionally, if passive resistance is calculated in conjunction with frictional resistance, the passive resistance should be reduced by ½.

5.7 SLOPE GRADING RECOMMENDATIONS

5.7.1 General Specifications

The following generalized recommendations are for engineered slopes (cut slopes and fill slopes). Recommendations for grading of engineered slopes are intended to minimize the potential for future surficial failures. For purposes of this report, surficial failure includes excessive erosion, sloughing, slumping, mass wasting, rockfall, and similar relatively shallow failures.

Engineered slopes should be no steeper than 2H:1V; steeper slopes (as steep as 1.5H:1V) may be allowed provided a reinforcement system that incorporates a HPTRM is utilized. Any slope reinforcement system should be designed by a qualified civil engineer (e.g. Western Excelsior *Extreme Armoring System*).

All fill slopes taller than about 10 feet should incorporate a *keyway* into the design, with a minimum depth of 2 feet and a minimum width of 8 feet.

5.7.2 Benching

Where fills are to be placed on ground with slopes steeper than 5H:1V, the ground should be stepped or benched. At a minimum, benches should be constructed every four (4) vertical feet. Benches shall be excavated a minimum lateral depth of four (4) feet into competent material or as otherwise recommended by IGES. However, the *lowest* bench should be excavated a minimum lateral depth of 8 feet into competent material (this measurement may include the keyway width for a fill slope).

5.7.3 Slope Protection

Slope planting and other measures should be provided immediately following construction. Slope protection polymers, straw waddles, and/or jute mesh should also be considered to limit the amount of erosion on slopes subject to erosion until landscaping and other permanent erosion protection measures are fully in place.

5.7.4 Earthwork Recommendations

In addition to the normal compaction procedures for structural fill specified in Section 5.3.4, compaction of fill slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to IGES. As an alternative to slope compaction, slopes may be constructed 2 to 3 feet ‘fat’ and trimmed back using a bulldozer with a slope board or similar equipment. Upon completion of grading, relative compaction of the fill out to the slope face shall be at least 90 percent of the maximum dry density per ASTM D 1557 (modified Proctor).

5.8 CONCRETE SLAB-ON-GRADE CONSTRUCTION

To minimize settlement and cracking of slabs, and to aid in drainage beneath the concrete floor slabs, all concrete slabs should be founded on a minimum 4-inch layer of compacted gravel overlying properly prepared subgrade. The gravel should consist of free-draining gravel or road base with a 3/4-inch maximum particle size and no more than 5 percent passing the No. 200 mesh sieve. The layer should be compacted to at least 95 percent of the MDD as determined by ASTM D-1557.

All concrete slabs should be designed to minimize cracking as a result of shrinkage. Consideration should be given to reinforcing the slab with a welded wire fabric, re-bar, or fibermesh. Slab reinforcement should be designed by the structural engineer; however, as a minimum, slab reinforcement should consist of 4''×4'' W4.0×W4.0 welded wire mesh within the middle third of the slab. We recommend that concrete be tested to assess that the slump and/or air content is in compliance with the plans and specifications. We recommend that concrete be placed in general accordance with the requirements of the American Concrete Institute (ACI). A Modulus of Subgrade Reaction of **250 psi/inch** may be used for design. It should be noted that the Modulus of Subgrade Reaction is not a function of soil properties alone but is also influenced by other factors, including the width of the loaded area, the shape of the loaded area, and the specific location under the slab. As such, the structural engineer should exercise care and engineering judgment when using the above stated value for design.

A moisture barrier (vapor retarder) consisting of 10-mil thick Visqueen (or equivalent) plastic sheeting should be placed below slabs-on-grade where moisture-sensitive floor coverings or equipment is planned. Prior to placing this moisture barrier, any objects that could puncture it, such as protruding gravel or rocks, should be removed from the building pad. Alternatively, the subgrade may be covered with 2 inches of clean sand**.**

5.9 MOISTURE PROTECTION AND SURFACE DRAINAGE

Surface moisture should not be allowed to infiltrate into the soils in the vicinity of the foundations. As such, design strategies to minimize ponding and infiltration near the structures should be implemented.

We recommend roof runoff devices be installed to direct all runoff a minimum of 10 feet away from foundations. If a basement level is planned, the builder should be responsible for compacting the exterior backfill soils around the foundation. Additionally, the ground surface within 10 feet of the structures should be constructed so as to slope a minimum of **five** percent away from the structure. Pavement sections should be constructed to divert surface water off the pavement into storm drains, curb/gutter, or another suitable location.

Where basements are planned, IGES recommends a perimeter foundation drain be constructed in accordance with the International Residential Code (IRC).

5.10 PAVEMENT

5.10.1 Pavement Design

The near-surface soils generally contained a significant clay fraction, grading from sandy/gravelly clay (CL) to clayey sand (SC). Accordingly, based on our observations, for pavement design we have modeled a CBR of 3. Anticipated traffic volumes were not available at the time this report was prepared; however, based on our understanding of the project development we assume traffic on the roadways would consist primarily of passenger cars with occasional heavy vehicles associated with construction, municipal waste collection, public transportation, fire trucks, and similar. The following pavement designs have been developed for a 20-year design life assuming a 0 percent annual growth rate, and our assumed equivalent single axle load (ESAL) of 200,000 ESALs for interior roadways. Based on the information obtained and the assumptions listed above, recommended pavement section alternatives are presented in Table 5.10.

Table 5.10

Pavement Design CBR 3.0 – Soft Surficial Soils, Clay

Material Type	Option 1	Option 2	Option 3
Asphalt Concrete Pavement (inches)	3.5	3.5	3.5
Untreated Road Base (inches)	16	12	10
Subbase	None	None	14
***Stabilization Fabric**	None	Mirafi RS380i	None

*Stabilization fabric is placed between the subgrade and the road base.

The pavement section thicknesses presented in Table 5.10 assume that there is no mixing over time between the road base and the clayey subgrade. In order to minimize mixing or fines migration, and thereby prolong the life of the pavement section, we recommend that the owner give consideration to placing a filter fabric between the native soils and the road base, such as the **Mirafi 140N** or an IGES-approved equivalent.

During construction, a significant amount of heavy construction traffic occurs. Some distress may manifest on pavement sections during this initial construction time period. Maintenance may need to be performed after completion of construction.

As a minimum, the upper 4 inches of the fine-grained soils beneath all pavement sections should be reworked in-place and compacted to at least 93% of the MDD with the moisture content at or slightly above the OMC as determined by ASTM D-1557 (highly organic earth materials that appear to be topsoil should not be left in-place or be allowed to be mixed-in with the reworked soil). Asphalt has been assumed to be a high stability plant mix and base course material composed of crushed stone with a minimum CBR of 70. Road base should be compacted to a minimum density of 95 percent as determined by ASTM D-1557 (Modified Proctor). Asphalt should be compacted to a minimum of 96 percent of the Marshall maximum density. Asphalt and aggregate base material should conform to local requirements. Subbase should be a coarse, granular pit-run material with a minimum CBR of 30.

Where Portland Cement Concrete (PCC) pavements are planned, such as near trash enclosures or other areas expected to support heavy truck traffic, the pavement is recommended to be a minimum of 5 inches in thickness. Concrete pavement should be underlain by a minimum 6 inches of aggregate base course.

If conditions vary significantly from our stated assumptions, IGES should be contacted so we can modify our pavement design parameters accordingly.

5.10.2 Pavement Construction

The preceding pavement design options meet AASHTO design guidelines; however, where particularly soft, pumping subgrade is encountered, difficulty may be encountered during construction, particularly with respect to stabilization of the pavement subgrade. If soft, pumping soils or mobility problems arise during construction, one of the following options may be implemented:

A. Where soft subgrade is encountered, Mirafi RS380i reinforcement or an engineer-approved equivalent can be placed between the soft subgrade and the subbase. *The subbase should be compacted in two lifts*; some pumping/deflection may be noticed during compaction of the first lift, however upon placement of the final lift the 12 inches of subbase over RS380i is expected to stabilize the subgrade.

B. Stabilization of soft or pumping subgrade can also be accomplished by using a clean, coarse angular material worked into the soft subgrade. We recommend the material be greater than 3 inches in nominal diameter, but less than 6 inches. Alternately, a locally available pit-run gravel may be suitable but should contain a high percentage of particles larger than 3 inches diameter and have less than 5 percent fines (material passing the No. 200 Sieve). A pit-run gravel may not be as effective as a coarse, angular material in stabilizing the soft soils and will likely require more material be placed. The stabilization material should be worked (pushed) into the soft subgrade soils until a relatively firm and unyielding surface is established. Once a relatively firm and unyielding surface is achieved, the area may be brought to final design grade using structural fill. Other earth materials not meeting aforementioned criteria may also be suitable; however, such material should be evaluated on a case-by-case basis and should be approved by IGES prior to use.

C. Where soft soils are encountered, the Contractor should consider compaction using static methods (e.g., wheel-rolling with heavy earth-moving equipment such as a loader or scraper). Compaction over soft soils using vibratory methods often proves to be marginally effective.

5.10.3 Frost Heave

The pavement designs presented in Table 5.10 do not take into account the deleterious effects of frost heave (positive volumetric strain of frozen soils). The prevailing near-surface soils generally contain a significant clay fraction; such soils often have a high moisture content and can be particularly susceptible to frost heave. Because the soils may be particularly susceptible to frost heave, the Owner may wish to consider placing a relatively frost-free material below the pavement section, e.g. a coarse subbase material with less than 20 percent fines content. Within the Summit Powder Mountain area, the frost depth is generally taken as 42 inches for design; however, the actual frost depth could be less, or more, depending on location and whether snow removal is maintained throughout the winter since snow often acts to insulate the ground from very cold air. In roadways, frost depth can exceed this value, particularly in shady areas that receive little sun, since snow insulation is negligible due to snow removal.

The thickness of frost-free material added to the pavement section will be dependent upon the degree of risk of frost heave that is acceptable to the Owner – as a minimum, a distance of 24" from finish grade to the frost-susceptible soils would be prudent (total pavement section thickness of 24", which would include asphalt, roadbase, and subbase combined). It should be noted that Option 3 from Table 5.10 would achieve this minimum. This would reduce, *but not eliminate* the risk associated with frost heave; the Owner may wish to consider additional thickness of frost-free material to further reduce the risk of reduced pavement life arising from frost heave.

5.11 SOIL CORROSION POTENTIAL

To evaluate the corrosion potential of concrete in contact with onsite native soil, two representative soil samples were tested in our soils laboratory for soluble sulfate content. Laboratory test results indicate that the samples tested had sulfate contents of 49 and 386 ppm. Based on this result, the onsite native soils are expected to exhibit a low potential for sulfate attack to concrete. Conventional Type I/II cement may be used for all concrete in contact with site soils.

To evaluate the corrosion potential of ferrous metal in contact with onsite native soil, two representative soil samples were tested in our soils laboratory for soil resistivity (AASHTO T288), chloride content, and pH. The tests indicated that the onsite soil tested has a minimum soil resistivity ranging from 435 (clay) to 18,197 OHM-cm (granular), chloride contents ranging from 5.2 to 38.5 ppm, and pH values ranging from 5.9 to 6.1. Based on these results, the onsite native soil is considered *severely corrosive* to ferrous metal. The corrosion potential is particularly high where clay soils are present.

5.12 CONSTRUCTION CONSIDERATIONS

5.12.1 Over-Size Material

Large boulders (up to 24 inches in diameter) were observed on the surface and within the test pits; as such, excavation of the basement may generate an abundance of over-size material that may require special handling, processing, or disposal.

5.12.2 Excavation Difficulty

In the five test pits excavated in 2017 during our initial work for Phase I, the excavator met with early refusal on hard stratum (bedrock consisting of Wasatch Formation, or conglomerate). The excavations were completed with a Caterpillar 313F tracked excavator. For equipment of this size or smaller, excavation for some foundations may be challenging, and excavations for basements or utilities may be very difficult. The Contractor should consider this information when determining the appropriate earth-moving equipment for this site.

6.0 CLOSURE

6.1 LIMITATIONS

The concept of risk is a significant consideration of geotechnical analyses. The analytical means and methods used in performing geotechnical analyses and development of resulting recommendations do not constitute an exact science. Analytical tools used by geotechnical engineers are based on limited data, empirical correlations, engineering judgment and experience. As such the solutions and resulting recommendations presented in this report cannot be considered risk-free and constitute IGES's best professional opinions and recommendations based on the available data and other design information available at the time they were developed. IGES has developed the preceding analyses, recommendations and designs, at a minimum, in accordance with generally accepted professional geotechnical engineering practices and care being exercised in the project area at the time our services were performed. No warrantees, guarantees or other representations are made.

The information contained in this report is based on limited field testing and understanding of the project. The subsurface data used in the preparation of this report were obtained largely from the explorations made for The Outlook project. It is very likely that variations in the soil, rock, and groundwater conditions exist between and beyond the points explored. The nature and extent of the variations may not be evident until construction occurs and additional explorations are completed. If any conditions are encountered at this site that are different from those described in this report, IGES must be immediately notified so that we may make any necessary revisions to recommendations presented in this report. In addition, if the scope of the proposed construction or grading changes from those described in this report, our firm must also be notified.

This report was prepared for our client's exclusive use on the project identified in the foregoing. Use of the data, recommendations or design information contained herein for any other project or development of the site not as specifically described in this report is at the user's sole risk and without the approval of IGES, Inc. It is the client's responsibility to see that all parties to the project including the designer, contractor, subcontractors, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

We recommend that IGES be retained to review the final design plans, grading plans and specifications to determine if our engineering recommendations have been properly incorporated in the project development documents. We also recommend that IGES be retained to evaluate construction performance and other geotechnical aspects of the project as construction initiates and progresses through its completion.

6.2 ADDITIONAL SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during the construction. IGES staff or other qualified personnel should be on site to verify compliance with these recommendations. These tests and observations should include at a minimum the following:

- Observations and testing during site preparation, earthwork and structural fill placement.
- Consultation as may be required during construction.
- Quality control on concrete placement to verify slump, air content, and strength.

We also recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding the report or wish to discuss additional services, please do not hesitate to contact us at your convenience at (801) 748-4044.

7.0 REFERENCES

AMEC, 2001. Report Engineering Geologic Reconnaissance/Geotechnical Study Powder Mountain Resort.

American Geologic Institute (AGI), 2005, Glossary of Geology, Fifth Edition, revised, Neuendorf, K.K.E., Mehl, Jr. J.P., and Jackson, J.A., editors: American Geological Institute, Alexandria, Virginia, 783 p.

Anderson, L.R., Keaton, J.R., and Bay, J.A., 1994, Liquefaction Potential Map for the Northern Wasatch Front, Utah, Complete Technical Report: Utah Geological Survey Contract Report 94-6, 169 p.

Blake, T.F., Hollingsworth, R.A. and Stewart, J.P., Editors (2002), Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for analyzing and mitigating landslide hazards in California: organized by the Southern California Earthquake Center.

Christenson, G.E., and Shaw, L.M., 2008a, Surface Fault Rupture Special Study Areas, Wasatch Front and Nearby Areas, Utah: Utah Geological Survey Supplement Map to Utah Geological Survey Circular 106, 1 Plate, Scale 1:200,000.

Christenson, G.E., and Shaw, L.M., 2008b, Debris-Flow/Alluvial Fan Special Study Areas, Wasatch Front and Nearby Areas, Utah: Utah Geological Survey Supplement Map to Utah Geological Survey Circular 106, 1 Plate, Scale 1:200,000.

Christenson, G.E., and Shaw, L.M., 2008c, Liquefaction Special Study Areas, Wasatch Front and Nearby Areas, Utah: Utah Geological Survey Supplement Map to Utah Geological Survey Circular 106, 1 Plate, Scale 1:200,000.

Colton, R.B., 1991, Landslide Deposits in the Ogden 30’ x 60’ Quadrangle, Utah and Wyoming: U.S. Geological Survey Open-File Report 91-297, 1 Plate, 8 p., Scale 1:100,000.

Coogan, J.C., and King, J.K., 2001, Progress Report Geologic Map of the Ogden 30’ x 60’ Quadrangle, Utah and Wyoming – Year 3 of 3: Utah Geological Survey Open-File Report 380, 1 Plate, 33 p., Scale 1:100,000.

Coogan, J.C., and King, J.K., 2016, Interim Geologic Map of the Ogden 30’ x 60’ Quadrangle, Box Elder, Cache, Davis, Morgan, Rich, and Summit Counties, Utah, and Uinta County, Wyoming: Utah Geological Survey Open-File Report 653DM, 1 Plate, 151 p., Scale 1:100,000.

Crittenden, Jr., M.D., 1972, Geologic Map of the Browns Hole Quadrangle, Utah: U.S. Geological Survey Geologic Quadrangle Map GQ-968, 1 Plate, Scale 1:24,000.

Elliott, A.H., and Harty, K.M., 2010, Landslide Maps of Utah, Ogden 30’ X 60’Quadrangle: Utah Geological Survey Map 246DM, Plate 6 of 46, Scale 1:100,000.

REFERENCES (Cont.)

Federal Emergency Management Agency [FEMA], 1997, *NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures,* FEMA 302, Washington, D.C.

Frankel, A., Mueller, C., Barnard, T., Perkins, D., Leyendecker, E.V., Dickman, N., Hanson, S., and Hopper, M., 1996, *National Seismic-hazard Maps: Documentation*, U.S. Geological Survey Open-File Report 96-532, June.

Hintze, L.F., 1988, Geologic History of Utah: Brigham Young University Geology Studies Special Publication 7, Provo, Utah, 202 p.

Hynes, M.E. and A. G. Franklin (1984). "Rationalizing the Seismic Coefficient Method" Miscellaneous Paper GL-84-13, U.S. Army Waterways Experiment Station, Vicksburg, Miss.

IGES, Inc., 2012a, Preliminary Geotechnical Investigation, Powder Mountain Resort, Weber County, Utah, Project No. 01628-001, dated July 26, 2012.

IGES, Inc., 2012b, Design Geotechnical Investigation, Powder Mountain Resort, Weber County, Utah, Project No. 01628-003, dated November 9, 2012.

IGES, Inc., 2017, Geotechnical and Geologic Hazard Investigation, The Overlook – Phase I, Summit Powder Mountain Resort, Weber County, Utah: IGES Project No. 01628-021, dated January 30, 2017.

IGES, Inc., 2018, Geotechnical and Geologic Hazard Investigation, Bobcat Ridge Subdivision, Summit Powder Mountain Resort, Weber County, Utah, Project No. 01628-028, dated September 20, 2018.

International Building Code [IBC], 2015, International Code Council, Inc.

Lund, W.R., 1990, editor, Engineering geology of the Salt Lake City metropolitan area, Utah: Utah Geological Survey Bulletin 126, 66 p.

Milligan, M.R., 2000, How was Utah's topography formed? Utah Geological Survey, Survey Notes, v. 32, no.1, pp. 10-11.

Sorensen, M.L., and Crittenden, Jr., M.D., 1979, Geologic Map of the Huntsville Quadrangle, Weber and Cache Counties, Utah: U.S. Geological Survey Geologic Quadrangle Map GQ-1503, 1 Plate, Scale 1:24,000.

Stokes, W.L., 1987, Geology of Utah: Utah Museum of Natural History and Utah Geological and Mineral Survey Department of Natural Resources, Salt Lake City, UT, Utah Museum of Natural History Occasional Paper 6, 280 p.

REFERENCES (Cont.)

U.S. Geological Survey, 2012/15, U.S. *Seismic "Design Maps" Web Application*, site: https://geohazards.usgs.gov/secure/designmaps/us/application.php, site accessed on January 27, 2017.

U.S. Geological Survey, 2017, Topographic Map of the Huntsville Quadrangle, Huntsville, Utah: Scale 1:24,000.

U.S. Geological Survey, 2017, Topographic Map of the Brown's Hole Quadrangle, Brown's Hole, Utah: Scale 1:24,000.

U.S. Geological Survey and Utah Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed 7-27-18, from USGS website: http://earthquake.usgs.gov/hazards/qfaults

Utah Geological Survey, 1996, The Wasatch Fault: UGS Public Information Series 40, 17 p.

Utah Geological Survey, 2018, Utah Geological Survey Aerial Imagery Collection https://geodata.geology.utah.gov/imagery/

Weber County, 2015, Natural Hazards Overlay Districts, Chapter 27 of Title 104 of the Weber County Code of Ordinances, adopted on December 22, 2015.

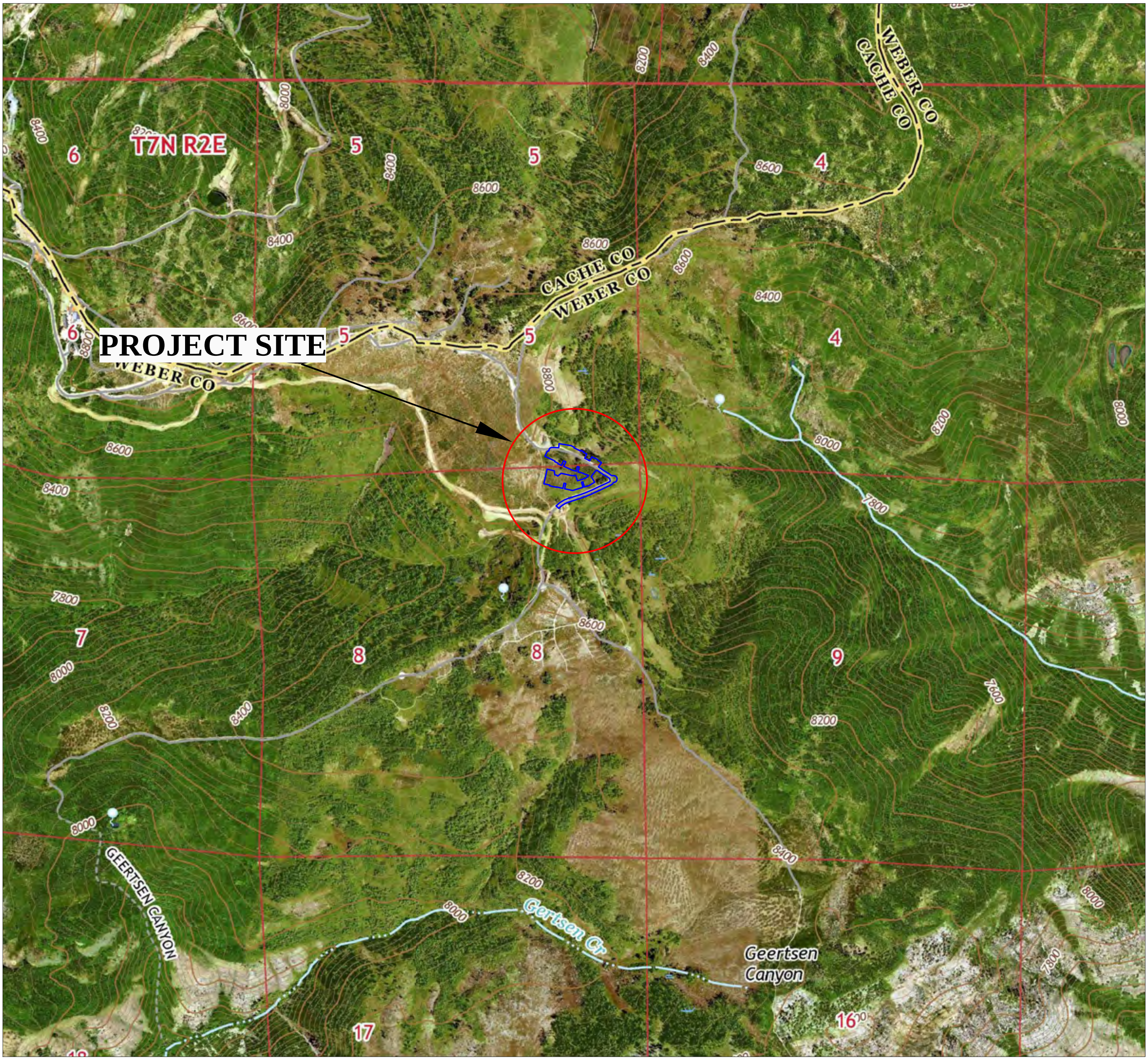
Western Geologic, 2012, Report: Geologic Hazards Reconnaissance, Proposed Area 1 Mixed-Use Development, Powder Mountain Resort, Weber County, Utah, dated August 28, 2012.

AERIAL PHOTOGRAPHS

Data Set	Date	Flight	Photographs	Scale
1947 AAJ	August 10, 1946	AAJ_1B	88, 89, 90	1:20,000
1953 AAI	September 14, 1952	AAI_4K	34, 35, 36	1:20,000
1963 ELK	June 25, 1963	ELK_3	57, 58, 59	1:15,840

*https://geodata.geology.utah.gov/imagery/

APPENDIX A



Base Maps:

-USGS *Brown's Hole, Huntsville, James Peak* and *Sharp Mountain* 7.5-Minute Quadrangles (2017)

N

0 1000 2000
FEET

1" = 2000'

IGES®

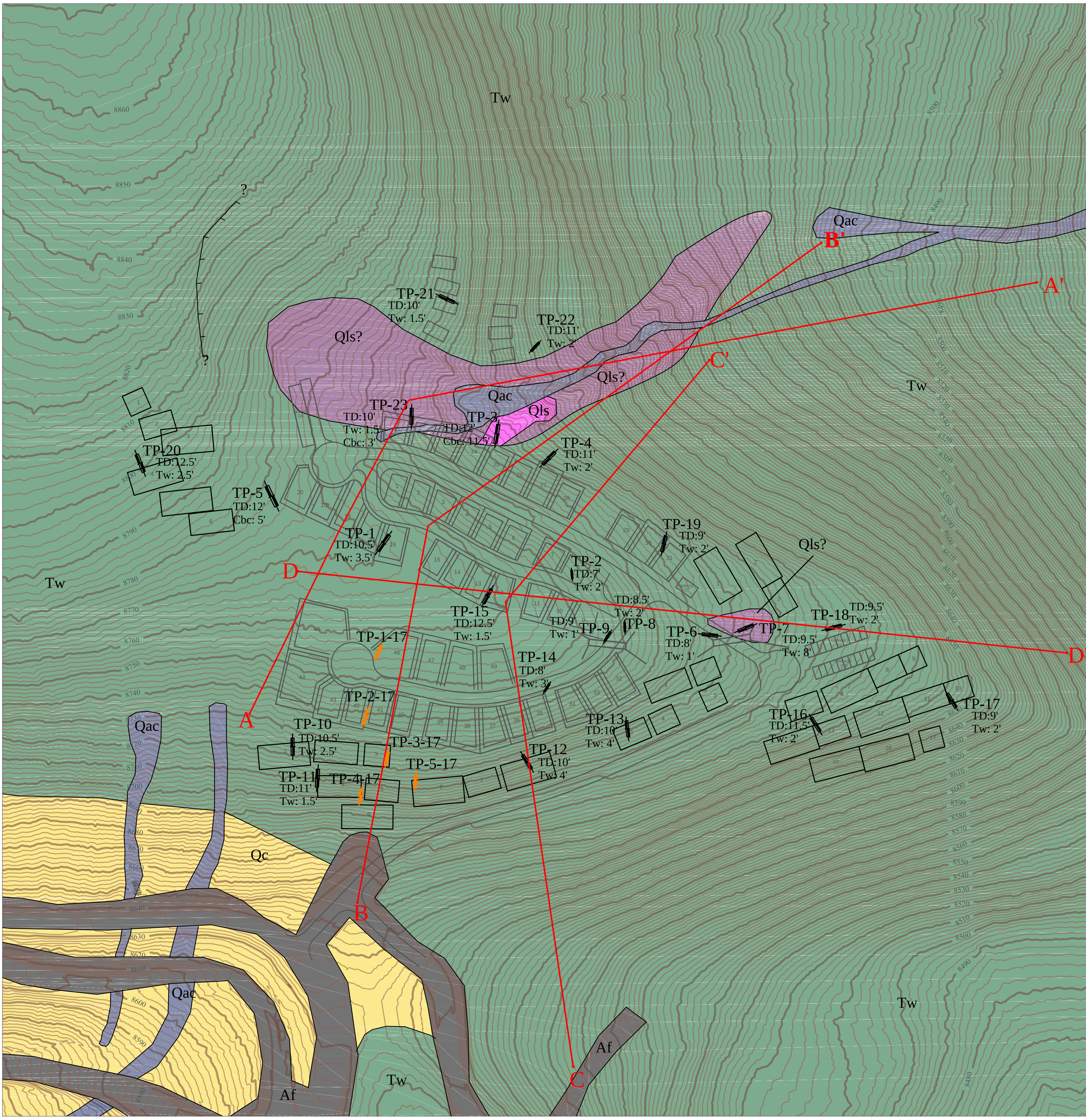
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Site Vicinity Map

Figure

A-1



LEGEND

Af	Artificial Fill (Human Disturbed)
Qac	Alluvium and Colluvium
Qc	Colluvium
Qls	Landslide Deposits
Qls?	Possible Landslide Deposits
Tw	Wasatch Formation

*All Geologic Contacts Approximate

Project Boundary

Cross-Section

Possible Landslide Headscarp

Test Pit Locations (current study)

Test Pit Locations (2017 Investigations)

TD = Total depth
Tw = Depth to Wasatch Fm
Cbc = Depth to Calls Fort Shale

Topo Data From:

Talisman Civil Consultants (2018)

Contour Interval: 2'

N

0 100 200
FEET

1" = 200'

IGES®

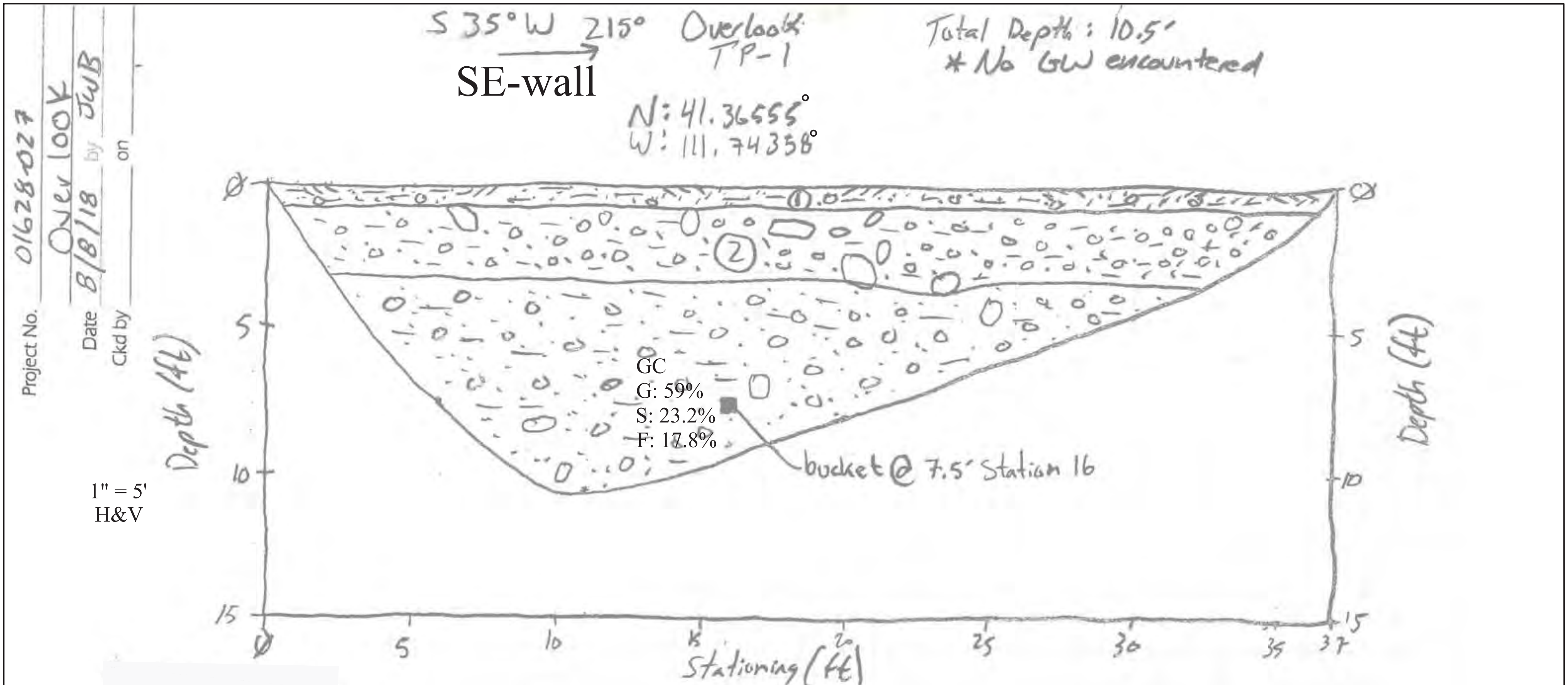
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook-Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Geotechnical and Local Geology Map

Figure

A-2



LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~6"-1' thick; light brown (5YR 6/4) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular light gray (N7) and moderate reddish brown (10R 4/6) quartzite up to 2' in diameter at surface, though mode clast size is <0.5"; common plant roots; gradational, irregular basal contact.

2. Colluvium: ~2-3' thick; light brown (5YR 6/4) to brownish gray (5YR 4/1) clayey GRAVEL with sand (GC) gradational to sandy lean CLAY with gravel (CL), medium dense, dry to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~40-50% of the unit; clasts are subangular to subrounded quartzite as above up to 3' in diameter, though mode clast size is ~4"; topsoil matrix; common to occasional plant roots; gradational, irregular basal contact.

3. Wasatch Formation (Tw): >7' thick; moderate reddish brown (10R 4/6) clayey GRAVEL with sand (GC) gradational to clayey SAND with gravel (SC), dense, slightly moist to moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~50% of the unit; clasts are subrounded quartzite as above and moderate yellowish brown (10YR 5/4) fine-grained sandstone up to 2' in diameter, though mode clast size is ~3"; typical Wasatch Fm.

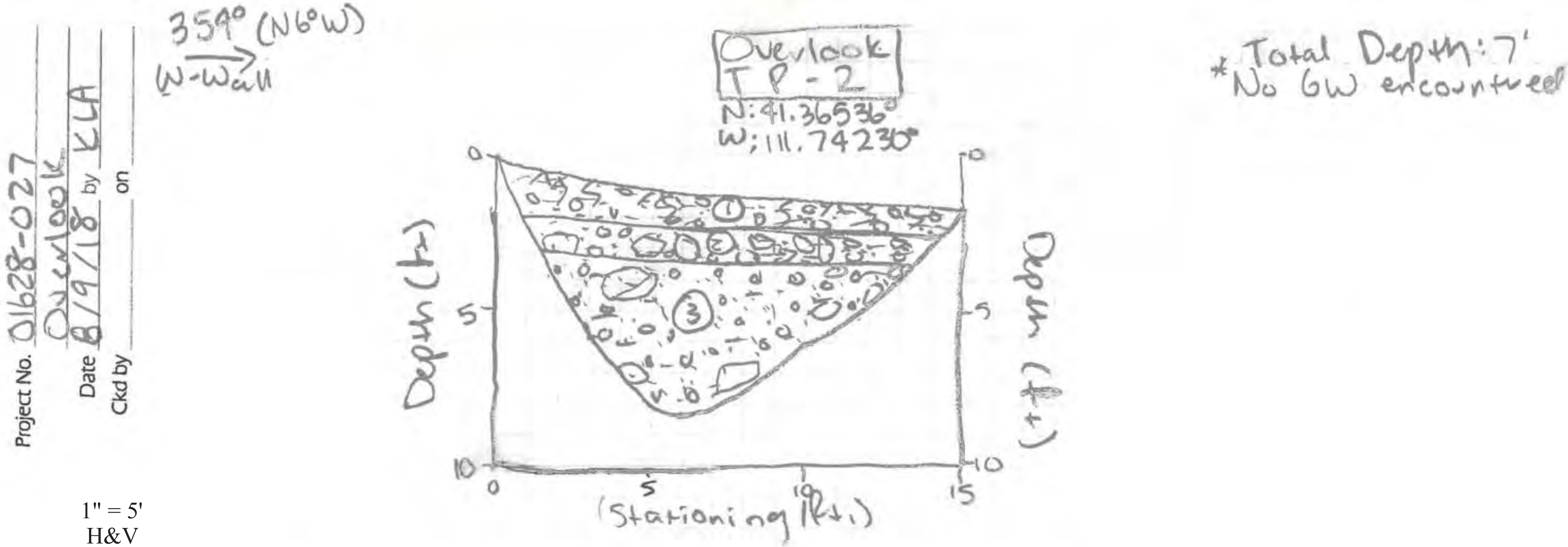
IGES®

Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-1 Log

Figure A-3



1" = 5'
H&V

LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 3" in diameter, though mode clast size is ~$\frac{1}{2}$-1"; abundant plant and tree roots; gradational, irregular basal contact.

2. Colluvium: ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~20-25% of the unit; clasts are subrounded to subangular quartzite as above up to 2.5' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant and tree roots; sharp, planar basal contact.

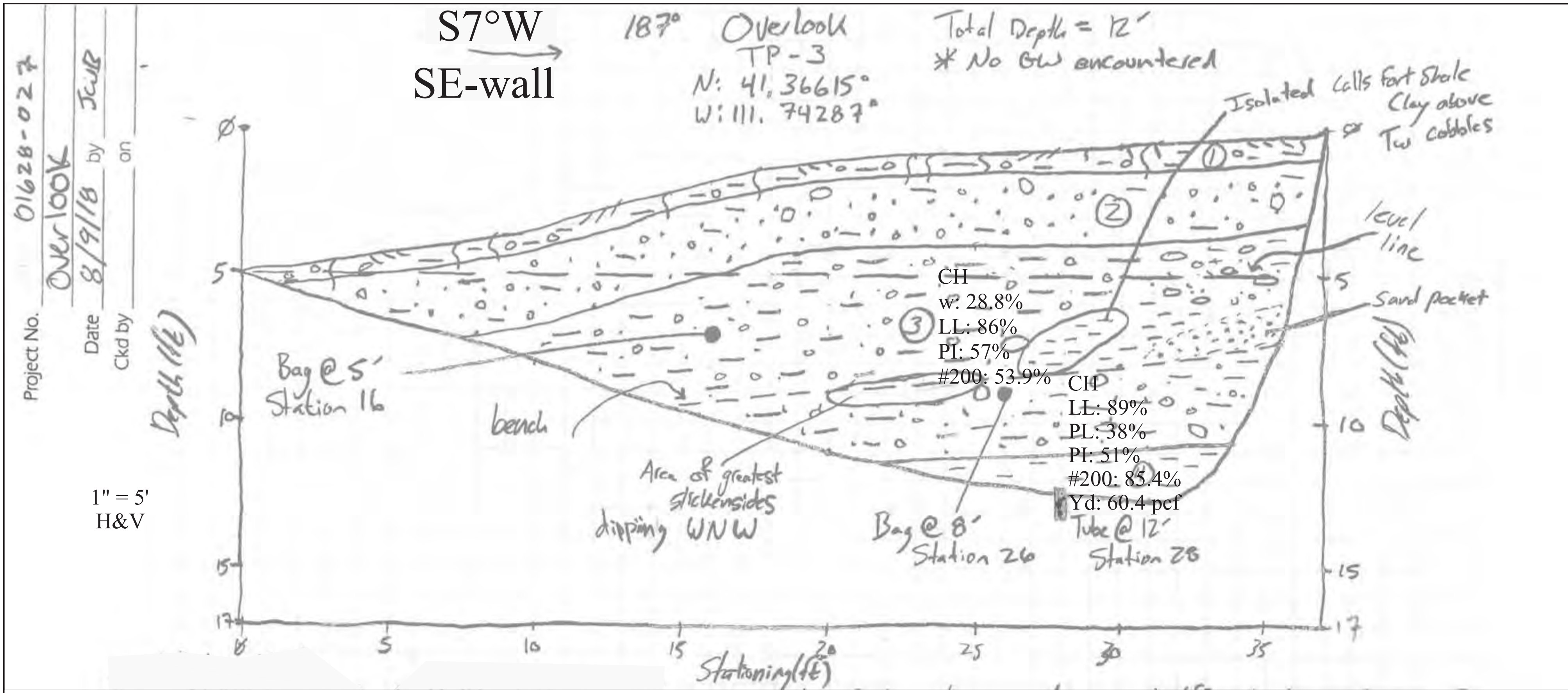
3. Wasatch Formation (Tw): >5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense, dry, low plasticity fines, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded quartzite as above up to 2' in diameter, though mode clast size is ~3"; occasional tree roots; sand is fine-grained to medium-grained.

IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-2 Log

Figure A-4



LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~1' thick; light brown (5YR $\frac{5}{6}$) to moderate brown (5YR $\frac{4}{4}$) sandy lean CLAY with gravel (CL), loose to medium stiff, slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular light gray (N7) and moderate reddish brown (10R $\frac{4}{6}$) quartzite up to 4' in diameter, though mode clast size is ~0.5"; abundant plant roots; possible discontinuous thin colluvial unit at base; gradational, irregular basal contact.

2. **Young Landslide (Qlsy):** ~2-2.5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense, slightly moist to moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~20% of the unit; clasts are subrounded to subangular quartzite as above and subrounded pale yellowish orange (10YR $\frac{8}{6}$) fine-grained sandstone; clasts are up to 2.5' in diameter, though mode clast size is ~2"; few plant roots; sharp, irregular basal contact.

3. **Slide Plane:** 7-8' thick; mottled moderate reddish brown (10R $\frac{4}{6}$), white (N9) and light gray (N7) sandy fat CLAY with gravel (CH), medium stiff to stiff, moist, medium to high plasticity, massive; gravel and larger sized clasts comprise ~5-10% of the unit; clasts are subangular to subrounded quartzite and sandstone as above, plus angular black (N1) chert; clasts up to 6-8" in diameter, though mode clast size is 1"; highly heterogeneous unit; slickensides and possible slickenlines observed in clayey areas; these features are continuous for 6-18"; isolated unit 4 material found within this unit; unit in places can be described as Tw cobbles and sand in a Calls Fort Shale clay matrix; sharp, irregular basal contact.

4. **Highly Weathered Calls Fort Shale:** >1.5' thick; mottled moderate reddish brown (10R $\frac{4}{6}$) and light gray (N7) fat CLAY (CH), stiff, moist, medium to high plasticity, massive; rare (<5%) highly weathered small (<0.5") shale clasts in unit.

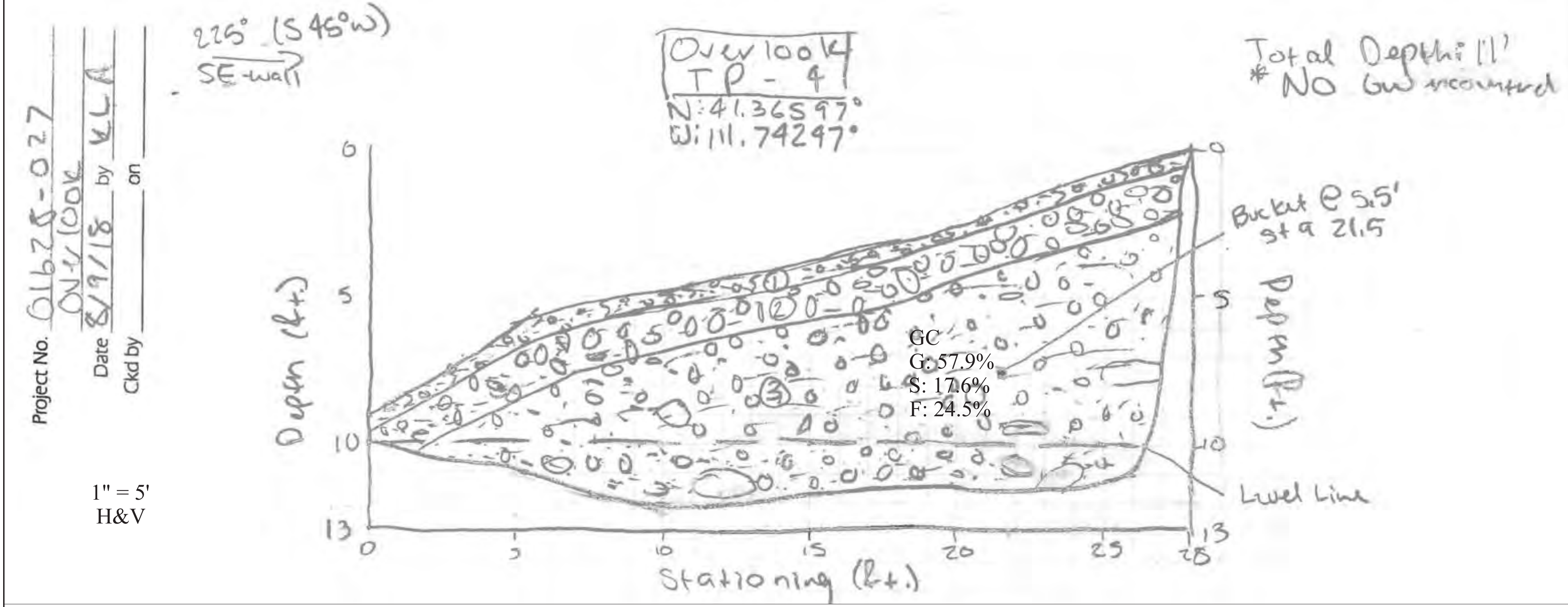
IGES®

Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-3 Log

Figure A-5



LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~6' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 1' in diameter, though mode clast size is ~$\frac{1}{2}$-1"; abundant plant roots; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~1.5' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 3' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant roots; sharp, planar basal contact.

3. <u>Wasatch Formation (Tw)</u>: >10' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey GRAVEL with sand (GC) gradational to well-graded SAND with gravel (SC), medium dense, moist, low to moderate plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above and moderate yellow (5Y $\frac{7}{6}$) sandstone; clasts are up to 3' in diameter, though mode clast size is ~2-3"; occasional plant roots; abundant 1-2 mm pinhole voids; sandy lean CLAY (CL) in middle of unit; well-graded SAND (SW) below sandy CLAY (CL); sand is fine to medium grained.

IGES®

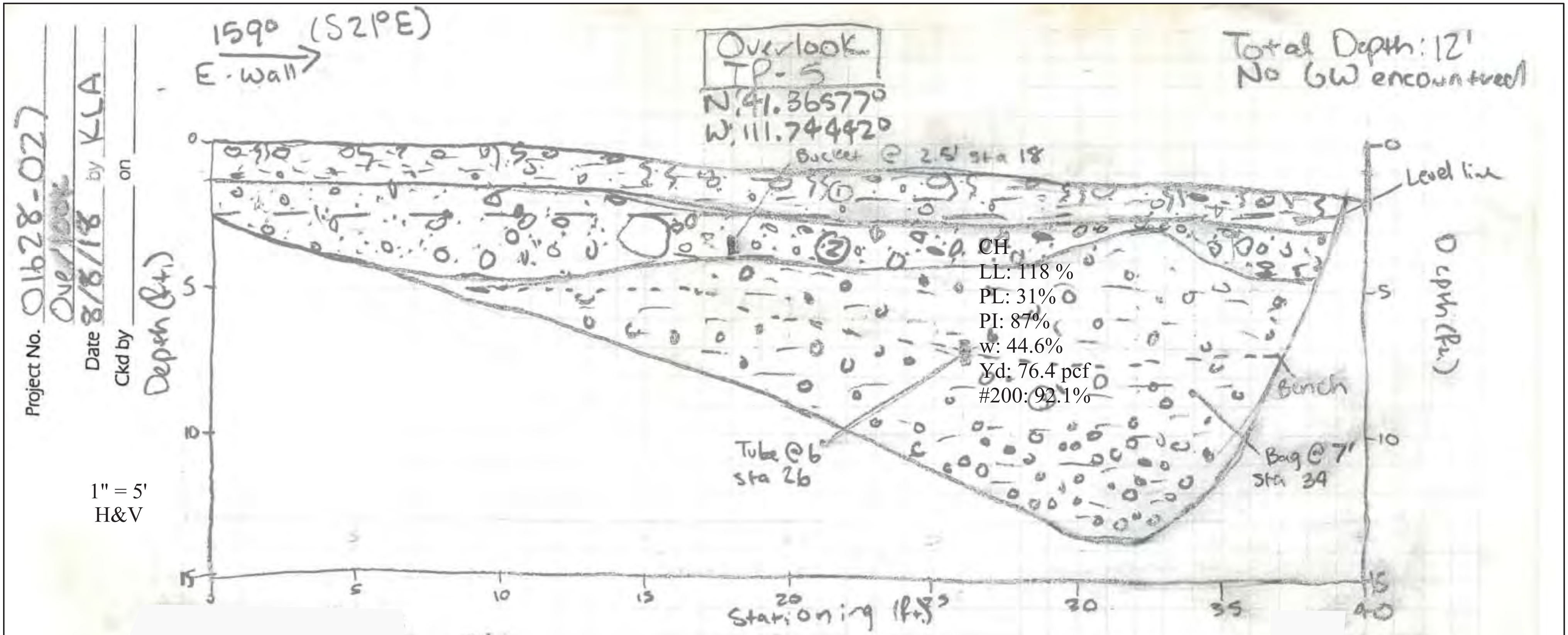
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-4 Log

Figure

A-6

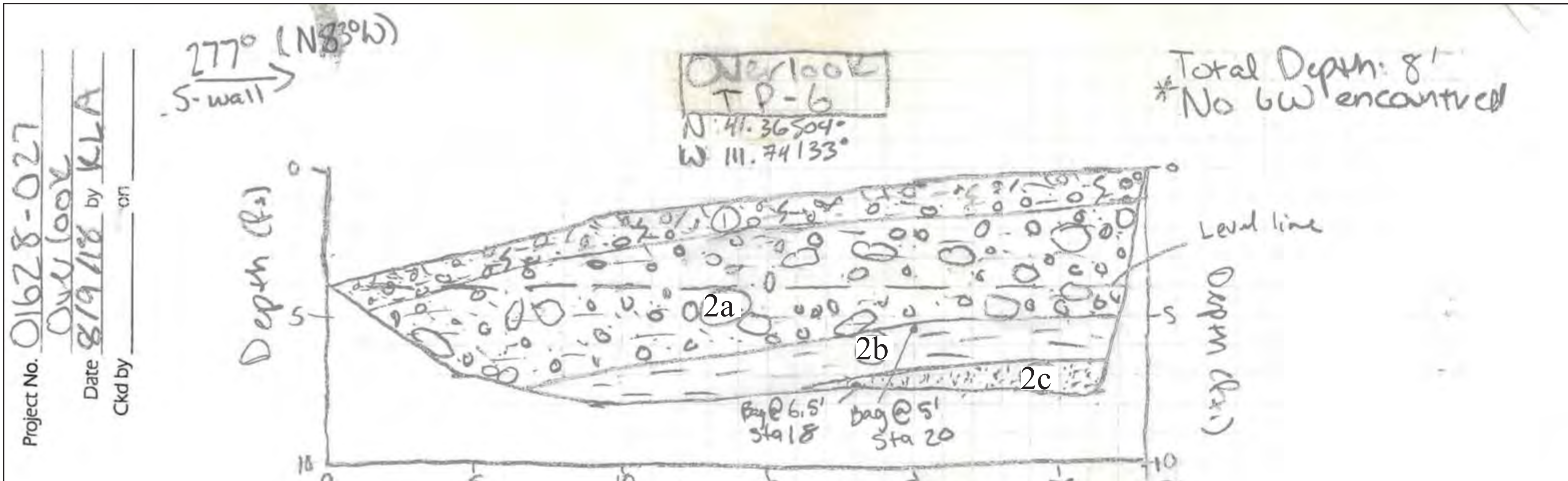


LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~1.5' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{5}{6}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to ~2' in diameter, though mode clast size ~0.5-1"; abundant plant and tree roots; sharp, planar basal contact.

2. <u>Wasatch Formation (Tw):</u> ~3.5' thick; moderate reddish orange (10R $\frac{6}{6}$) clayey SAND with gravel (SC) gradational to sandy lean CLAY with gravel (CL), medium dense, dry to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular moderate orange pink (10R $\frac{7}{4}$) to medium gray (N5) quartzite up to 13" in diameter, though the mode clast size is ~2-3"; occasional plant roots; basal light gray coloring; sharp, irregular basal contact.

3. <u>Weathered Calls Fort Shale:</u> >10.5' thick; moderate reddish orange (10R $\frac{6}{6}$) mottled with grayish orange pink (10R $^{8}_{2}$) gravelly fat CLAY (CH), medium stiff to stiff, slightly moist, medium plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subangular to angular moderate reddish orange (10R $\frac{6}{6}$) shale up to 2" in diameter, though mode clast size is ~0.5-1"; clasts are soft and fall apart easily; clasts increase in occurrence with depth; occasional short and discontinuous slickensides (mechanically induced); cracked and blocky when dried out; occasional plant roots.



1" = 5'
H&V

LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~20-25% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) to medium gray (N5) quartzite up to 3" in diameter, though mode clast size is ~$\frac{1}{2}$-1"; abundant plant roots; gradational, planar basal contact.

2. <u>Wasatch Formation (Tw):</u> >6' thick; 3 sub-units; **<u>2a)</u>:** ~4' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC) gradational to sandy lean CLAY with gravel (CL) , medium dense, dry, low to moderate plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the subunit; clasts are subrounded to subangular quartzite as above and medium gray (N5) quartzite; clasts are up to 1.5' in diameter, though mode clast size is ~2-3"; occasional plant roots; abundant 1-2 mm pinhole voids; sand is fine-grained to medium-grained; sharp, planar basal contact; **<u>2b)</u>:**~1.5' thick; moderate reddish brown (10R $\frac{4}{6}$) mottled with grayish red (5R $\frac{4}{2}$) fat CLAY (CH); stiff, moist, medium plasticity, massive; devoid of clasts; common plant roots; gradational, planar basal contact; **<u>2c)</u>:** >0.5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND (SC); medium dense, moist, medium plasticity fines, massive; devoid of clasts; common plant roots.

IGES®

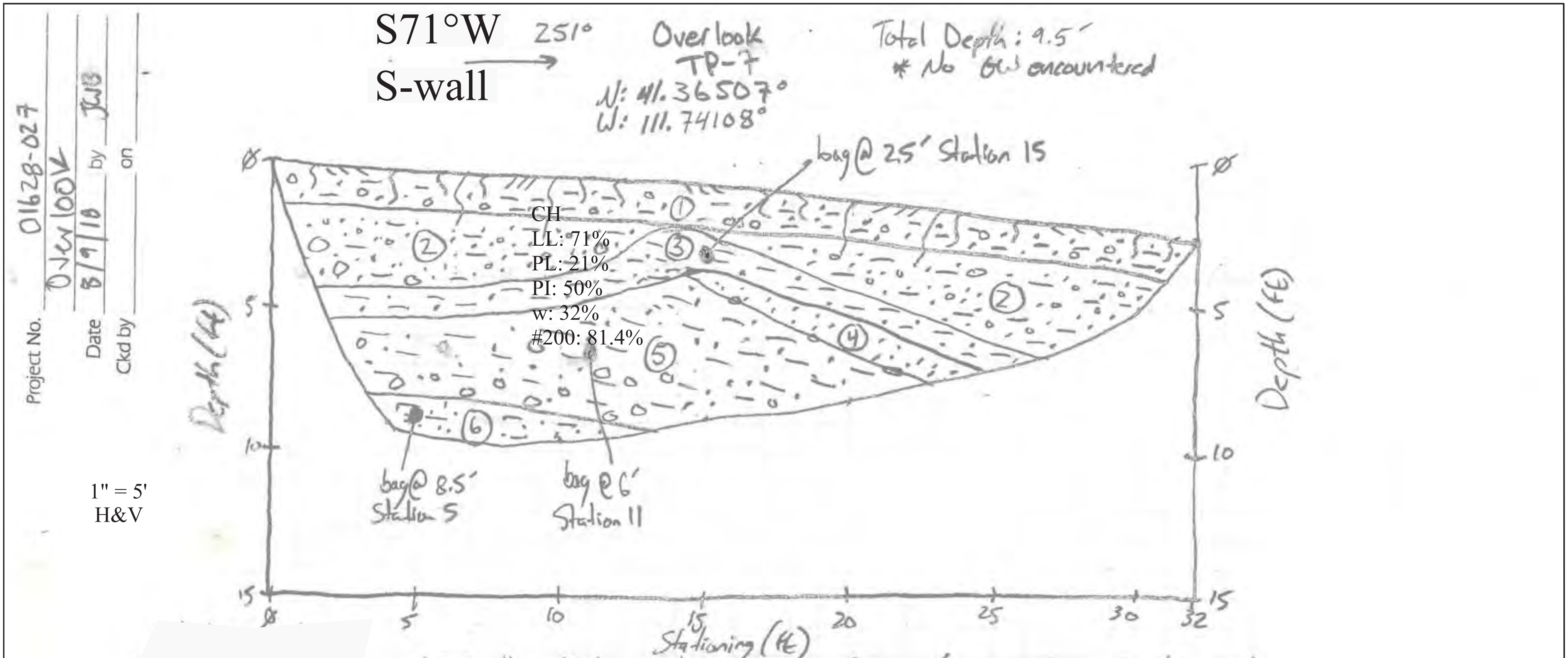
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-6 Log

Figure

A-8



LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~1.5-2' thick; light brown (5YR $\frac{6}{4}$) to moderate brown (5YR $\frac{4}{4}$) sandy lean CLAY with gravel (CL), loose, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~10-15% of the unit; clasts are subrounded to subangular light gray (N7) to moderate yellowish brown (10YR $\frac{5}{4}$) quartzite up to ~1' in diameter, though mode clast size is ~0.5-1"; possible thin, discontinuous colluvial unit at base; abundant plant roots; sharp, irregular basal contact.

2. Shallow Landslide (Qlsy): ~0-3' thick; pale reddish brown (10R $\frac{5}{4}$) to moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC) gradational to sandy lean CLAY with gravel (CL), medium dense, moist to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~30% of the unit; clasts are subangular to subrounded quartzite as above up to 4" in diameter, with a mode clast size of ~0.5-1"; not present in center of test pit; common plant roots; sharp, irregular basal contact.

3. Clay Seam 1: ~1.5-2' thick; moderate reddish brown (10R $\frac{4}{6}$) to dark reddish brown (10R $\frac{3}{4}$) sandy lean CLAY (CL); medium stiff to loose, moist to slightly moist, medium plasticity, massive; devoid of clasts; small mechanically induced slickensides; blocky drying pattern similar to TP-20 unit 3a; sharp, wavy basal contact.

4. Sand Pocket: ~0.5-1' thick; light gray (N7) to white (N9) silty SAND (SM); dense to medium dense, slightly moist to dry, low plasticity fines, massive; devoid of clasts; sand is poorly sorted and ranges from very fine to coarse grained; sharp, planar basal contact.

5. Clay Seam 2: ~2.5-5' thick; intercollated moderate reddish brown (10R $\frac{4}{6}$) and light gray (N7) to medium gray (N5) sandy fat CLAY with gravel (CH); stiff, moist, moderate to high plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular quartzite as above; clasts are up to 4" in diameter, though mode clast size is ~3-4"; slickensides up to 5-6" long observed; clasts possibly concentrated at base of unit; gray clay component resembles weathered Calls Fort Shale; few plant roots; possible shear plane; sharp, planar basal contact.

6. Wasatch Formation (Tw): >1.5' thick; moderate reddish brown (10R $\frac{4}{6}$) to pale reddish brown (10R $\frac{5}{4}$) clayey SAND (SC); dense, moist, low plasticity fines, massive; devoid of clasts; few plant roots.

IGES®

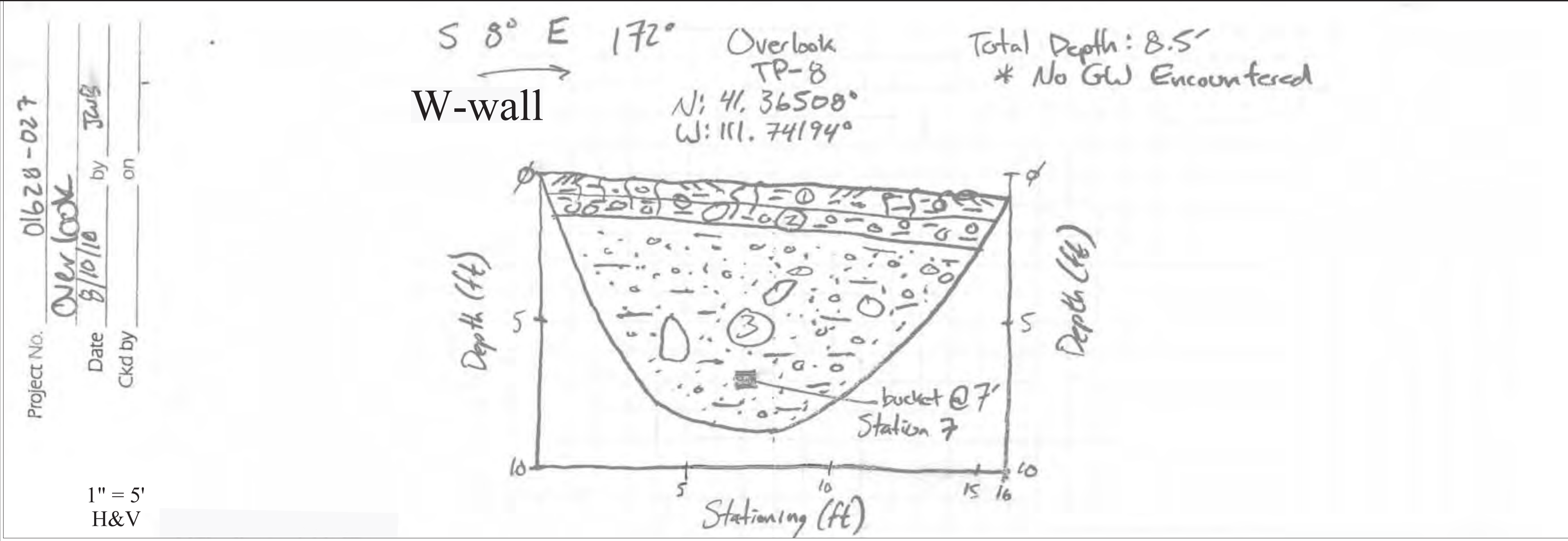
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-7 Log

Figure

A-9



LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~6-12" thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~5-10% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to ~3" in diameter, though mode clast size ~0.5-1"; abundant plant and tree roots; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~6"-1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above up to 1' in diameter, though mode clast size is ~4-5"; abundant plant and tree roots; topsoil matrix; sharp, planar basal contact.

3. <u>Wasatch Formation (Tw)</u>: >7' thick; moderate reddish brown (10R $\frac{4}{6}$) well graded SAND with clay (SW), medium dense, moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~20-30% of the unit; clasts are subrounded to subangular quartzite as above, medium gray (N5) quartzite and moderate reddish orange (10R $\frac{6}{6}$) sandstone up to 2.5' in diameter, though the mode clast size is ~2-4"; sand is fine to medium grained; occasional plant and tree roots.

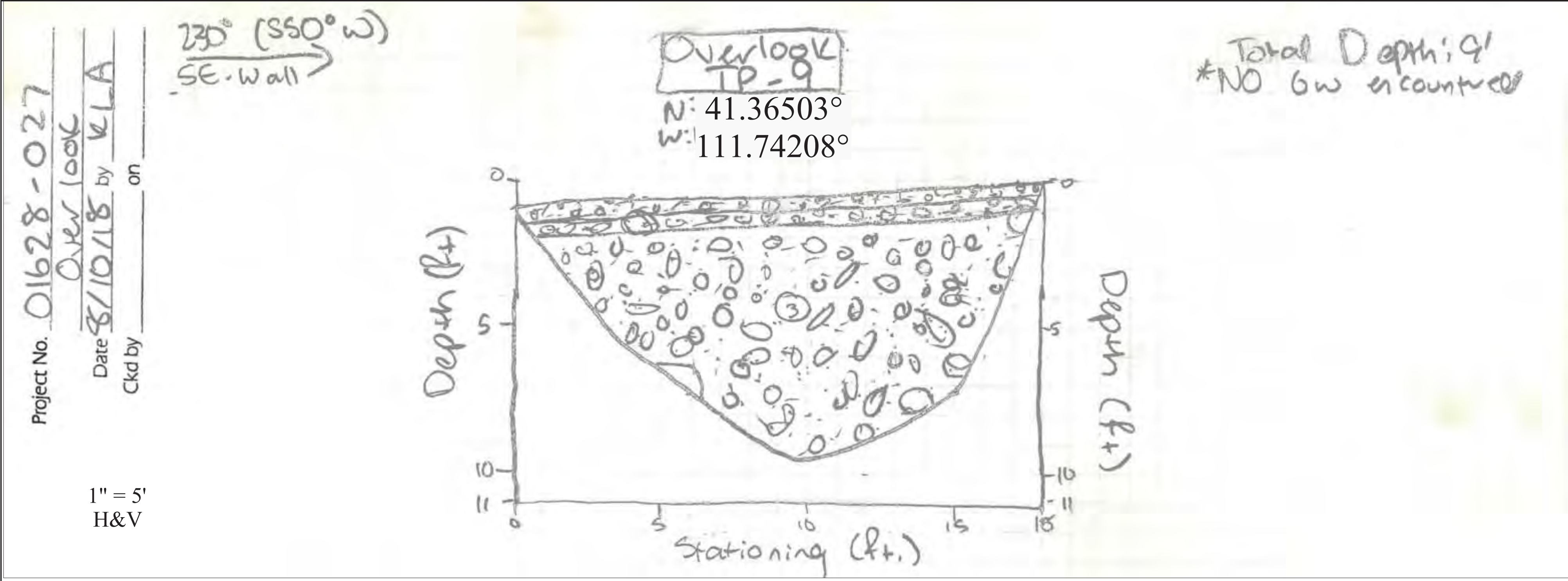
IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-8 Log

Figure

A-10

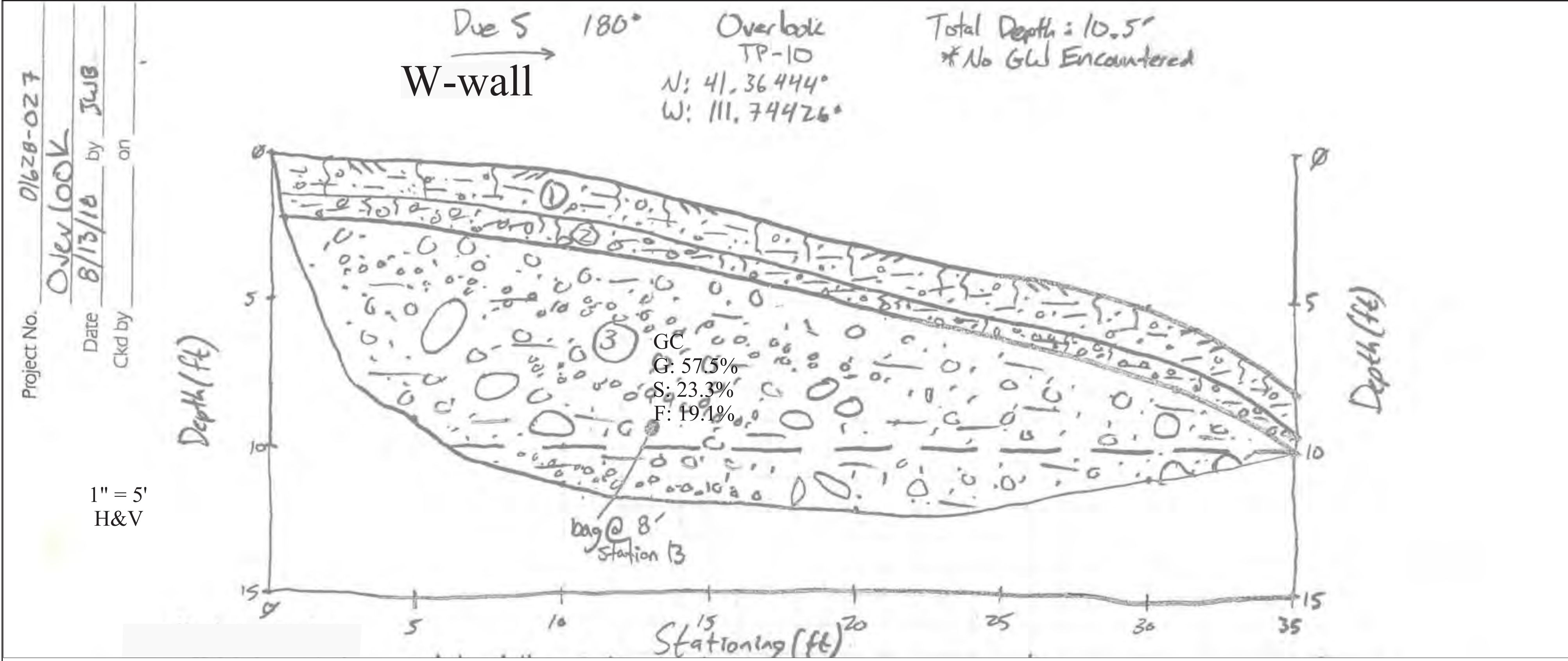


LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~6” thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to ~3” in diameter, though mode clast size ~0.5-1”; abundant plant and tree roots; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~6” thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above up to 1' in diameter, though mode clast size is ~2-3”; abundant plant and tree roots; topsoil matrix; sharp, planar basal contact.

3. <u>Wasatch Formation (Tw)</u>: >8' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense, moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~20-30% of the unit; clasts are subrounded to subangular quartzite as above, medium gray (N5) quartzite and moderate reddish orange (10R $\frac{6}{6}$) sandstone up to 1-1.5' in diameter, though the mode clast size is ~2-4”; sand is fine to medium grained; occasional plant and tree roots.

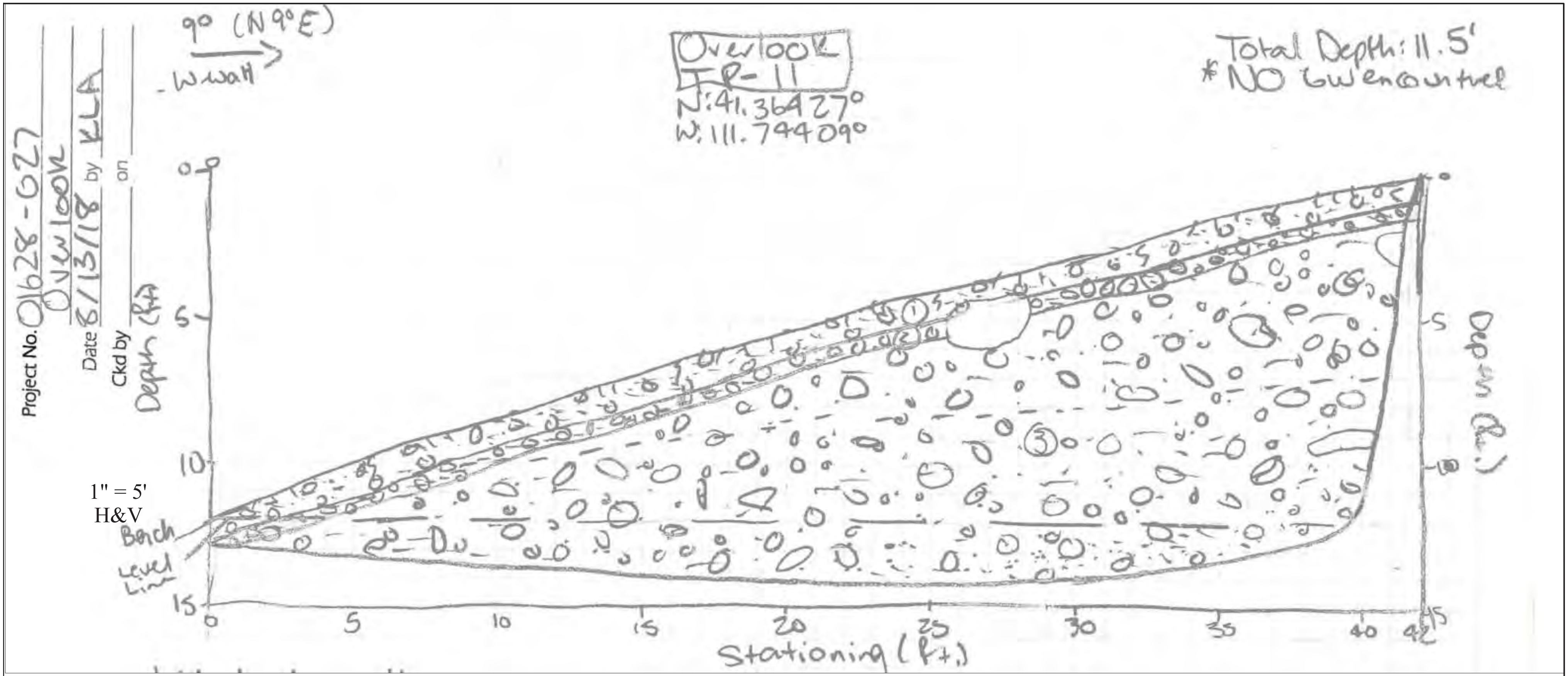


LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~1-1.5' thick; light brown (5YR 6/4) to pale yellowish brown (10YR 6/2) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~15-20% of the unit; clasts are subrounded to subangular medium light gray (N6) to moderate yellowish brown (10YR 5/4) quartzite up to ~3" in diameter, though mode clast size is ~1"; common to abundant plant roots; sharp, irregular basal contact.

2. Colluvium: ~6"-1' thick; light brown (5YR 6/4) to pale yellowish brown (10YR 6/2) sandy lean CLAY with gravel (CL), medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 1.5-2' in diameter, though mode clast size is ~2-3"; common plant roots; topsoil matrix; sharp, irregular basal contact.

3. Wasatch Formation (Tw): >8' thick; moderate reddish brown (10R 4/6) clayey SAND with gravel (SC), medium dense, moist, low plasticity fines, massive to possible poorly defined beds; gravel and larger sized clasts comprise ~40% of the unit; clasts are subrounded to subangular quartzite as above plus subangular to subrounded dark yellowish orange (10YR 6/6) fined grained highly weathered sandstone, clasts are up to 3' in diameter, though mode clast size is 1" and 3-4" in a bi-modal distribution; bi-modal distribution correlates with vague bedding; few plant roots; sand is fine grained primarily.



LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~20-25% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to medium gray (N5) quartzite up to ~3" in diameter, though mode clast size is ~0.5-1"; abundant plant roots; gradational, irregular basal contact.

2. Colluvium: ~6" thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 2' in diameter, though mode clast size is ~2-3"; abundant plant roots; topsoil matrix; sharp, planar basal contact.

3. Wasatch Formation (Tw): >10' thick; moderate reddish brown (10R $\frac{4}{6}$) sandy lean CLAY with gravel (CL) gradational to clayey SAND with gravel (SC), medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above plus moderate reddish orange (10R $\frac{6}{6}$) sandstone; clasts are up to 3.5' in diameter, though mode clast size is ~2-3"; occasional plant roots; sand is fine to medium grained, sandier with depth.

IGES®

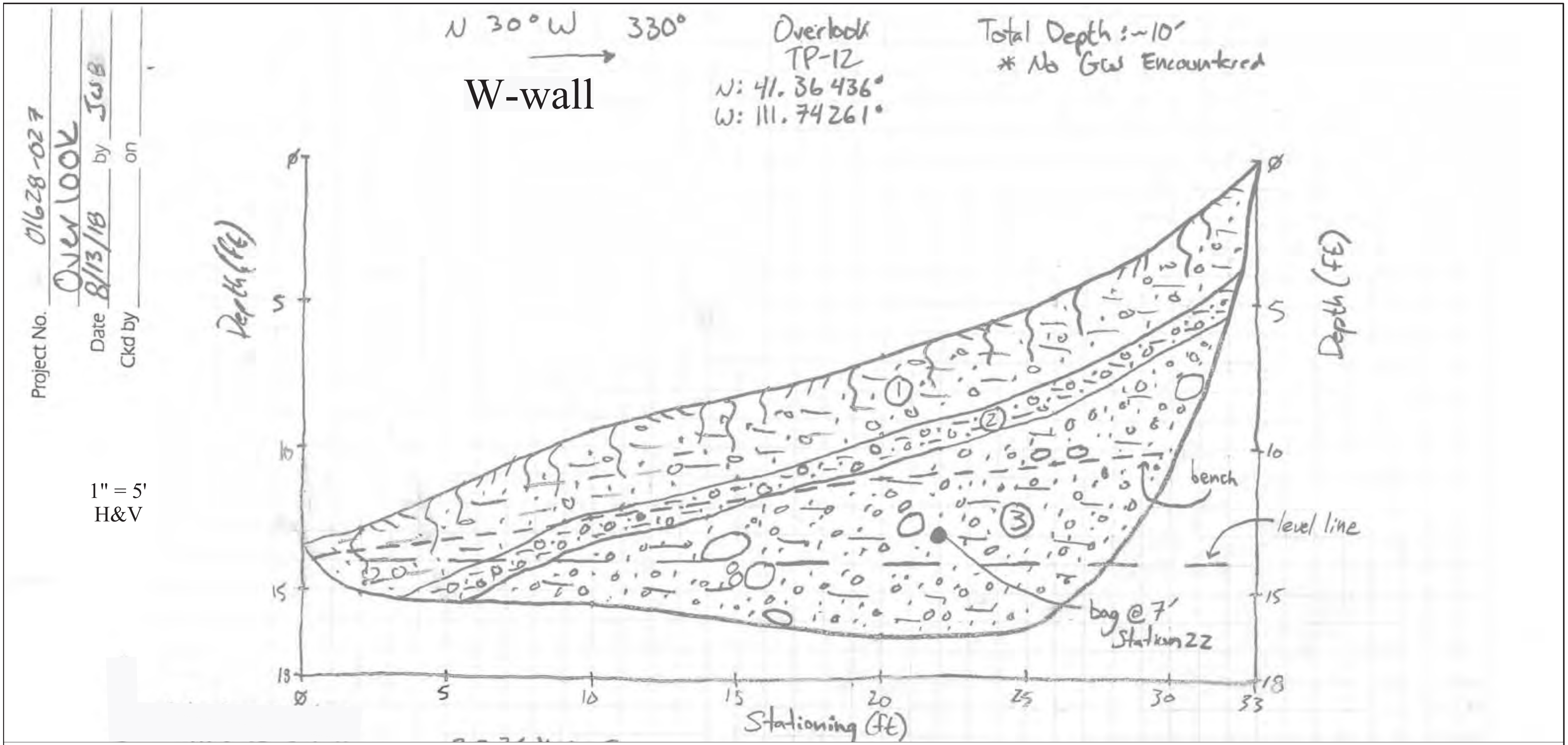
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-11 Log

Figure

A-13



LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~2.5-3' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~20-25% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to medium gray (N5) quartzite up to ~3" in diameter, though mode clast size is ~0.5-1"; abundant plant and tree roots; gradational, irregular basal contact.

2. **Colluvium:** ~6"-1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 7" in diameter, though mode clast size is ~2-3"; abundant plant and tree roots; topsoil matrix; sharp, planar basal contact.

3. **Wasatch Formation (Tw):** >7' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense, slightly moist to moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~35-40% of the unit; clasts are subrounded to subangular medium light gray (N6) and pale reddish brown (10R $\frac{5}{4}$) quartzite plus highly weathered moderate reddish brown and dark yellowish orange (10YR $\frac{6}{6}$) fine grained sandstone, up to 16" in diameter, though mode clast size is ~1-2"; few to occasional plant roots; gravel component is well graded, sand is mostly fine grained.

IGES®

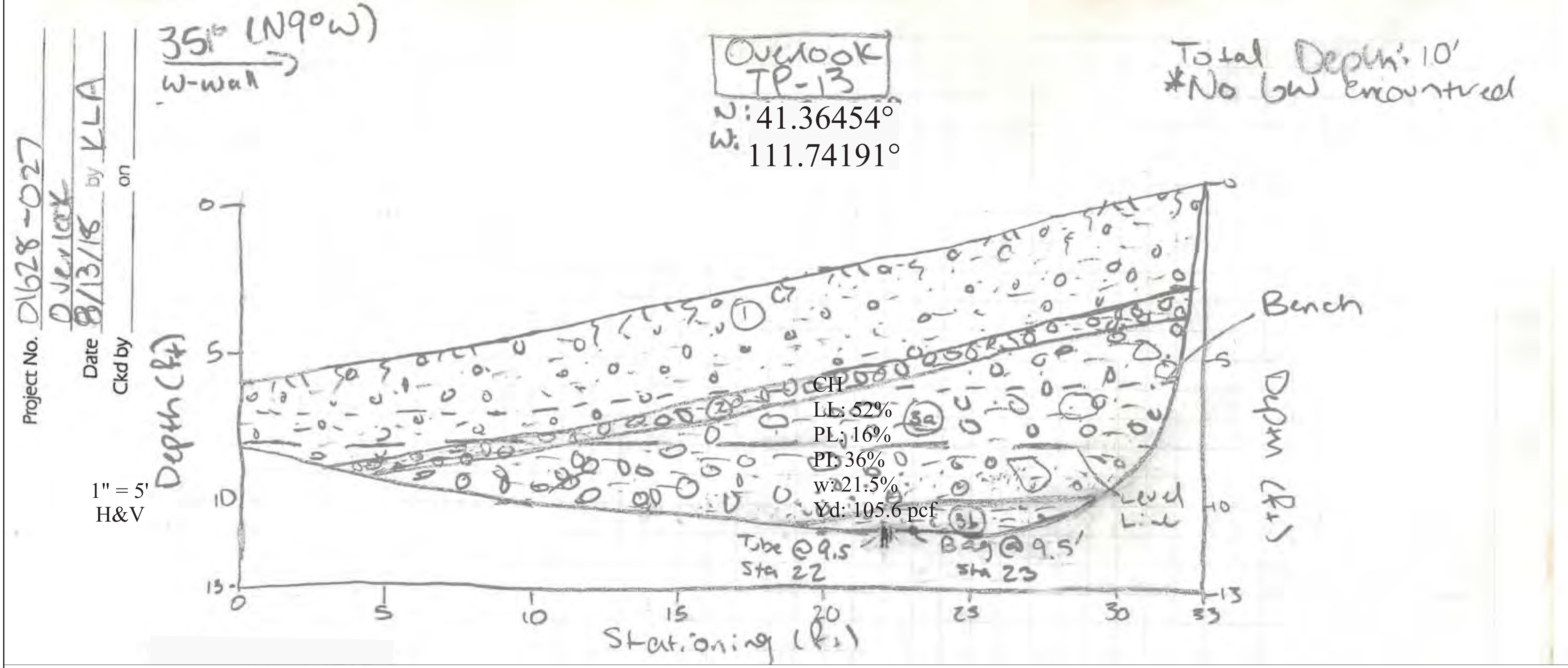
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-12 Log

Figure

A-14

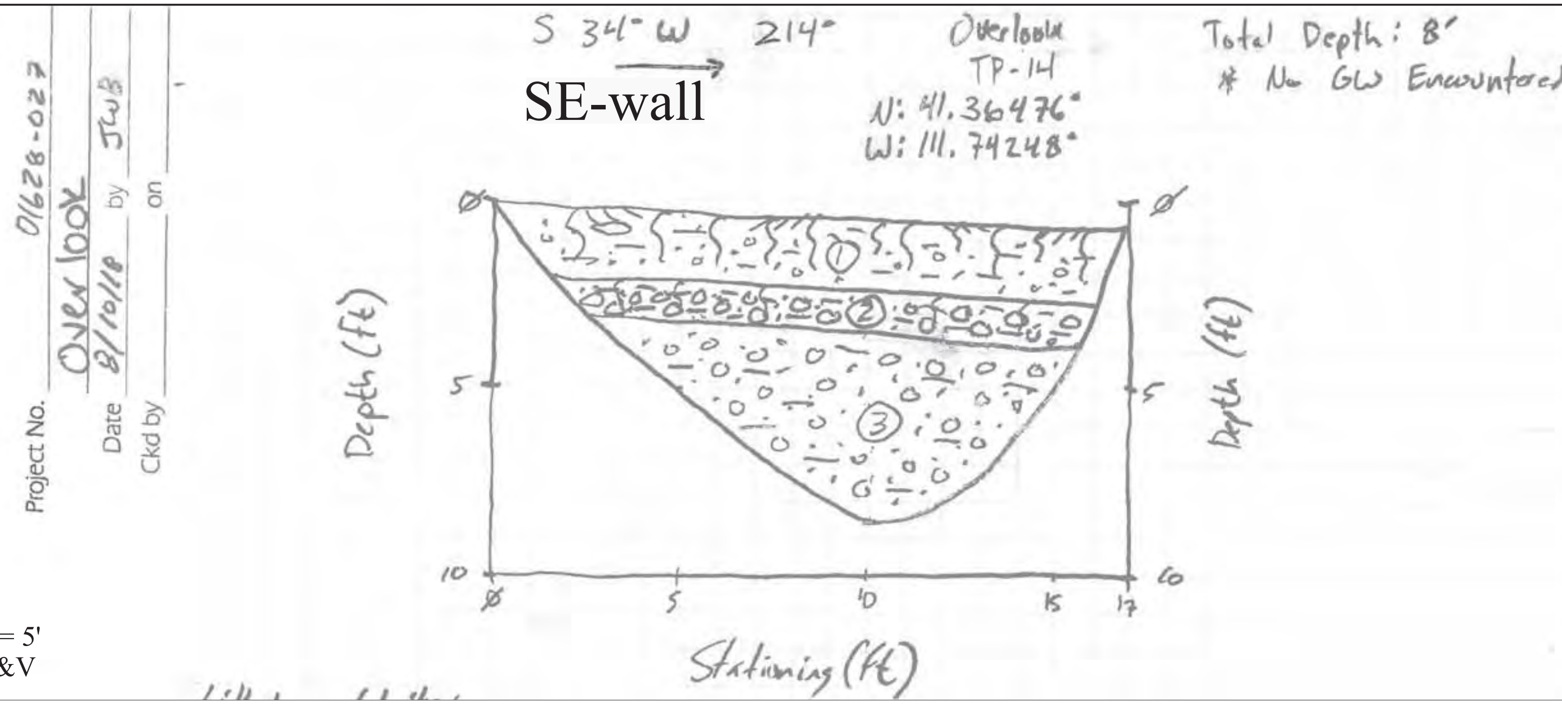


LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~3.5' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~20-25% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to medium gray (N5) quartzite up to ~3" in diameter, though mode clast size is ~0.5-1"; abundant plant and tree roots; gradational, irregular basal contact.

2. Colluvium: ~6" thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 1' in diameter, though mode clast size is ~2-3"; abundant plant and tree roots; topsoil matrix; sharp, planar basal contact.

3. Wasatch Formation (Tw): >6' thick; 2 subunits; **3a):** ~5' thick; moderate reddish brown (10R $\frac{4}{6}$) sandy lean CLAY with gravel (CL) gradational to clayey well-graded SAND with gravel (SC), medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above plus moderate reddish orange (10R $\frac{6}{6}$) sandstone; clasts are up to 2' in diameter, though mode clast size is ~2-3"; occasional plant and tree roots; sand is fine to medium grained, sandier with depth; sharp, planar basal contact; **3b):** >1' thick; moderate reddish brown (10R $\frac{4}{6}$) mottled with black (N1) and light gray (N7) sandy fat CLAY with gravel (CH), medium stiff, moist, moderate plasticity, massive; gravel and larger sized clasts comprise ~5-10% of the unit; clasts are quartzite as above up to 1" in diameter, though mode clast size is ~0.5"; sand is fine grained.



1" = 5'
H&V

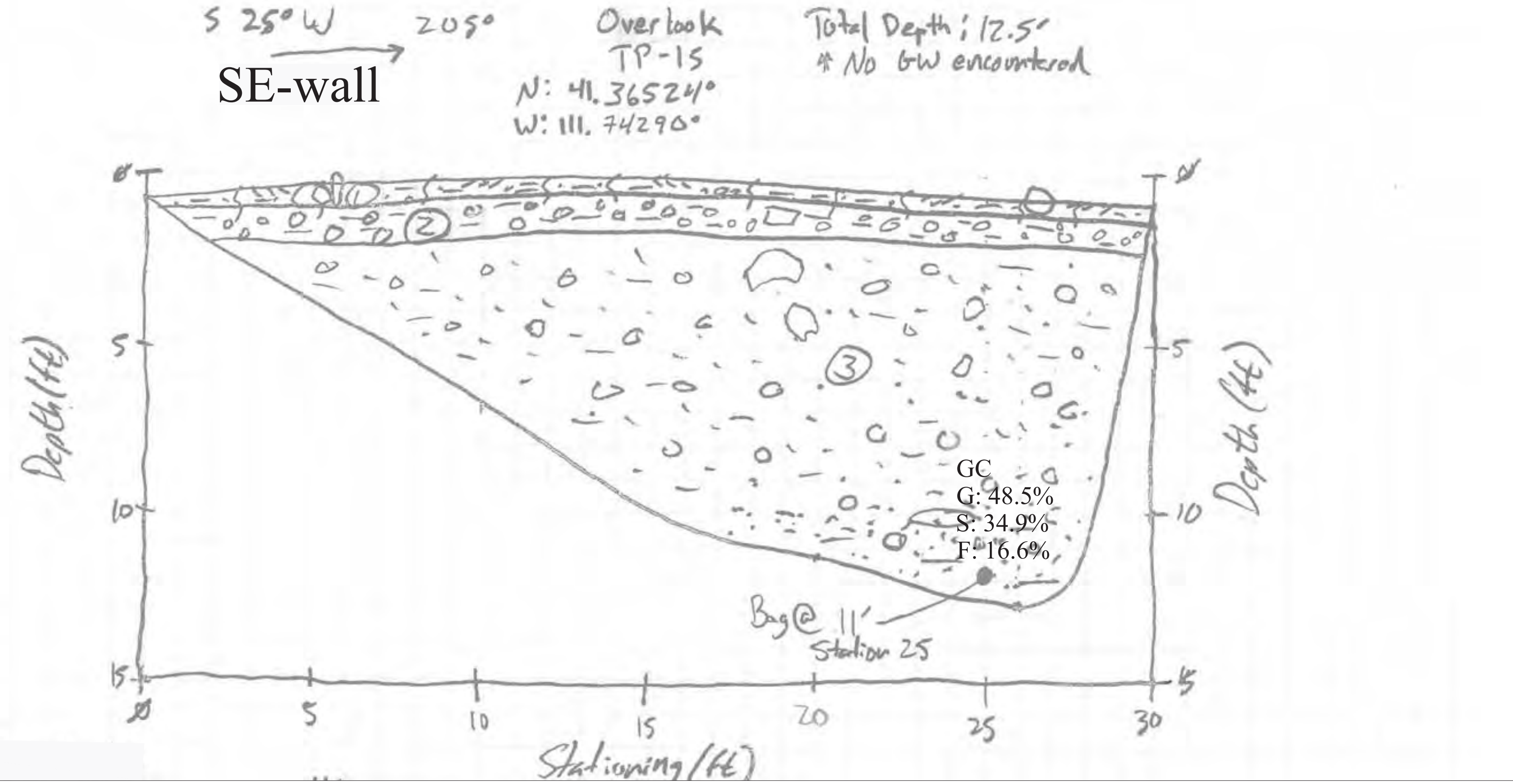
LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~2' thick; light brown (5YR $\frac{6}{4}$) to moderate brown (5YR $\frac{3}{4}$) sandy lean CLAY with gravel (CL), loose to medium stiff, slightly moist to dry, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded light gray (N7) to pale yellowish orange (10YR $\frac{8}{6}$) quartzite up to ~6" in diameter, though mode clast size is ~0.5-1"; abundant plant and tree roots; sharp, irregular basal contact.

2. Colluvium:~1' thick; moderate brown (5YR $\frac{3}{4}$) sandy lean CLAY with gravel (CL), medium stiff, slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 1.5' in diameter, though mode clast size is ~3"; common plant and tree roots; topsoil matrix; sharp, irregular basal contact.

3. Wasatch Formation (Tw): >5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense to dense, slightly moist to moist, low to medium plasticity fines, massive; gravel and larger sized clasts comprise ~40% of the unit; clasts are subangular to subrounded quartzite as above, clasts are up to 2' in diameter, though mode clast size is 1-2"; classic Tw.

Project No. 01628-027 Overlook Date 8/9/18 by JWB Ckd by on



1" = 5'
H&V

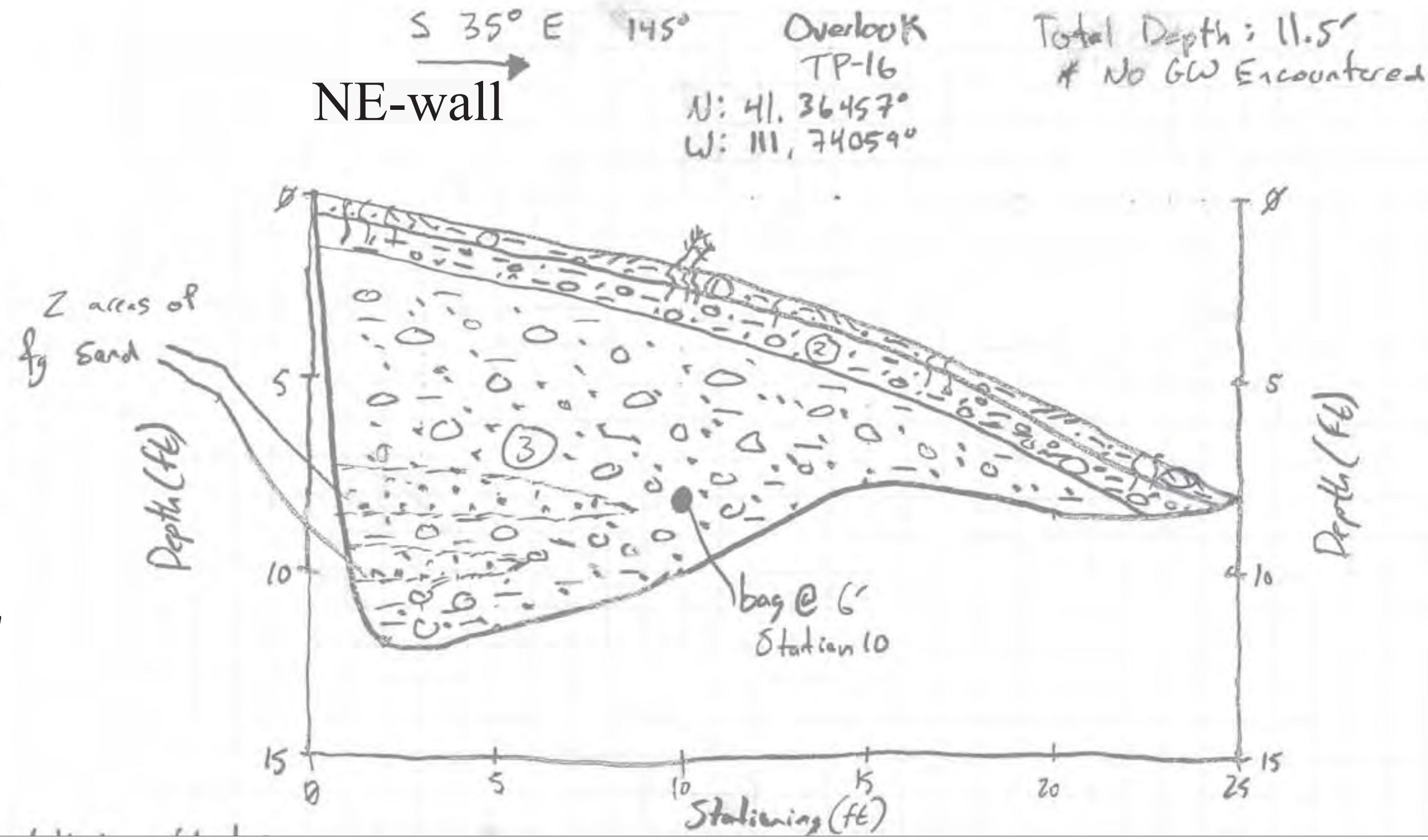
LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~6" thick; light brown (5YR 6/4) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular light gray (N7) and moderate reddish brown (10R 4/6) quartzite up to ~3-4" in diameter, though mode clast size is ~1"; common plant roots; gradational, irregular basal contact.

2. **Colluvium:** ~1' thick; light brown (5YR 6/4) to brownish grey (5YR 4/1) clayey GRAVEL with sand (GC) gradational to sandy lean CLAY with gravel (CL), medium dense, dry to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~40-50% of the unit; clasts are subangular to subrounded quartzite as above up to 3' in diameter, though mode clast size is ~4"; topsoil matrix; common to occasional plant roots; gradational, irregular basal contact.

3. **Wasatch Formation (Tw):** >10.5' thick; moderate reddish brown (10R 4/6) clayey GRAVEL with sand (GC), dense to medium dense, slightly moist to moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~30% of the unit, clasts are subrounded quartzite as above up to 2' in diameter, though mode clast size is ~3"; possibly sandier with depth; typical Wasatch Fm.

Project No. 01628-027 Overlook
Date 8/10/18 by JWB
Ckd by on



1" = 5'
H&V

LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~6"-1' thick; light brown (5YR $\frac{6}{4}$) sandy lean CLAY with gravel (CL), loose, dry, low plasticity, massive; gravel and larger sized clasts comprise ~20% of the unit; clasts are subrounded to subangular light gray (N7) to moderate reddish brown (10R $\frac{4}{6}$) quartzite up to ~1-2' in diameter, though mode clast size ~2-3"; abundant plant roots; gradational, irregular basal contact.

2. **Colluvium:** ~1' thick; grayish brown (5Y $\frac{3}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 1-2' in diameter, though mode clast size is ~2-3"; topsoil matrix; common to abundant plant roots; sharp, irregular basal contact.

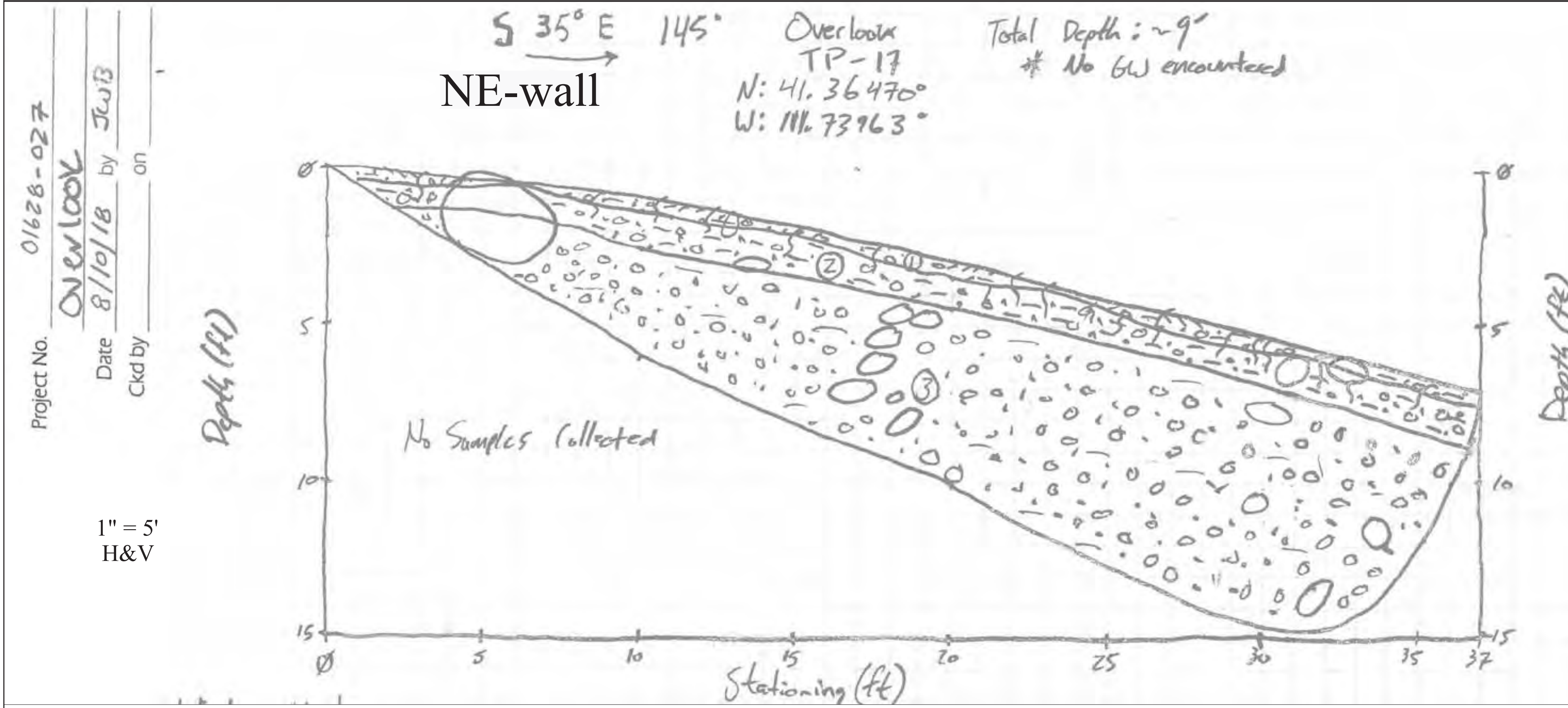
3. **Wasatch Formation (Tw):** >10' thick; moderate pink (5R $\frac{7}{4}$) to pale reddish brown (10R $\frac{5}{4}$) clayey SAND with gravel (SC); medium dense, slightly moist to moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~40% of the unit; clasts are subrounded to subangular quartzite as above and moderate reddish brown (10R $\frac{4}{6}$) to pale yellowish brown (10YR $\frac{6}{2}$) fine grained sandstone clasts, clasts are up to 3.5' in diameter, though the mode clast size is ~1-2"; few plant roots; darker color (moderate reddish brown) when wetted.

IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-16 Log

Figure A-18

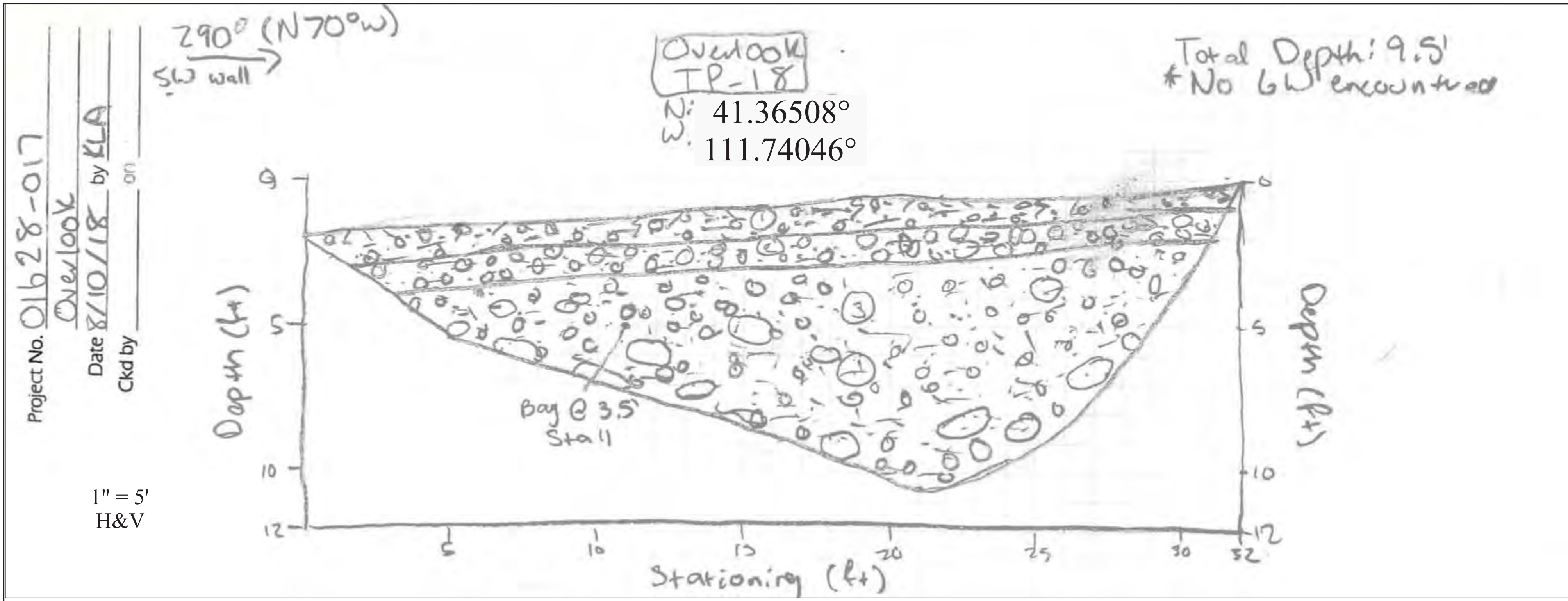


LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~0-6" thick; light brown (5YR $\frac{6}{4}$) sandy lean CLAY with gravel (CL), loose, dry, low plasticity, massive; gravel and larger sized clasts comprise ~20% of the unit; clasts are subrounded to subangular light gray (N7) to moderate reddish brown (10R $\frac{4}{6}$) quartzite up to ~3-4 in diameter, though mode clast size ~2-3"; abundant plant roots; very thin to absent in places; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~1-1.5' thick; grayish brown (5Y $\frac{3}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 3-4' in diameter, though mode clast size is ~4"; topsoil matrix; common to abundant plant roots; sharp, irregular basal contact.

3. <u>Wasatch Formation (Tw):</u> >8' thick; moderate pink (5R $\frac{7}{4}$) to pale reddish brown (10R $\frac{5}{4}$) clayey GRAVEL with sand (GC); medium dense, slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~60% of the unit; clasts are subrounded to subangular quartzite as above, clasts are up to 3-4' in diameter, though the mode clast size is ~3-4"; few plant roots; darker color (moderate reddish brown) when wetted.



LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR 6/4) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 3" in diameter, though mode clast size is ~1/2-1"; abundant plant roots; gradational, irregular basal contact.

2. **Colluvium:** ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 1' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant roots; sharp, planar basal contact.

3. **Wasatch Formation (Tw):** >7.5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey GRAVEL with sand (GC) gradational to sandy lean CLAY with gravel (CL), medium dense to dense, slightly moist to moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~50% of the unit; clasts are subrounded quartzite as above up to 2' in diameter, though mode clast size is ~2-3"; occasional plant roots; where clayier, unit is blocky where clayey due to drying; abundant 1-2mm pinhole voids; sand is fine-grained to medium-grained.

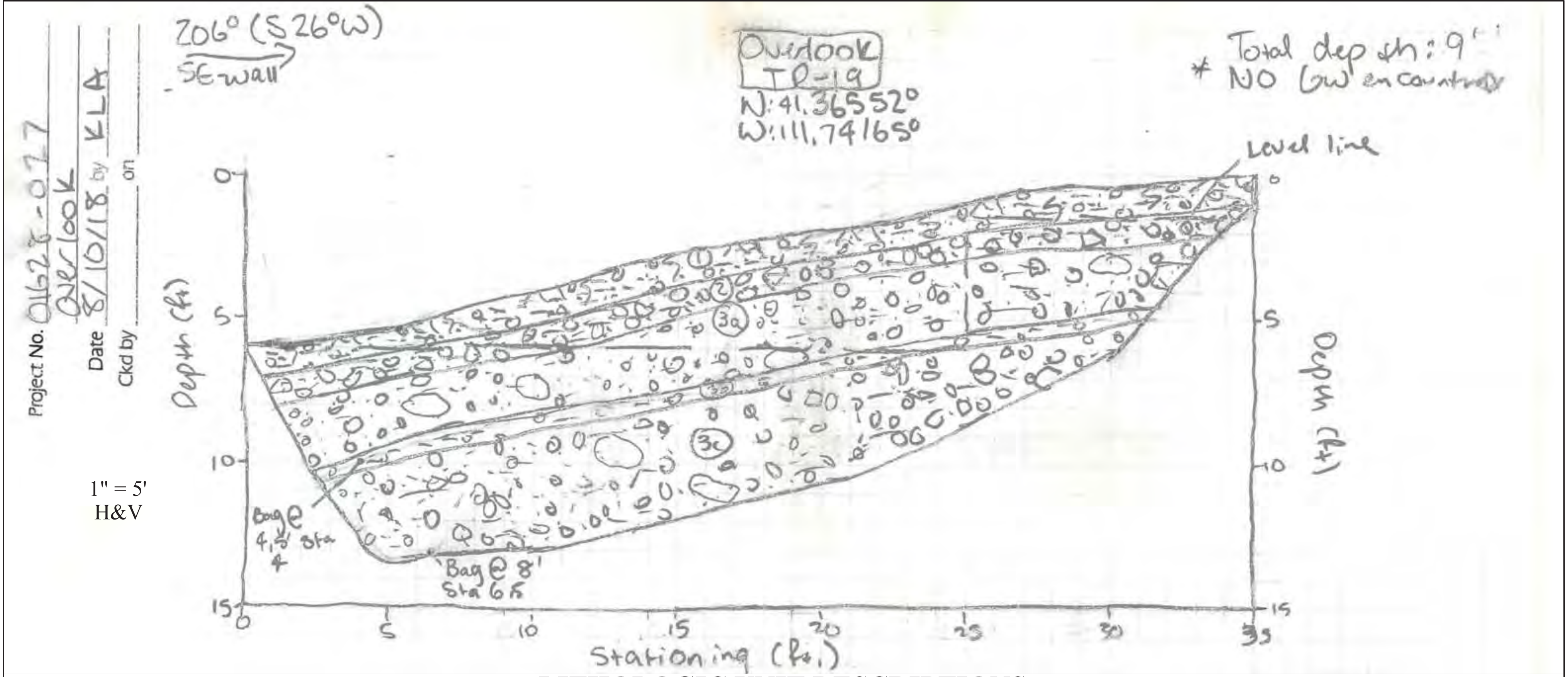
IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-18 Log

Figure

A-20



LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon:</u> ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 3" in diameter, though mode clast size is ~$\frac{1}{2}$-1"; abundant plant and tree roots; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 2' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant and tree roots; sharp, planar basal contact.

3. <u>Wasatch Formation (Tw):</u> >7' thick; 3 sub-units; **3a)**: ~2.5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC) gradational to sandy lean CLAY with gravel (CL) loose to medium dense; slightly moist to moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~50% of the unit, clasts are subrounded quartzite as above up to 3' in diameter, though mode clast size is ~3"; abundant 1-2 mm pinhole voids; typical Wasatch Fm. **<u>3b)</u>:** ~6" thick; moderate reddish brown (10R $\frac{4}{6}$) lean CLAY with gravel (CL); medium stiff, moist, medium plasticity, massive; gravel and larger sized clasts comprise ~5-10% of the unit; clasts are subrounded to subangular medium grey (N5) to light brown (5YR $\frac{6}{4}$) quartzite as above, clasts are up to 0.5" in diameter, the mode clast size is ~0.5"; abundant tree roots; sharp, planar basal contact. **<u>3c)</u>:** >4' thick; moderate reddish brown (10R $\frac{4}{6}$) mottled with very pale orange (10YR $\frac{8}{2}$) clayey SAND with gravel (SC); medium dense, moist, low to medium plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular quartzite as above plus dark yellowish orange (10YR $\frac{6}{6}$) sandstone, clasts are up to 1.5' in diameter, though the mode clast size is ~2-3"; occasional plant roots; sand is fine to medium grained.

IGES®

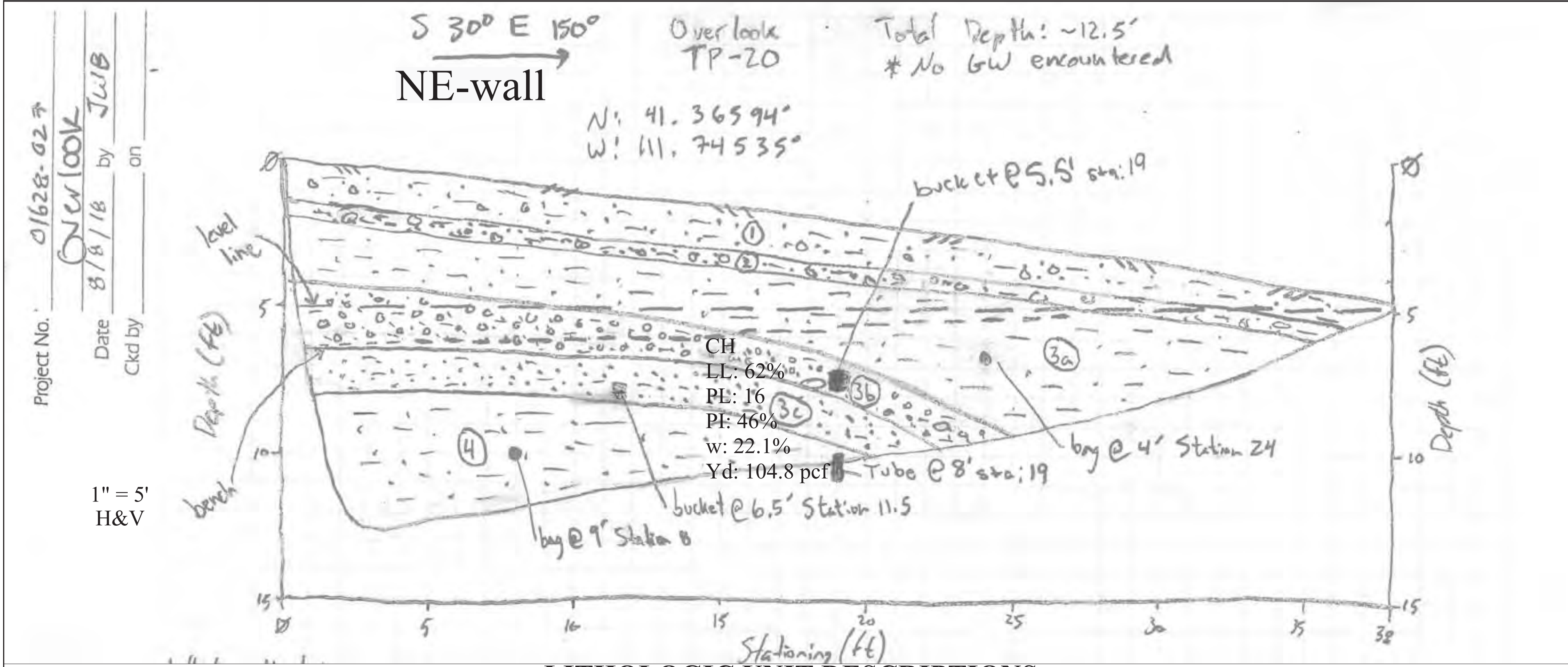
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-19 Log

Figure

A-21



LITHOLOGIC UNIT DESCRIPTIONS

1. <u>A/B Soil Horizon</u>: ~1-2' thick; light brown (5YR 6/4) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-15% of the unit; clasts are subrounded to subangular light gray (N7) to moderate reddish brown (10R 4/6) quartzite up to ~7' in diameter at the surface, though mode clast size ~0.5-1"; common plant roots; gradational, irregular basal contact.

2. <u>Colluvium:</u> ~6" thick; moderate reddish brown (10R 4/6) sandy lean CLAY with gravel (CL), medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~30% of the unit; clasts are subrounded to subangular quartzite as above up to 18" in diameter, though mode clast size is ~3-4"; occasional plant roots; gradational, irregular basal contact.

3.<u>Wasatch Formation (Tw)</u>: ~6' thick; 3 subunits; **<u>3a)</u>:** ~2.5-3.5' thick; moderate reddish brown (10R 4/6) to dark reddish brown (10R 3/4) sandy lean CLAY (CL); medium stiff, dry to slightly moist, low to medium plasticity, massive; devoid of clasts; common plant roots; blocky fracture pattern (due to drying out?); possible pinhole voids but likely root traces; gradational, irregular basal contact. **<u>3b)</u>:** ~1.5-2' thick; moderate reddish brown to dark reddish brown clayey GRAVEL with sand (GC) dense to very dense, moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~50% of the unit, clasts are subrounded to subangular quartzite as above plus dark reddish brown (10R 3/4) fine grained sandstone, up to 8" in diameter, mode <0.5"; sharp, planar basal contact. **<u>3c)</u>:** ~1.5-2 thick; dark reddish brown (10R 3/4) clayey SAND (SC); medium dense, moist, medium plasticity, possible planar bedding observed; devoid of clasts; common plant roots; blocky fracture pattern (due to drying out?); black (N1) MnO2? layers along bedding; few plant roots; sharp, planar basal contact.

4. <u>Clay Seam</u>: >4.5' thick; moderate reddish brown (10R 4/6) sandy fat CLAY with gravel (CH), stiff to very stiff, moist, moderate to high plasticity, massive; devoid of clasts.

IGES®

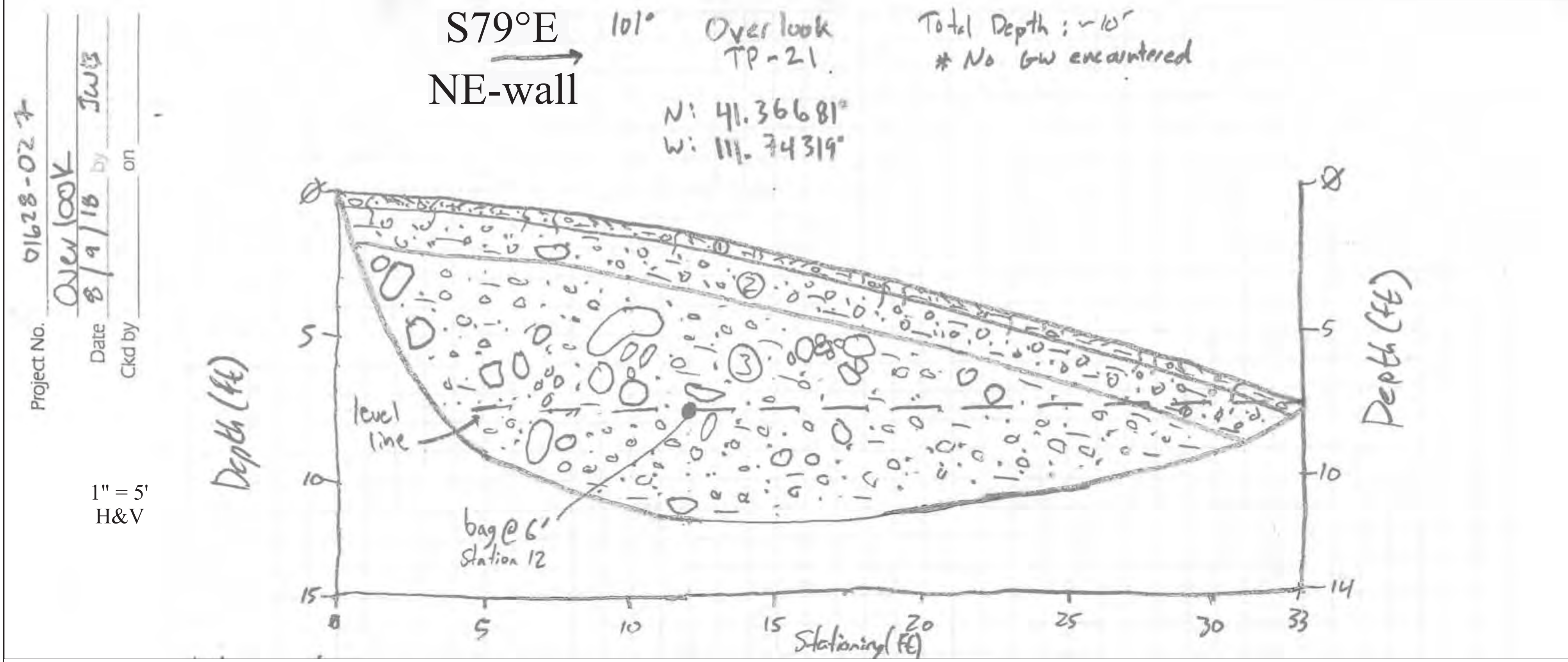
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-20 Log

Figure

A-22



LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~6-8” thick; light brown (5YR $\frac{6}{4}$) sandy lean CLAY with gravel (CL), loose, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular light gray (N7) and moderate reddish brown (10R $\frac{4}{6}$) quartzite up to 4-5' in diameter, though mode clast size is <0.5”; abundant plant roots; gradational, irregular basal contact.

2. Colluvium: ~1-2' thick; light brown (5YR 6/4) to brownish grey (5YR $\frac{4}{1}$) clayey GRAVEL with sand (GC) gradational to sandy lean CLAY with gravel (CL), medium dense, dry to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~40-50% of the unit; clasts are subangular to subrounded quartzite as above up to 3' in diameter, though mode clast size is ~4”; topsoil matrix; common to common plant roots; gradational, irregular basal contact.

3. Wasatch Formation (Tw): >8' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey GRAVEL with sand (GC) gradational to clayey SAND with gravel (SC), dense, slightly moist to moist, medium plasticity fines, massive; gravel and larger sized clasts comprise ~50% of the unit, clasts are subrounded quartzite as above up to 3' in diameter, though mode clast size is a bi-modal distribution of ~1-3' and 2-3"; typical Wasatch Fm.

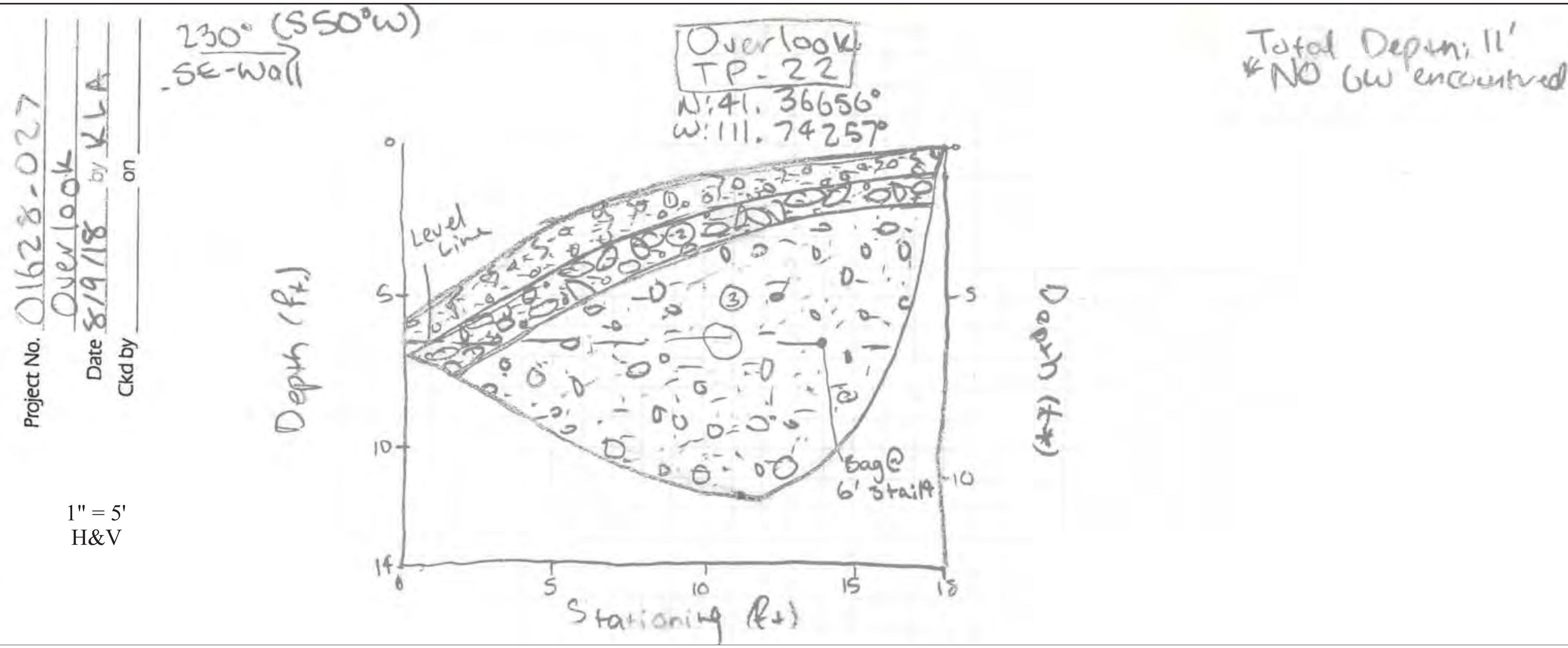
IGES®

Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-21 Log

Figure A-23



1" = 5'
H&V

LITHOLOGIC UNIT DESCRIPTIONS

1. A/B Soil Horizon: ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~10-20% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 3" in diameter, though mode clast size is ~$\frac{1}{2}$-1"; abundant plant roots; gradational, irregular basal contact.

2. Colluvium: ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subrounded to subangular quartzite as above up to 3' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant roots; sharp, planar basal contact.

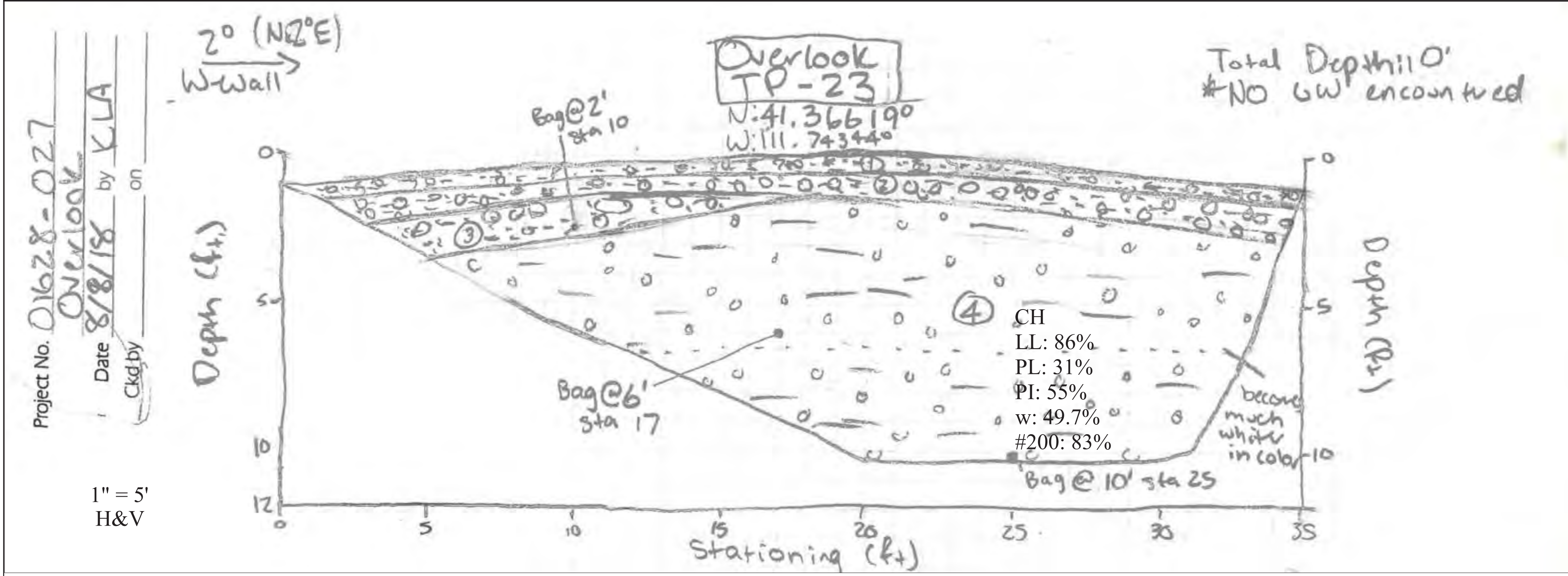
3. Wasatch Formation (Tw): >8.5' thick; moderate reddish brown (10R $\frac{4}{6}$) clayey SAND with gravel (SC), medium dense, moist, low to moderate plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the subunit; clasts are subrounded to subangular quartzite as above, clasts are up to 1.5' in diameter, though mode clast size is ~2-3"; occasional plant roots; abundant 1-2 mm pinhole voids, sand is fine-grained to medium-grained.

IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

TP-22 Log

Figure A-24



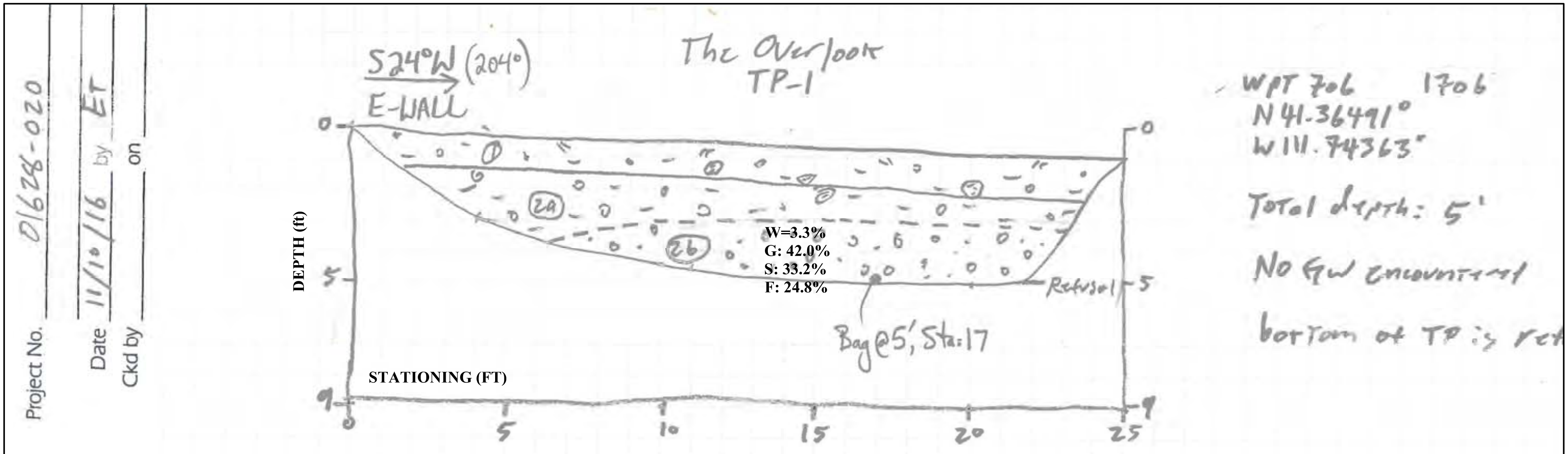
LITHOLOGIC UNIT DESCRIPTIONS

1. **A/B Soil Horizon:** ~6" thick; moderate brown (5YR $\frac{4}{4}$) sandy lean CLAY with gravel (CL), loose to medium stiff, moist, low plasticity, massive; gravel and larger sized clasts comprise ~10% of the unit; clasts are subrounded to subangular light brown (5YR $\frac{6}{4}$) to moderate orange pink (10R $\frac{7}{4}$) quartzite up to 2" in diameter, though mode clast size is ~0.5-1"; abundant plant roots; gradational, planar basal contact.

2. **Colluvium:** ~1' thick; pale yellowish brown (10YR $\frac{6}{2}$) sandy lean CLAY with gravel (CL), loose to medium stiff, dry, low plasticity, massive; gravel and larger sized clasts comprise ~20-30% of the unit; clasts are subrounded to subangular quartzite as above up to 1.5' in diameter, though mode clast size is ~2-3"; topsoil matrix; abundant plant and tree roots; sharp, planar basal contact.

3. **Landslide Deposit? (Qls?)**: ~1.5' thick; moderate reddish orange (10R $\frac{6}{6}$) clayey SAND with gravel (SC), medium dense, dry to slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise ~30-35% of the unit; clasts are subrounded to subangular moderate orange pink (10R $\frac{7}{4}$) to medium gray (N5) moderate reddish orange (10R $\frac{6}{6}$) sandstone and quartzite as above up to 6" in diameter, though the mode clast size is ~2-3"; common plant roots; basal light gray coloring; sharp, angular basal contact.

4. **Highly Weathered Calls Fort Shale**: >9' thick; moderate reddish orange (10R $\frac{6}{6}$) mottled with greyish orange pink (10R $\frac{8}{2}$) gravely fat CLAY (CH), medium stiff to stiff, slightly moist, medium plasticity, massive; gravel and larger sized clasts comprise ~30-40% of the unit; clasts are subangular to angular moderate reddish orange (10R $\frac{6}{6}$) shale up to 2" in diameter, though mode clast size is ~0.5-1"; occasional plant roots; clasts are soft and fall apart easily, clasts increase in occurrence with depth; short and discontinuous slickensides (mechanically induced), cracked and blocky when dried out; gradational to white (N9) to light grey (N7) in color with depth; clasts in white (N9) clay at depth are light grey (N7), clasts are similar in size and sorting throughout unit; mechanically induced slickensides about 6" long; becomes crumbly when drier; mottled with moderate reddish orange (10R $\frac{6}{6}$) spots in whiter clay.



LITHOLOGIC UNIT DESCRIPTIONS:

1) **A/B Soil Horizon:** ~1' thick; dark yellowish brown (10YR 4/2) sandy lean CLAY with gravel (CL), loose, moist, low to moderate plasticity, massive; gravel and larger sized clasts comprise ~15-20% of unit; clasts entirely subangular quartzite up to 10" in diameter, though mode size 1-2"; abundant plant and tree roots; gradational, irregular basal contact.

2) **Wasatch Formation:** At least ~4' thick; contains 2 subunits:

2a: Highly Weathered Wasatch Formation: ~1-2' thick; dark reddish brown (10R ¾) to grayish brown (5Y 3/2) sandy fat CLAY with gravel (CH), medium-stiff, moist, moderate to high plasticity, massive; gravel and larger sized clasts comprise ~20% of subunit; clasts include ~70% subangular to subrounded quartzite and ~30% subangular to subrounded sandstone up to 7" in diameter, though mode size ~1-2"; occasional plant and tree roots; sharp, irregular basal contact.

2b: Competent Bedrock: At least ~2' thick; conglomerate bedrock disaggregated to moderate reddish brown (10R 4/6) to dark reddish brown (10R ¾) to pale reddish brown (10R 5/4) clayey GRAVEL with sand (GC) gradational to clayey SAND with gravel (SC), very dense, slightly moist, low plasticity fines, massive; gravel and larger sized clasts comprise 42% of subunit; clasts entirely subangular quartzite up to 5" in diameter, though mode size ~1"; subunit produced trackhoe refusal.

SCALE: 1"=5' H&V

IGES®

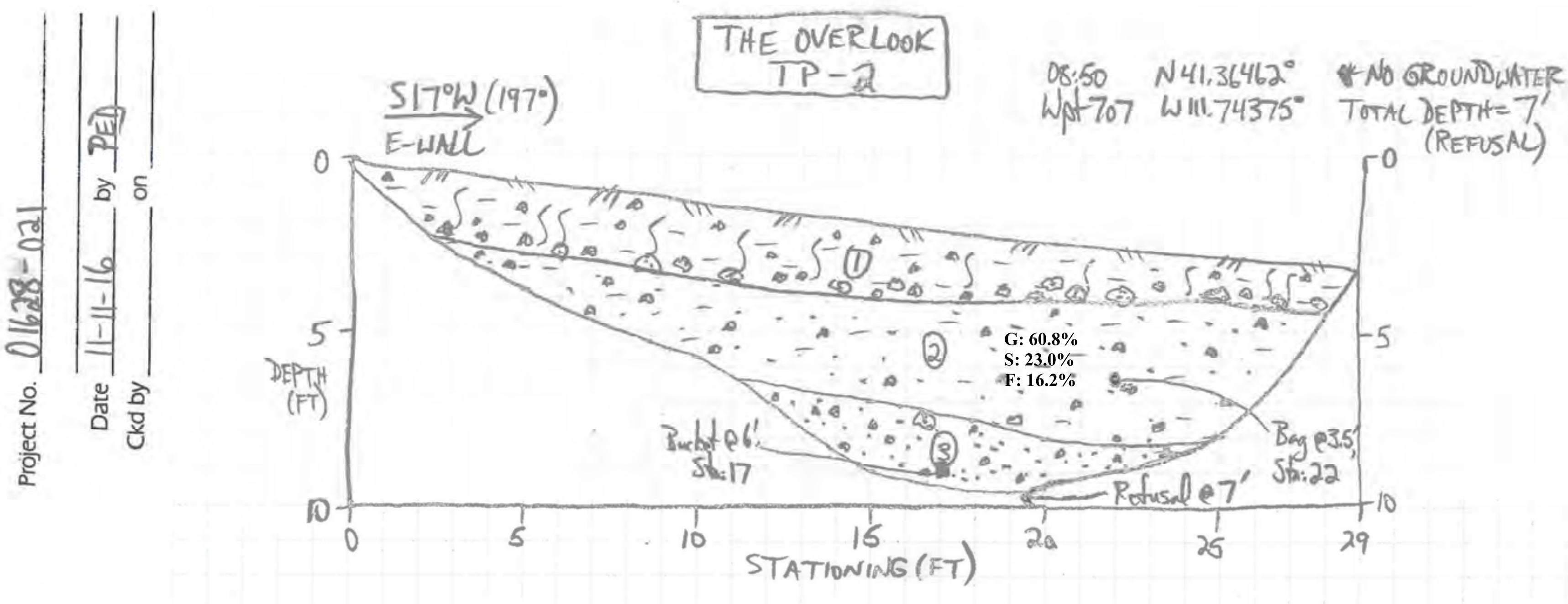
Project No. 01628-021

Geotechnical & Geologic Hazard Investigation
The Overlook - Phase I
Summit Powder Mountain Resort
Weber County, Utah

TEST PIT LOG TP-1-17

Figure

A-26



LITHOLOGIC UNIT DESCRIPTIONS:

1) **A/B Soil Horizon:** ~1.5-2' thick; grayish brown (5Y 3/2) to dark yellowish brown (10YR 4/2) lean CLAY with gravel (CL), loose to medium-stiff, moist, low plasticity, massive; gravel and larger sized clasts comprise ~15-20% of unit; clasts entirely medium gray (N5) subrounded to subangular quartzite up to 7" in diameter, though mode size ~2-4"; basal ~6" is highly cobbly and may represent a thin, loose colluvium unit with topsoil matrix; abundant plant and tree roots; sharp, planar basal contact.

2) **Weathered Wasatch Formation:** ~3-4' thick; brownish gray (5YR 4/1) to moderate reddish brown (10R 4/6) clayey GRAVEL with sand (GC), medium-dense, moist, low plasticity, massive; gravel and larger sized clasts comprise ~61% of unit; clasts entirely subrounded to subangular medium gray (N5) to pale yellowish orange (10YR 8/6) quartzite up to 6" in diameter, though mode size ~2-4"; common plant and tree roots; becomes redder and more competent with depth; sharp, irregular basal contact.

3) **Wasatch Formation:** At least ~2' thick; competent conglomerate bedrock, partially disaggregated to light gray (N7) to pale reddish brown (10R 5/4) gravelly SAND (SW) gradational to sandy GRAVEL (GW), very dense to dense, slightly moist to dry, massive to weakly bedded; gravel and larger sized clasts comprise ~40-50% of unit; clasts entirely quartzite as above up to 5" in diameter, though mode size <1"; well-cemented, and close to original conglomerate bedrock; unit caused trackhoe refusal.

SCALE: 1"=5' H&V

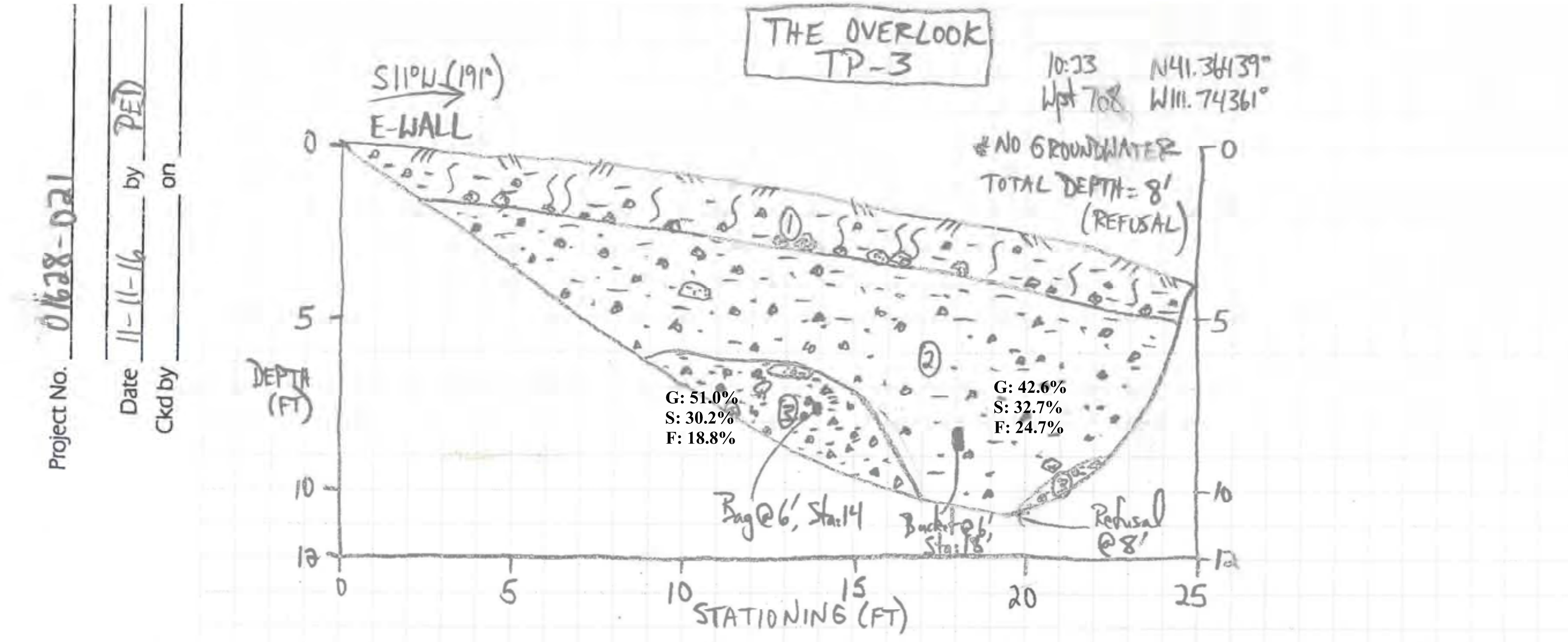
IGES®

Project No. 01628-021

Geotechnical & Geologic Hazard Investigation
The Overlook - Phase I
Summit Powder Mountain Resort
Weber County, Utah

TEST PIT LOG TP-2-17

Figure A-27



LITHOLOGIC UNIT DESCRIPTIONS:

1) **A/B Soil Horizon:** ~1.5-2' thick; grayish brown (5Y 3/2) to dark yellowish brown (10YR 4/2) lean CLAY with gravel (CL), loose to medium-stiff, moist, low plasticity, massive; gravel and larger sized clasts comprise ~15-20% of unit; clasts entirely medium gray (N5) subrounded to subangular quartzite up to 10" in diameter, though mode size ~2-4"; basal ~6" is highly cobbly and may represent a thin, loose colluvium unit with topsoil matrix; cobbles within thin colluvial horizon comprise ~30-35% of basal 6"; abundant plant and tree roots; sharp, largely planar basal contact.

2) **Weathered Wasatch Formation:** ~2.5-4.5' thick; moderate reddish brown (10R 4/6) to brownish gray (5YR 4/1) to dark reddish brown (10R ¾) clayey GRAVEL with sand (GC), medium-dense to dense, moist, low plasticity, massive; gravel and larger sized clasts comprise ~43% of unit; clasts entirely subrounded to subangular medium gray (N5) to purple quartzite up to 1' in diameter, though mode size ~2-3"; sand is medium-grained; becomes denser and coarser with depth; uppermost ~1' is brownish gray, and unit increases in red color with depth which may reflect transition from partially weathered to largely unaltered bedrock; occasional to common plant roots; sharp, wavy basal contact may simply reflect moisture content, as irregular shape is not seen on west wall of test pit but simply a planar contact.

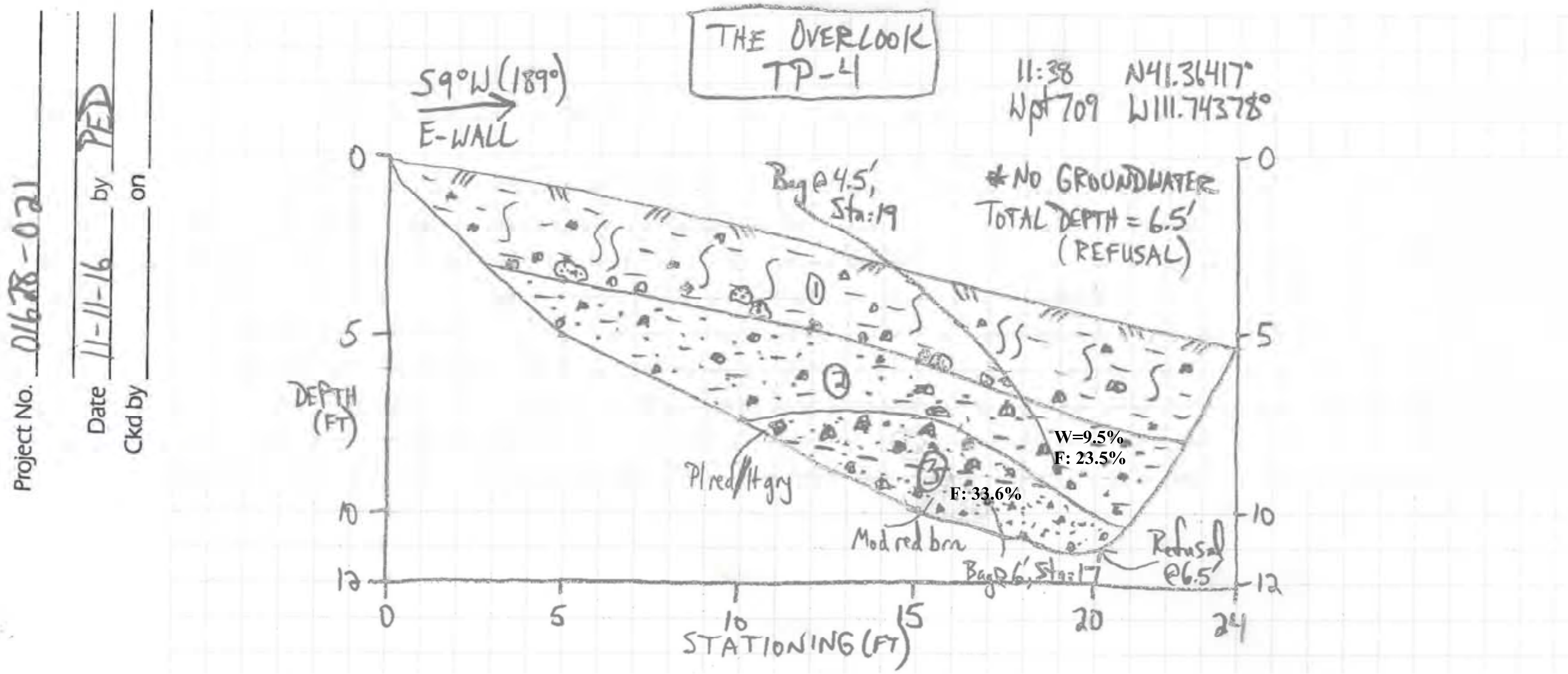
3) **Wasatch Formation:** At least ~2.5' thick; competent conglomerate bedrock, partially disaggregated to pale reddish brown (10R 5/4) to moderate reddish brown (10R 4/6) to light gray (N7) clayey GRAVEL with sand (GC), very dense, slightly moist to dry, low plasticity, massive; gravel and larger sized clasts comprise 51% of unit; clasts entirely quartzite as above up to 9" in diameter, though mode size <1"; well-cemented, and close to original conglomerate bedrock; sand is fine-grained; gradational between matrix-supported and clast-supported; unit caused trackhoe refusal.

SCALE: 1"=5' H&V

IGES®
Project No. 01628-021

Geotechnical & Geologic Hazard Investigation
The Overlook - Phase I
Summit Powder Mountain Resort
Weber County, Utah
TEST PIT LOG TP-3-17

Figure
A-28



LITHOLOGIC UNIT DESCRIPTIONS:

1) **A/B Soil Horizon:** ~2.5-3' thick; grayish brown (5Y 3/2) to dark yellowish brown (10YR 4/2) lean CLAY with gravel (CL), loose to medium-stiff, moist, low plasticity, massive; gravel and larger sized clasts comprise ~10-15% of unit; clasts entirely medium gray (N5) to pale yellowish orange (10YR 8/6) subrounded to subangular quartzite up to 10" in diameter, though mode size ~2-4"; basal ~6"-1' is a possible thin, loose colluvium unit with topsoil matrix; cobbles within thin colluvial horizon comprise ~25% of basal 6"-1' of unit; abundant plant and tree roots; gradational, planar basal contact.

2) **Weathered Wasatch Formation:** ~2' thick; moderate reddish brown (10R 4/6) to brownish gray (5YR 4/1) clayey GRAVEL with sand (GC), medium-dense to dense, moist, low plasticity, massive; gravel and larger sized clasts comprise ~40% of unit; clasts entirely quartzite as above up to 5" in diameter, though mode size <1"; becomes denser and coarser with depth; grades with depth to largely unaltered Wasatch Formation; common plant and tree roots; sharp, irregular basal contact.

3) **Wasatch Formation:** At least ~3' thick; competent conglomerate bedrock, partially disaggregated to pale reddish brown (10R 5/4) to moderate reddish brown (10R 4/6) to light gray (N7) clayey GRAVEL with sand (GC), very dense, slightly moist to dry, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of unit; clasts entirely quartzite as above up to 7" in diameter, though mode size <1"; occasional pinholes (1 mm diameter); generally well-cemented, and close to original conglomerate bedrock; some clasts appear imbricated downslope and unit may have faint bedding downslope; occasional plant roots; unit caused trackhoe refusal.

SCALE: 1"=5' H&V

IGES®

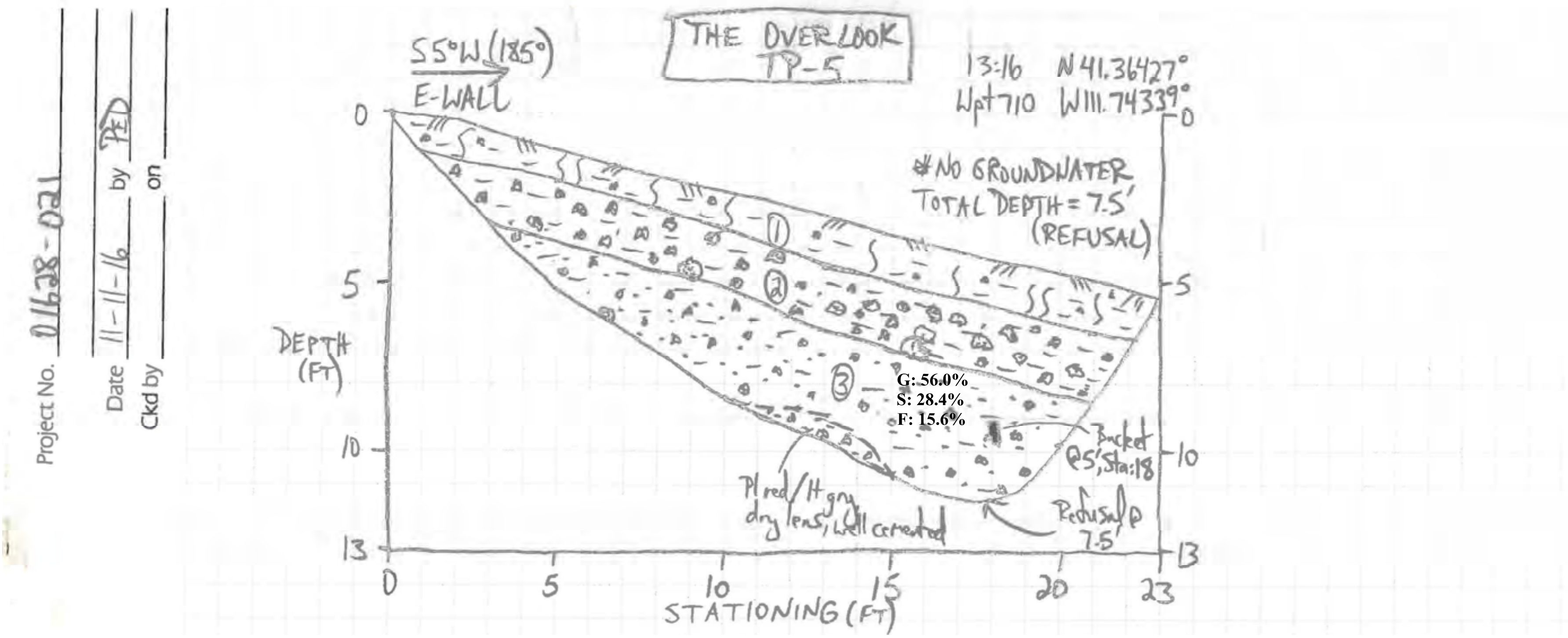
Project No. 01628-021

Geotechnical & Geologic Hazard Investigation
The Overlook - Phase I
Summit Powder Mountain Resort
Weber County, Utah

TEST PIT LOG TP-4-17

Figure

A-29



LITHOLOGIC UNIT DESCRIPTIONS:

1) **A/B Soil Horizon:** ~1-1.5' thick; grayish brown (5Y 3/2) lean CLAY with gravel (CL), loose to medium-stiff, moist, low plasticity, massive; gravel and larger sized clasts comprise ~10% of unit; clasts entirely medium gray (N5) to pale yellowish orange (10YR 8/6) subrounded to subangular quartzite up to 4" in diameter, though mode size ~1"; abundant plant and tree roots; largely gradational, planar basal contact.

2) **Loose Colluvium:** ~2-2.5' thick; grayish brown (5Y 3/2) gravelly lean CLAY with sand (CL), medium-stiff to loose, moist, low plasticity, massive; gravel and larger sized clasts comprise ~30-40% of unit; clasts entirely quartzite as above up to 8" in diameter, though mode size ~4-6"; topsoil matrix; abundant plant and tree roots; sharp, irregular basal contact.

3) **Wasatch Formation:** At least ~3.5' thick; competent conglomerate bedrock, partially disaggregated to moderate reddish brown (10R 4/6) to dark reddish brown (10R ¾) clayey GRAVEL with sand (GC), very dense to dense, moist to slightly moist, low plasticity, massive; gravel and larger sized clasts comprise 56% of unit; clasts entirely quartzite as above up to 6" in diameter, though mode size ~2-4"; loamy; largely well-cemented, very hard, and close to original conglomerate bedrock; sand is fine-grained to medium-grained; occasional plant roots; unit caused trackhoe refusal.

SCALE: 1"=5' H&V

IGES®

Project No. 01628-021

Geotechnical & Geologic Hazard Investigation
The Overlook - Phase I
Summit Powder Mountain Resort
Weber County, Utah

TEST PIT LOG TP-5-17

Figure

A-30

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

LOG KEY SYMBOLS

BORING SAMPLE LOCATION

TEST-PIT SAMPLE LOCATION

WATER LEVEL (level after completion)

WATER LEVEL (level where first encountered)

CEMENTATION

DESCRIPTION	DESCRIPTION
WEAKELY	CRUMBLES OR BREAKS WITH HANDLING OR SLIGHT FINGER PRESSURE
MODERATELY	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE
STRONGLY	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE

OTHER TESTS KEY

C	CONSOLIDATION	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	DS	DIRECT SHEAR
UC	UNCONFINED COMPRESSION	T	TRIAXIAL
S	SOLUBILITY	R	RESISTIVITY
O	ORGANIC CONTENT	RV	R-VALUE
CBR	CALIFORNIA BEARING RATIO	SU	SOLUBLE SULFATES
COMP	MOISTURE/DENSITY RELATIONSHIP	PM	PERMEABILITY
CI	CALIFORNIA IMPACT	-200	% FINER THAN #200
COL	COLLAPSE POTENTIAL	Gs	SPECIFIC GRAVITY
SS	SHRINK SWELL	SL	SWELL LOAD

MODIFIERS

DESCRIPTION	%
TRACE	<5
SOME	5 - 12
WITH	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER, USUALLY SOIL BELOW WATER TABLE

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
2. No warranty is provided as to the continuity of soil conditions between individual sample locations.
3. Logs represent general soil conditions observed at the point of exploration on the date indicated.
4. In general, Unified Soil Classification designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2"
LAYER	1/2 - 12"

DESCRIPTION	THICKNESS
OCCASIONAL	ONE OR LESS PER FOOT OF THICKNESS
FREQUENT	MORE THAN ONE PER FOOT OF THICKNESS

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT (blows/ft)	MODIFIED CA. SAMPLER (blows/ft)	CALIFORNIA SAMPLER (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
VERY LOOSE	<4	<4	<5	0 - 15	EASILY PENETRATED WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
LOOSE	4 - 10	5 - 12	5 - 15	15 - 35	DIFFICULT TO PENETRATE WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
MEDIUM DENSE	10 - 30	12 - 35	15 - 40	35 - 65	EASILY PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
DENSE	30 - 50	35 - 60	40 - 70	65 - 85	DIFFICULT TO PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
VERY DENSE	>50	>60	>70	85 - 100	PENETRATED ONLY A FEW INCHES WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER

CONSISTENCY - FINE-GRAINED SOIL

		TORVANE	POCKET PENETROMETER	FIELD TEST
CONSISTENCY	SPT (blows/ft)	UNTRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	
VERY SOFT	<2	<0.125	<0.25	EASILY PENETRATED SEVERAL INCHES BY THUMB. EXUDES BETWEEN THUMB AND FINGERS WHEN SQUEEZED BY HAND.
SOFT	2 - 4	0.125 - 0.25	0.25 - 0.5	EASILY PENETRATED ONE INCH BY THUMB. MOLDED BY LIGHT FINGER PRESSURE.
MEDIUM STIFF	4 - 8	0.25 - 0.5	0.5 - 1.0	PENETRATED OVER 1/2 INCH BY THUMB WITH MODERATE EFFORT. MOLDED BY STRONG FINGER PRESSURE.
STIFF	8 - 15	0.5 - 1.0	1.0 - 2.0	INDENTED ABOUT 1/2 INCH BY THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.
VERY STIFF	15 - 30	1.0 - 2.0	2.0 - 4.0	READILY INDENTED BY THUMBNAIL.
HARD	>30	>2.0	>4.0	INDENTED WITH DIFFICULTY BY THUMBNAIL.

KEY TO SOIL SYMBOLS AND TERMINOLOGY

Project No. **01628-027**
Engr. **DAG**
Drafted By **DAG**
Date **October 2018**

IGES
Intermountain Geo-Environmental Services, Inc.

Figure A-31

Rock Classification Should Include:	
1.	Rock name (or classification)
2.	Color
3.	Weathering
4.	Fracturing
5.	Competency
6.	Additional comments indicating rock characteristics which might affect engineering properties

Weathering

Weathering	Field Test
Fresh	No visible sign of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	Slight discoloration inwards from open fractures, otherwise similar to Fresh.
Moderately Weathered	Discoloration throughout. Weaker minerals such as feldspar are decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped with a knife. Texture preserved.
Highly Weathered	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with a knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	Minerals decomposed to soil but fabric and structure preserved. Specimens easily crumble or penetrated.

Fracturing

Spacing	Description
>6 ft	Very Widely
2-6 ft	Widely
8-24 in	Moderately
2 ½-8 in	Closely
¾-2 ½ in	Very Closely

Bedding of Sedimentary Rocks

Splitting Property	Thickness	Stratification
Massive	>4.0 ft	Very thick bedded
Blocky	2.0-4.0 ft	Thick-bedded
Slabby	2 ½-24 in	Thin-bedded
Flaggy	½-2 ½ in	Very thin-bedded
Shaly or platy	⅛ – ½ in	Laminated
Papery	< ⅛ in	Thinly laminated

RQD

RQD (%)	Rock Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

Competency

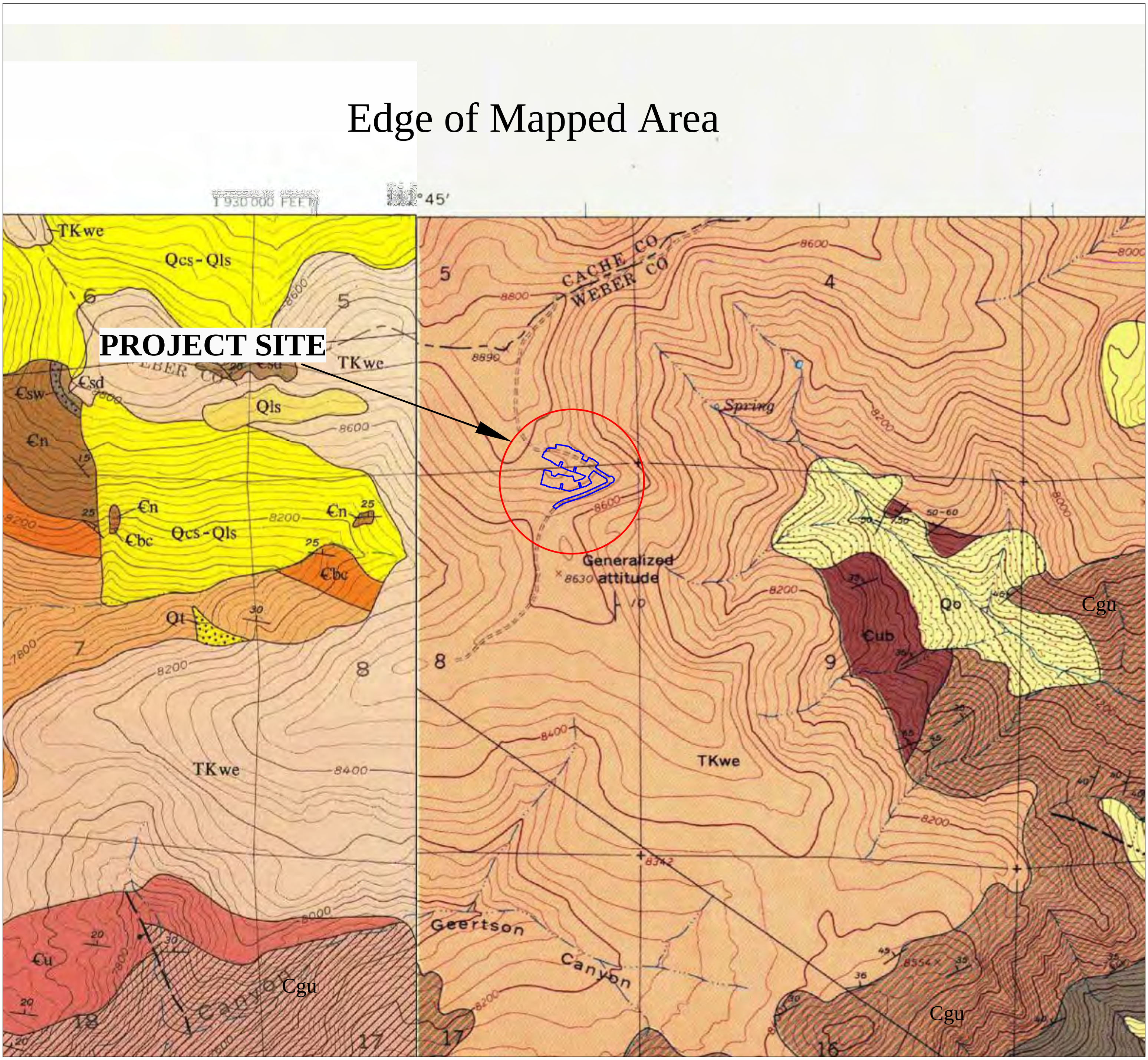
Class	Strength	Field Test	Approximate Range of Unconfined Compressive Strength (tsf)
I	Extremely Strong	Many blows with geologic hammer required to break intact specimen.	>2000
II	Very Strong	Hand-held specimen breaks with pick end of hammer under more than one blow.	2000-1000
III	Strong	Cannot by scraped or peeled with knife, hand-held specimen can be broken with single moderate blow with pick end of hammer	1000-500
IV	Moderately Strong	Can just be scraped or peeled with knife. Indentations 1-3 mm show in specimen with moderate blow with pick end of hammer.	500-250
V	Weak	Material crumbles under moderate blow with pick end of hammer and can be peeled with a knife, but is hard to hand-trim for triaxial test specimen.	250-10
VI	Friable	Material crumbles in hand.	N/A

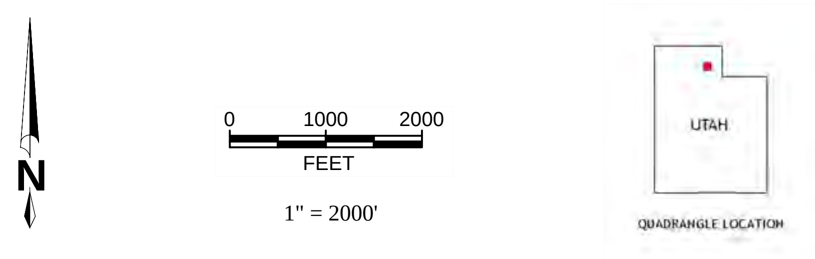
KEY TO PHYSICAL ROCK PROPERTIES

Project No. 01628-027
Engr. DAG
Drafted By DAG
Date October 2018

IGES
Intermountain Geo-Environmental Services, Inc.

Figure A-32





Base Maps:

-USGS *Huntsville Quadrangle*, 1:24,000 scale, map GQ-1503, Sorensen and Crittenden (1979)

-USGS *Brown's Hole Quadrangle*, 1:24,000 scale, map GQ-968, Crittenden (1979)

IGES®

Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Regional Geology Map 1

Figure

A-33a

MAP LEGEND

Qal	**ALLUVIAL DEPOSITS, UNDIFFERENTIATED** (Holocene) – Unconsolidated gravel, sand, and silt deposits in presently active stream channels and floodplains; thickness 0-6 m
Qcs	**COLLUVIUM AND SLOPEWASH** (Holocene) – Bouldery colluvium and slopewash chiefly along eastern margin of Ogden Valley; in part, lag from Tertiary units; thickness 0-30 m
Qf	**ALLUVIAL FAN DEPOSITS** (Holocene) – Alluvial fan deposits; postdate, at least in part, time of highest stand of former Lake Bonneville; thickness 0-30 m
Qls	**LANDSLIDE DEPOSITS** (Holocene) – thickness 0-6 m
Qt	**TALUS DEPOSITS** (Holocene) – thickness 0-6 m
TKwe	**WASATCH AND EVANSTON(?) FORMATIONS, UNDIVIDED** (Eocene, Paleocene, and Upper Cretaceous?) – Unconsolidated pale-reddish-brown pebble, cobble, and boulder conglomerate; forms boulder-covered slopes. Clasts are mainly Precambrian quartzite and are tan, gray, or purple; matrix is mainly poorly consolidated sand and silt; thickness 0-150 m

St. Charles Limestone (Upper Cambrian) Includes:

€sd	Dolomite member – See above
€sw	Worm Creek Quartzite Member – See above
€n	**NOUNAN DOLOMITE** – See above
€bc	**CALLS FORT SHALE MEMBER OF BLOOMINGTON FORMATION** – See above
€lu	**CAMBRIAN LIMESTONES, UNDIVIDED** (Middle Cambrian) – Includes limestone and Hodges Shale Members of Bloomington Formation, and Blacksmith and Ute Limestones
€b	**BLACKSMITH LIMESTONE** (Middle Cambrian)) – Medium- to thin-bedded, light-gray to dark-blue-gray limestone; thin-bedded, flaggy-weathering, gray to tan silty limestone and interbedded siltstone; light- to dark-gray dolomite, with some reddish siliceous partings; thickness 400? m

MAP LEGEND

€u — **UTE LIMESTONE** (Middle Cambrian) – Medium- to thin-bedded, finely crystalline, light- to dark-gray silty limestone with irregular wavy partings, mottled and streaked surfaces, worm tracks, and twiggy structures common throughout unit; oolites and *Girvanella* in many beds; olive-drab fissile shale interbedded throughout unit. Includes thin-bedded, gray-weathering, pale-tan to brown dolomite exposed at base of unit, 18-24 m at head of Geertsen Canyon and 0-3 m elsewhere; thickness 245? m

BRIGHAM GROUP (Crittenden and others, 1971) – Includes:

GEERTSEN CANYON QUARTZITE (Lower Cambrian) – Includes:

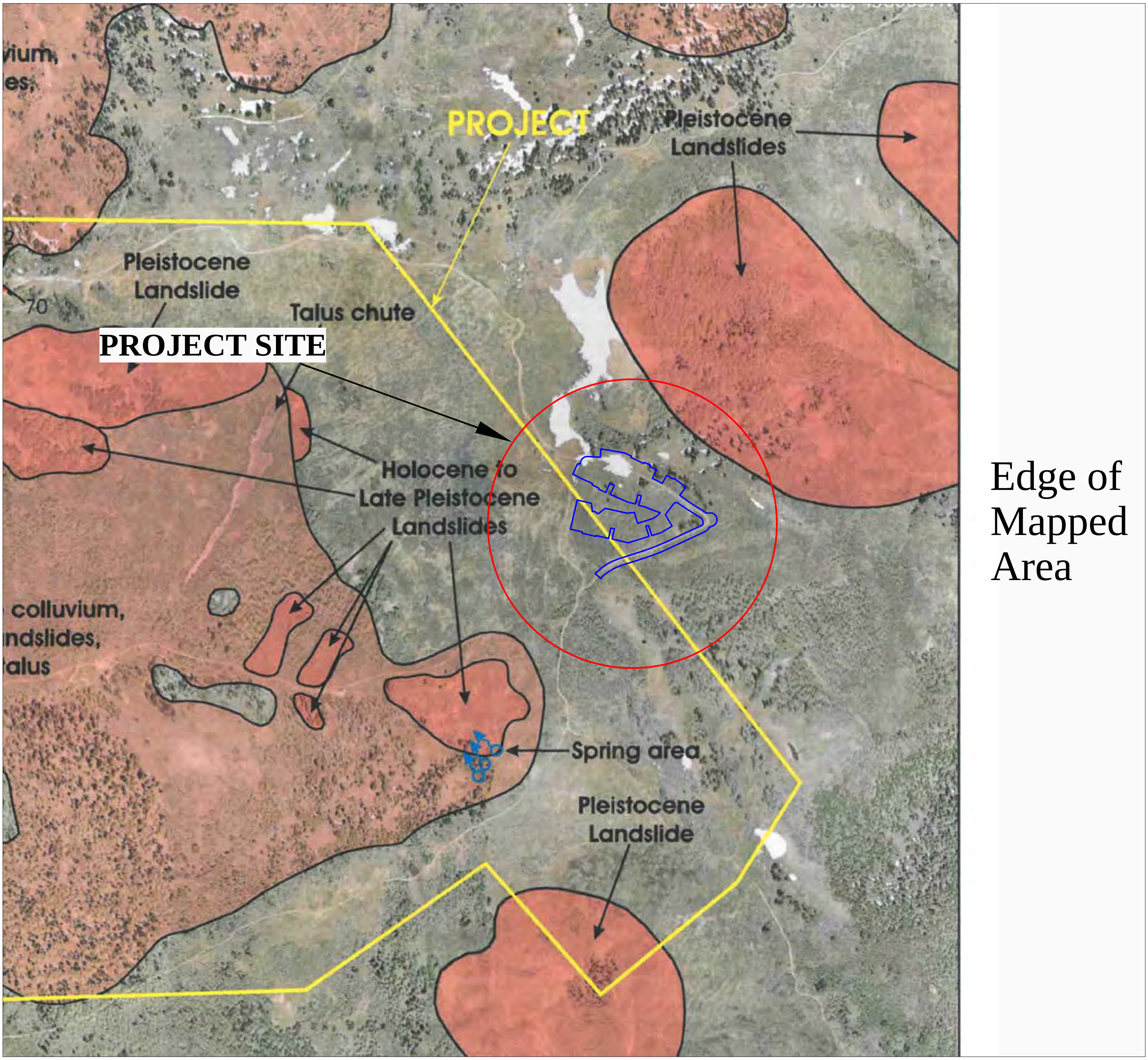
€gcu — Upper member – Pale-buff to white or flesh-pink quartzite, locally streaked with pale red or purple. Coarse-grained; small pebbles occur throughout unit and increase in abundance downward. Base marked by zone 30-60 m thick of cobble conglomerate in beds 30 cm to 2 m thick; clasts, 5-10 cm in diameter, are mainly reddish vein quartz or quartzite, sparse gray quartzite, or red jasper; thickness 730-820 m

€gcl — Lower member – Pale-buff to white and tan quartzite with irregular streaks and lenses of cobble conglomerate decreasing in abundance downward. Lower 90-120 m strongly arkosic, streaked greenish or pinkish. Feldspar clasts increase in size to 0.6-1.3 cm in lower part of unit; thickness 490-520 m

Recently active normal fault – Dashed where inferred. Ticks on downthrown side

Pre-Tertiary normal fault – Dotted where concealed Bar and ball on downthrown side

Thrust fault – Dashed where inferred Sawteeth on upper plate



Base Map:

-Western Geologic (2012) Geologic Hazards Reconnaissance Report, Figure 3

N

0 500 1000
FEET

1" = 1000'

IGES®

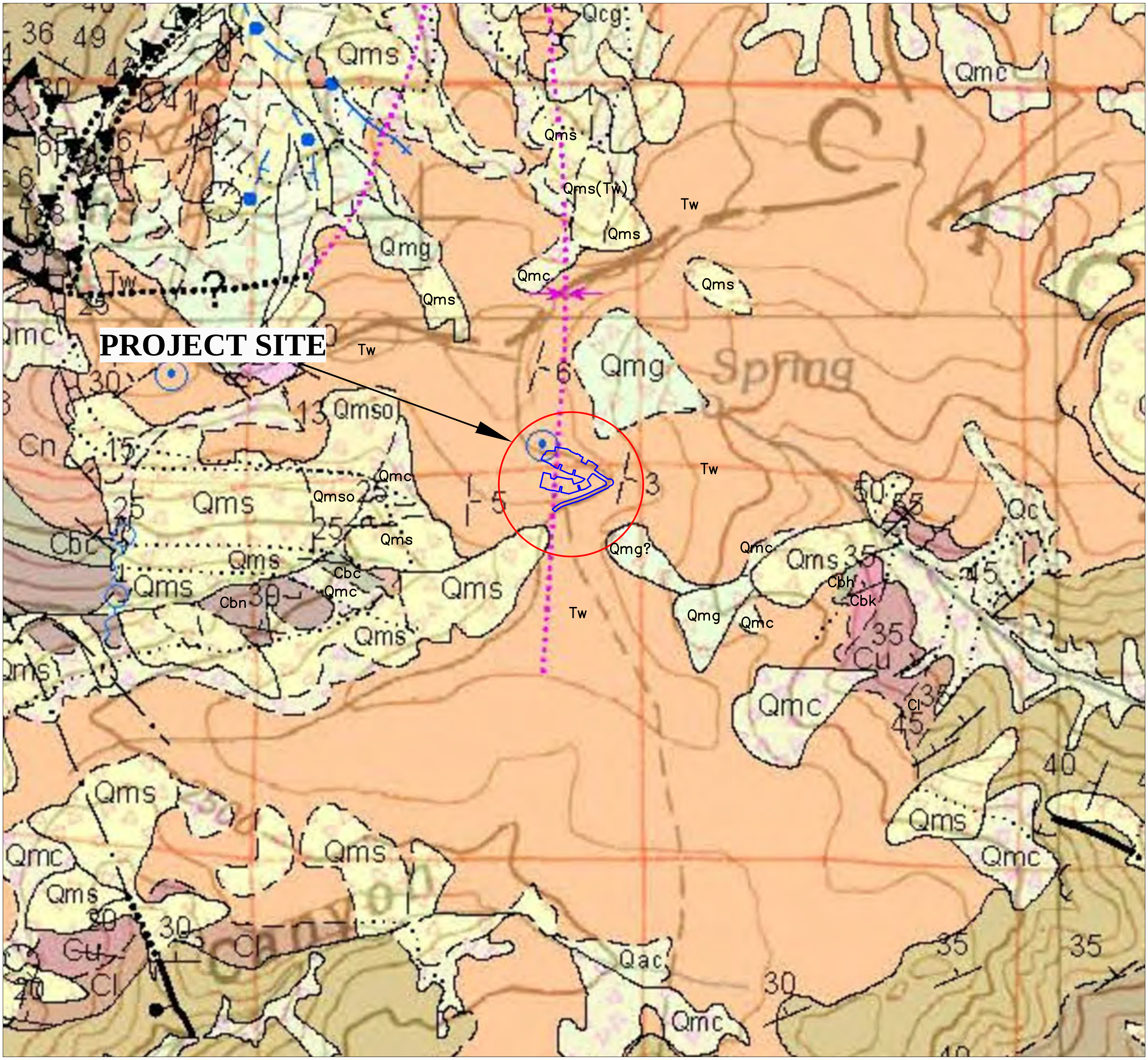
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Regional Geology Map 2

Figure

A-34



Base Map:

-UGS *Ogden 30' x 60' Geologic Quadrangle*, 1:62,500 scale, map OFR-635DM, Coogan and King (2016)

N

0 1000 2000
FEET

1" = 2000'

IGES®

Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Regional Geology Map 3

Figure

A-35a

MAP LEGEND

Qms, Qms?, Qmsy, Qmsy?, Qmso, Qmso?

Landslide deposits (Holocene and upper and middle? Pleistocene) – Poorly sorted clay- to boulder-sized material; includes slides, slumps, and locally flows and floods; generally characterized by hummocky topography, main and internal scarps, and chaotic bedding in displaced blocks; composition depends on local sources; morphology becomes more subdued with time and amount of water in material during emplacement; Qms may be in contact with Qms when landslides are different/distinct; thickness highly variable, up to about 20 to 30 feet (6-9 m) for small slides, and 80 to 100 feet (25-30 m) thick for larger landslides. Qmsy and Qmso queried where relative age uncertain; Qms queried where classification uncertain. Numerous landslides are too small to show at map scale and more detailed maps shown in the index to geologic mapping should be examined.

Qms without a suffix is mapped where the age is uncertain (though likely Holocene and/or late Pleistocene), where portions of slide complexes have different ages but cannot be shown separately at map scale, or where boundaries between slides of different ages are not distinct. Estimated time of emplacement is indicated by relative-age letter suffixes with: Qmsy mapped where landslides deflect streams or failures are in Lake Bonneville deposits, and scarps are variably vegetated; Qmso typically mapped where deposits are "perched" above present drainages, rumpled morphology typical of mass movements has been diminished, and/or younger surficial deposits cover or cut Qmso. Lower perched Qmso deposits are at Qao heights above drainages (95 ka and older) and the higher perched deposits may correlate with high level alluvium (QTa_) (likely older than 780 ka) (see table 1). Suffixes y and o indicate probable Holocene and Pleistocene ages, respectively, with all Qmso likely emplaced before Lake Bonneville transgression. These older deposits are as unstable as other slides, and are easily reactivated with the addition of water, be it irrigation or septic tank drain fields.

Qmso?(Qafoe), Qmso?(QTcg?), Qmso?(Ts), Qmso?(Tcg), Qmso?(Tn), Qmso?(Tf), Qmso?(Xfc)

Block landslide and possible block landslide deposits (Holocene and upper and middle? Pleistocene) – Mapped where nearly intact block is visible in landslide (mostly block slide) with stratal strikes and dips that are different from nearby in-place bedrock; unit involved in landslide shown in parentheses, for example Qms(Tw) and composition depends bedrock unit; rx shown where bedrock unit in block not known or multiple units are in the block, with Zrx shown where the units are Neoproterozoic; see surficial deposits or rock unit in parentheses for descriptions of blocks; thickness highly variable, up to about 20 to 30 feet (6-9 m) for small slides, and cross sections show larger blocks are about 150 feet (45 m) thick. Relative ages are like those for other landslide deposits (Qms, Qmso).

Qms and Qmso queried (Qms?, Qmso?) where bedrock block may be in place, that is stratal strikes and dips in queried block are about the same as nearby in-place bedrock.

Qmc **Landslide and colluvial deposits, undivided (Holocene and Pleistocene)** – Poorly sorted to unsorted clay- to boulder-sized material; mapped where landslide deposits are difficult to distinguish from colluvium (slopewash and soil creep) and where mapping separate, small, intermingled areas of landslide and colluvial deposits is not possible at map scale; locally includes talus and debris flow and flood deposits; typically mapped where landslides are thin ("shallow"); also mapped where the blocky or rumpled morphology that is characteristic of landslides has been diminished ("smoothed") by slopewash and soil creep; composition depends on local sources; 6 to 40 feet (2-12 m) thick. These deposits are as unstable as other landslide units (Qms, Qmsy, Qmso).

Qmg, Qmg?

Mass-movement and glacial deposits, undivided (Holocene and Pleistocene) – Unsorted and unstratified clay, silt, sand, and gravel; mapped where glacial deposits lack typical moraine morphology, and appear to have failed or moved down slope; also mapped in upper Strawberry Bowl (Snow Basin quadrangle) where glacial deposits have lost their distinct morphology and the contacts between them and colluvium and talus in the cirques cannot be mapped; likely less than 30 feet (9 m) thick, but may be thicker in Mantua, James Peak, North Ogden, Huntsville, and Peterson quadrangles.

MAP LEGEND

Tw, Tw?

Wasatch Formation (Eocene and upper Paleocene) – Typically red to brownish-red sandstone, siltstone, mudstone, and conglomerate with minor gray limestone and marlstone locally (see Twl); lighter shades of red, yellow, tan, and light gray present locally and more common in uppermost part, complicating mapping of contacts with overlying similarly colored Norwood and Fowkes Formations; clasts typically rounded Neoproterozoic and Paleozoic sedimentary rocks, mainly Neoproterozoic and Cambrian quartzite; basal conglomerate more gray and less likely to be red, and containing more locally derived angular clasts of limestone, dolomite and sandstone, typically from Paleozoic strata, for example in northern Causey Dam quadrangle; sinkholes indicate karstification of limestone beds; thicknesses on Willard thrust sheet likely up to about 400 to 600 feet (120-180 m) in Sharp Mountain, Dairy Ridge, and Horse Ridge quadrangles (Coogan, 2006a-b), about 1300 feet (400 m) in Monte Cristo Peak quadrangle, about 1100 feet (335 m) in northeast Browns Hole quadrangle, about 2200 feet (670 m) in southwest Causey Dam quadrangle, about 2600 feet (800 m) at Herd Mountain in Bybee Knoll quadrangle, and about 1300 feet (400 m) in northwest Lost Creek Dam quadrangle, estimated by elevation differences between pre-Wasatch rocks exposed in drainages and the crests of gently dipping Wasatch Formation on adjacent ridges (King); thickness varies locally due to considerable relief on basal erosional surface, for example along Right Fork South Fork Ogden River, and along leading edge of Willard thrust; much thicker, about 5000 to 6000 feet (1500-1800 m), south of Willard thrust sheet near Morgan. Wasatch Formation is queried (Tw?) where poor exposures may actually be surficial deposits. The Wasatch Formation is prone to slope failures. Other information on the Wasatch Formation is in Tw descriptions under the heading "Sub-Willard Thrust - Ogden Canyon Area" since Tw strata are extensive near Morgan Valley and cover the Willard thrust, Ogden Canyon, and Durst Mountain areas.

Contact, approximately located

Contact, concealed

Contact, well located

Older moraine crest, symmetry unknown

Thrust fault, concealed

Syncline, upright, concealed

Bedding, strike & dip, upright

Water well

Select spring

APPENDIX B

Water Content and Unit Weight of Soil

(In General Accordance with ASTM D7263 Method B and D2216)

Project: **Summit-The Overlook**
No: **01628-021**
Location: Powder Mountain, UT
Date: 12/20/2016
By: NB/BSS

Sample Info.	Boring No.	TP-1-17	TP-4-17						
	Sample								
	Depth	5.0'	4.5'						
	Split	Yes	Yes						
	Split sieve	3/8"	3/8"						
Total sample (g)		4297.06	4474.74						
Moist coarse fraction (g)		1534.66	1423.14						
Moist split fraction (g)		2762.40	3051.60						
	Sample height, H (in)								
	Sample diameter, D (in)								
	Mass rings + wet soil (g)								
	Mass rings/tare (g)								
	Moist unit wt., γ_m (pcf)								
Coarse Fraction	Wet soil + tare (g)	2246.20	1733.54						
	Dry soil + tare (g)	2229.71	1699.53						
	Tare (g)	711.55	310.40						
	Water content (%)	1.1	2.4						
Split Fraction	Wet soil + tare (g)	737.91	956.70						
	Dry soil + tare (g)	711.71	893.13						
	Tare (g)	128.88	409.81						
	Water content (%)	4.5	13.2						
Water Content, w (%)		**3.3**	**9.5**						
Dry Unit Wt., γ_d (pcf)									

Entered by:___________

Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\021_The_Overlook\[MDv2.xlsx]1

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

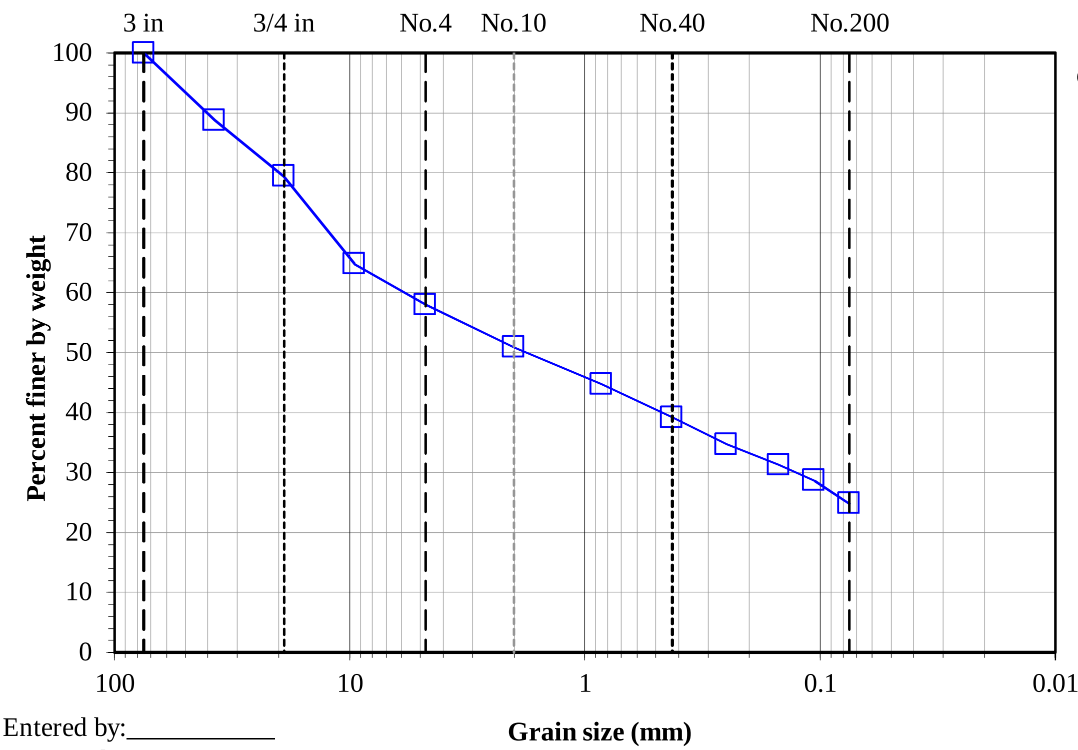
Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/20/2016
By: NB

Boring No.: TP-1-17
Sample:
Depth: 5.0'
Description: Reddish brown clayey gravel with sand

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	4297.06	4160.02
+3/8" Coarse fraction (g):	1481.93	1466.00
-3/8" Split fraction (g):	609.03	582.83
Split fraction:	0.648	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2246.21	737.91
Dry soil + tare (g):	2229.71	711.71
Tare (g):	711.55	128.88
Water content (%):	1.1	4.5

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	467.60	37.5	88.8	
3/4"	856.80	19	79.4	
3/8"	1466.00	9.5	64.8	←Split
No.4	60.97	4.75	58.0	
No.10	124.69	2	50.9	
No.20	180.40	0.85	44.7	
No.40	230.37	0.425	39.2	
No.60	270.40	0.25	34.7	
No.100	301.56	0.15	31.3	
No.140	324.82	0.106	28.7	
No.200	359.63	0.075	24.8	



Gravel (%): 42.0
Sand (%): 33.2
Fines (%): 24.8

Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\021_The_Overlook\[GSDv2.xlsx]1

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

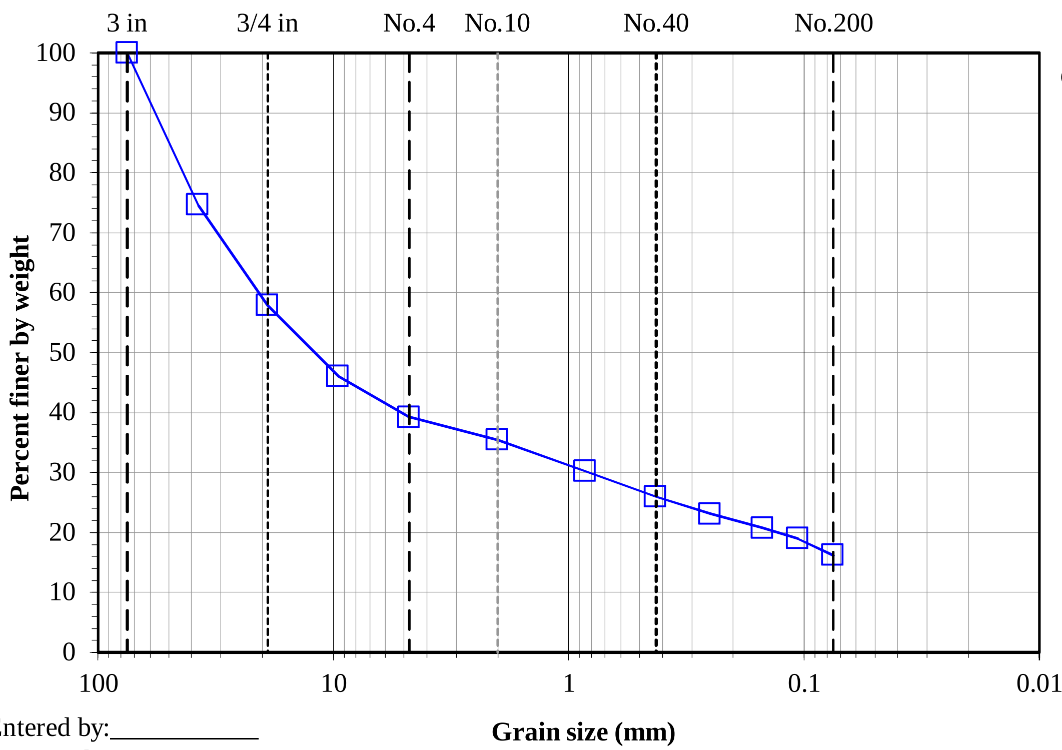
Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/21/2016
By: BSS

Boring No.: TP-2-17
Sample: Depth: 3.5'
Description: Red clayey gravel with sand

Split:	Yes	
Split sieve:	#4	
	Moist	Dry
Total sample wt. (g):	5406.58	5088.86
+#4 Coarse fraction (g):	3181.58	3094.53
-#4 Split fraction (g):	360.27	322.92
Split fraction:	0.392	

Water content data	C.F.(+#4)	S.F.(-#4)
Moist soil + tare (g):	3492.10	768.21
Dry soil + tare (g):	3405.05	730.86
Tare (g):	310.52	407.94
Water content (%):	2.8	11.6

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	100.0
1.5"	1291.28	37.5	74.6
3/4"	2142.82	19	57.9
3/8"	2748.00	9.5	46.0
No.4	3094.53	4.75	39.2 ←Split
No.10	31.43	2	35.4
No.20	73.81	0.85	30.2
No.40	109.13	0.425	25.9
No.60	133.07	0.25	23.0
No.100	152.15	0.15	20.7
No.140	167.02	0.106	18.9
No.200	189.74	0.075	16.2



Gravel (%): 60.8
Sand (%): 23.0
Fines (%): 16.2

Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\021_The_Overlook\[GSDv2.xlsx]2

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

IGES

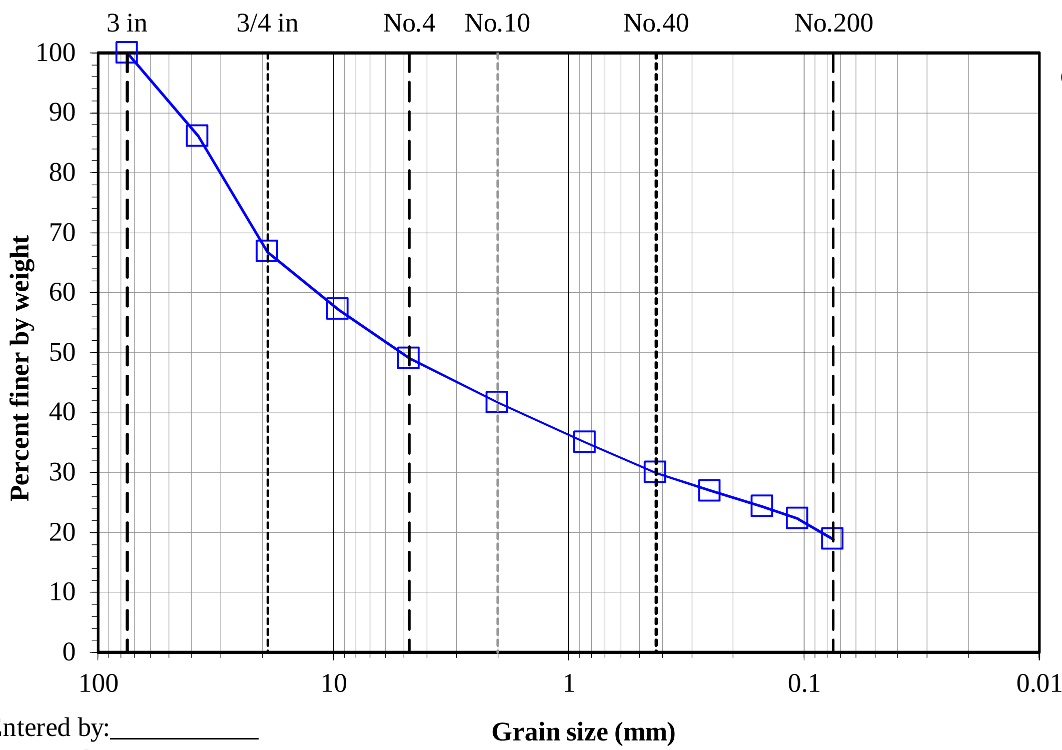
Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/21/2016
By: BSS

Boring No.: TP-3-17
Sample: Sta. 14
Depth: 6.0'
Description: Reddish brown clayey gravel with sand

Split:	Yes	
Split sieve:	3/4"	
	Moist	Dry
Total sample wt. (g):	5210.58	5068.15
+3/4" Coarse fraction (g):	1693.68	1682.47
-3/4" Split fraction (g):	657.99	633.44
Split fraction:	0.668	

Water content data	C.F.(+3/4")	S.F.(-3/4")
Moist soil + tare (g):	2004.70	968.63
Dry soil + tare (g):	1993.49	944.08
Tare (g):	311.02	310.64
Water content (%):	0.7	3.9

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	704.73	37.5	86.1	
3/4"	1682.47	19	66.8	←Split
3/8"	91.44	9.5	57.2	
No.4	168.58	4.75	49.0	
No.10	238.71	2	41.6	
No.20	301.62	0.85	35.0	
No.40	349.38	0.425	30.0	
No.60	378.54	0.25	26.9	
No.100	403.31	0.15	24.3	
No.140	422.72	0.106	22.2	
No.200	454.90	0.075	18.8	



Gravel (%): 51.0
Sand (%): 30.2
Fines (%): 18.8

Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\021_The_Overlook\[GSDv2.xlsx]3

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

IGES

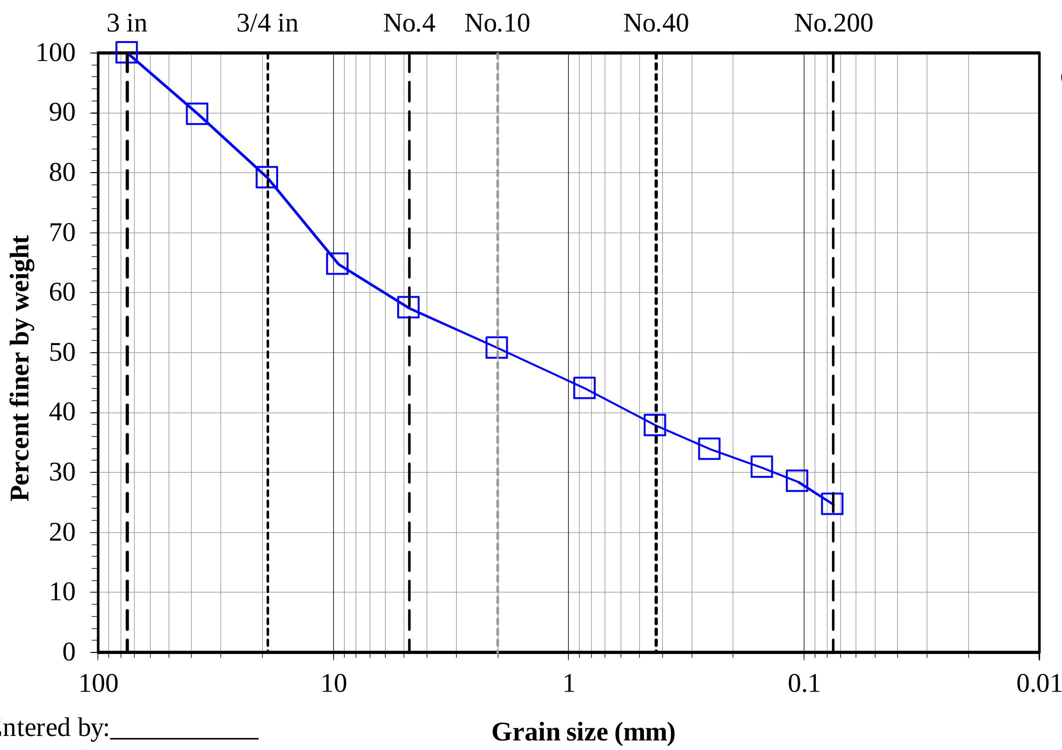
Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/21/2016
By: BSS

Boring No.: TP-3-17
Sample: Sta. 18
Depth: 6.0'
Description: Reddish brown clayey gravel with sand

Split:	Yes	
Split sieve:	3/4"	
	Moist	Dry
Total sample wt. (g):	24876.20	23078.04
+3/4" Coarse fraction (g):	4956.20	4815.11
-3/4" Split fraction (g):	754.57	691.80
Split fraction:	0.791	

Water content data	C.F.(+3/4")	S.F.(-3/4")
Moist soil + tare (g):	2798.82	1165.00
Dry soil + tare (g):	2728.05	1102.23
Tare (g):	312.83	410.43
Water content (%):	2.9	9.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	2377.57	37.5	89.7	
3/4"	4815.11	19	79.1	←Split
3/8"	126.17	9.5	64.7	
No.4	189.90	4.75	57.4	
No.10	248.60	2	50.7	
No.20	307.38	0.85	44.0	
No.40	361.31	0.425	37.8	
No.60	396.12	0.25	33.8	
No.100	422.75	0.15	30.8	
No.140	443.25	0.106	28.4	
No.200	476.10	0.075	24.7	



Gravel (%): 42.6
Sand (%): 32.7
Fines (%): 24.7

Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\021_The_Overlook\[GSDv2.xlsx]4

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

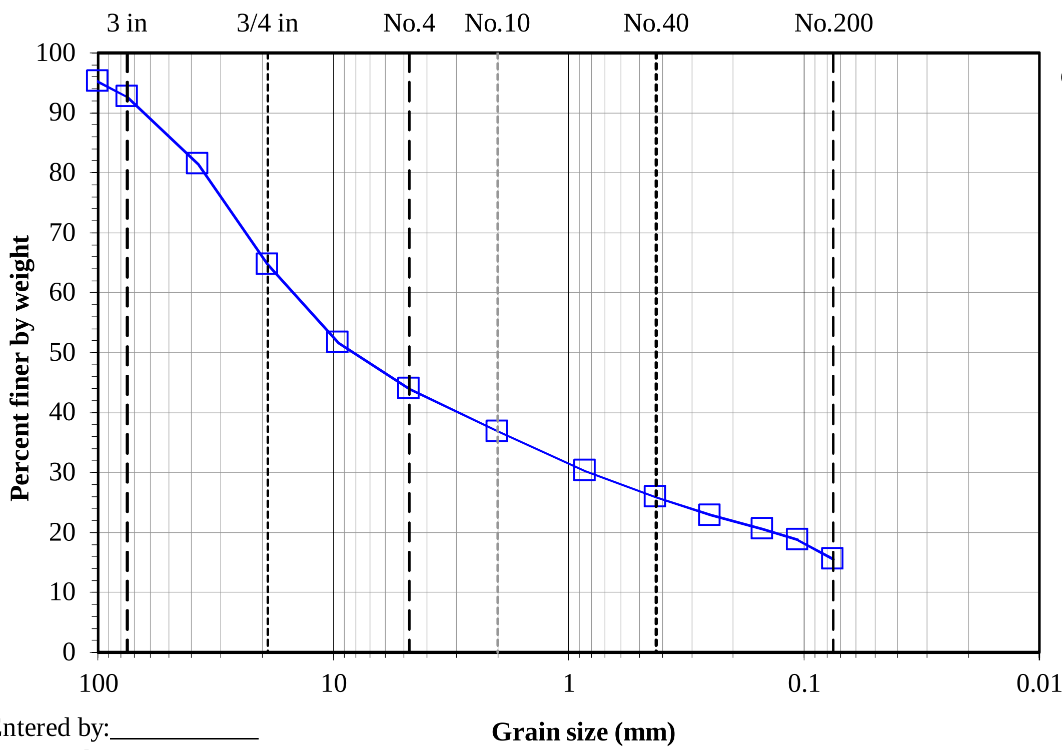
Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/22/2016
By: BSS

Boring No.: TP-5-17
Sample:
Depth: 5.0'
Description: Brown clayey gravel with sand

Split:	Yes	
Split sieve:	3/4"	
	Moist	Dry
Total sample wt. (g):	25928.60	25020.57
+3/4" Coarse fraction (g):	8996.00	8833.21
-3/4" Split fraction (g):	631.87	604.06
Split fraction:	0.647	

Water content data	C.F.(+3/4")	S.F.(-3/4")
Moist soil + tare (g):	3487.46	960.15
Dry soil + tare (g):	3431.75	932.34
Tare (g):	408.88	328.28
Water content (%):	1.8	4.6

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	100.0	
4"	1190.75	100	95.2	
3"	1841.07	75	92.6	
1.5"	4642.54	37.5	81.4	
3/4"	8833.21	19	64.7	←Split
3/8"	122.24	9.5	51.6	
No.4	193.66	4.75	44.0	
No.10	260.03	2	36.8	
No.20	321.75	0.85	30.2	
No.40	362.45	0.425	25.9	
No.60	390.74	0.25	22.8	
No.100	412.52	0.15	20.5	
No.140	429.30	0.106	18.7	
No.200	458.83	0.075	15.6	



Gravel (%): 56.0
Sand (%): 28.4
Fines (%): 15.6

Entered by:___________
Reviewed:___________

Amount of Material in Soil Finer than the No. 200 (75µm) Sieve

(ASTM D1140)

IGES

Project: **Summit - The Overlook**
No: **01628-021**
Location: Powder Mountain, UT
Date: 12/21/2016
By: BSS

Sample Info.	Boring No.	TP-4-17	TP-4-17						
	Sample								
	Depth	4.5'	6.0'						
	Split	Yes	Yes						
	Split Sieve*	3/8"	3/8"						
	Method	B	B						
	Specimen soak time (min)	390	370						
	Moist total sample wt. (g)	4474.74	4649.66						
	Moist coarse fraction (g)	1423.14	921.36						
	Moist split fraction + tare (g)	956.70	1053.17						
	Split fraction tare (g)	409.81	316.57						
	Dry split fraction (g)	483.32	701.10						
	Dry retained No. 200 + tare (g)	721.36	721.36						
	Wash tare (g)	409.81	316.57						
	No. 200 Dry wt. retained (g)	311.55	404.79						
	Split sieve* Dry wt. retained (g)	1389.13	913.61						
	Dry total sample wt. (g)	4086.01	4462.23						
Coarse Fraction	Moist soil + tare (g)	1733.54	1230.82						
	Dry soil + tare (g)	1699.53	1223.07						
	Tare (g)	310.40	309.46						
	Water content (%)	2.45	0.85						
Split Fraction	Moist soil + tare (g)	956.70	1053.17						
	Dry soil + tare (g)	893.13	1017.67						
	Tare (g)	409.81	316.57						
	Water content (%)	13.15	5.06						
	Percent passing split sieve* (%)	**66.0**	**79.5**						
	Percent passing No. 200 sieve (%)	**23.5**	**33.6**						

Entered by:___________
Reviewed:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT
Date: 12/27/2016
By: JDF

Boring No.: TP-2-17
Sample:
Depth: 3.5'
Sample Description: Brown clayey sand
Sample type: Arbitrary remold

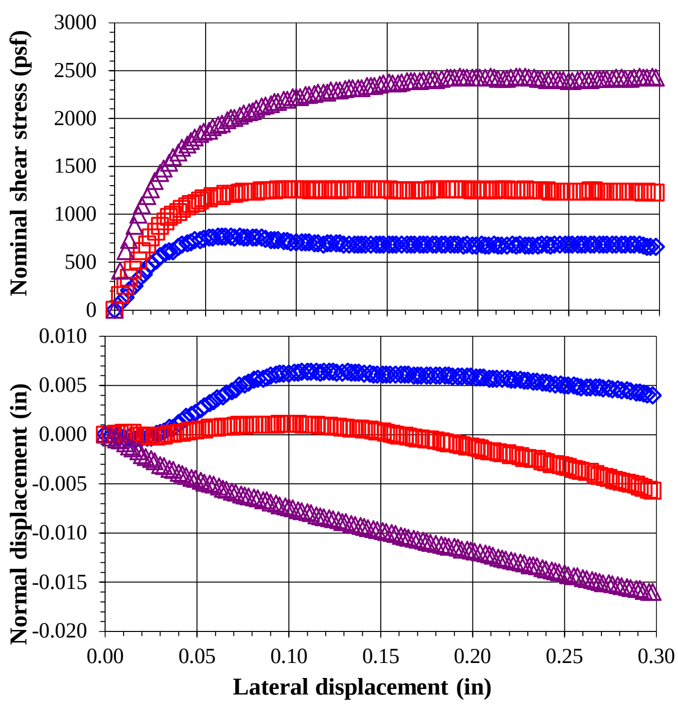
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0172
Specific gravity, Gs: 2.65 Assumed

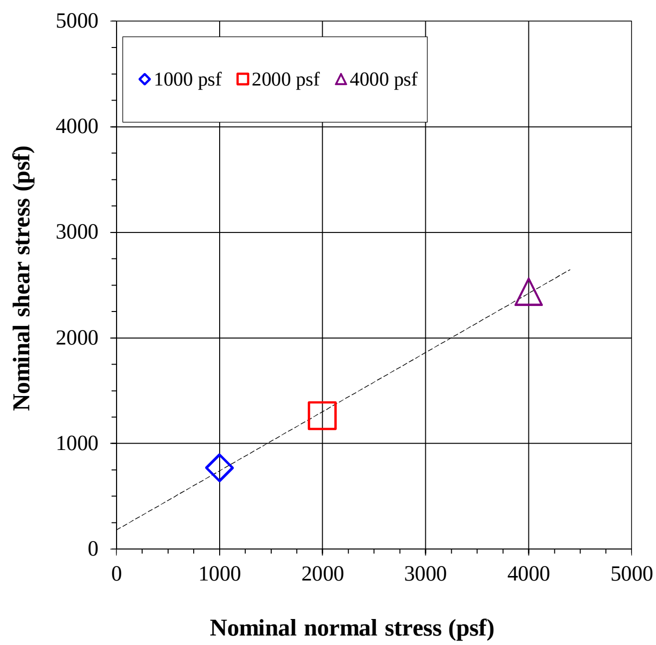
	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	1000		2000		4000	
Peak shear stress (psf)	768		1260		2436	
Lateral displacement at peak (in)	0.057		0.090		0.190	
Load Duration (min)	183		213		82	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.0000	0.9230	1.0000	0.9867	1.0000	0.9835
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	197.71	198.40	197.19	202.66	199.25	204.48
Wt. rings (g)	43.12	43.12	42.60	42.60	44.66	44.66
Wet soil + tare (g)	365.67		365.67		365.67	
Dry soil + tare (g)	339.75		339.75		339.75	
Tare (g)	123.74		123.74		123.74	
Water content (%)	12.0	12.5	12.0	16.0	12.0	15.8
Dry unit weight (pcf)	114.7	124.2	114.7	116.2	114.7	116.6
Void ratio, e, for assumed Gs	0.44	0.33	0.44	0.42	0.44	0.42
Saturation (%)*	71.9	100.0	71.9	100.0	71.9	100.0

φ' (deg)	29
c' (psf)	180

Average of 3 samples	Initial	Pre-shear
Water content (%)	12.0	14.8
Dry unit weight (pcf)	114.7	119.0

*Pre-shear saturation set to 100% for phase calculations





Entered by:___________
Reviewed:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2016

Project: Summit - The Overlook **Boring No.:** TP-2-17

No: 01628-021 **Sample:**

Location: Powder Mountain, UT **Depth:** 3.5'

Nominal normal stress = 1000 psf			Nominal normal stress = 2000 psf			Nominal normal stress = 4000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.003	72	0.000	0.003	156	0.000	0.003	408	0.000
0.006	132	0.000	0.006	252	0.000	0.006	612	-0.001
0.008	204	0.000	0.008	336	0.000	0.008	732	-0.001
0.011	252	0.000	0.010	420	0.000	0.011	876	-0.001
0.013	324	0.000	0.013	516	0.000	0.013	996	-0.001
0.016	372	-0.001	0.015	612	0.000	0.015	1092	-0.001
0.018	432	0.000	0.018	684	0.000	0.018	1188	-0.002
0.020	480	0.000	0.020	756	0.000	0.020	1260	-0.002
0.023	516	0.000	0.023	816	0.000	0.022	1344	-0.002
0.025	564	0.000	0.025	876	0.000	0.025	1428	-0.003
0.028	600	0.000	0.028	924	0.000	0.027	1476	-0.003
0.030	612	0.000	0.030	972	0.000	0.030	1536	-0.003
0.032	612	0.000	0.032	996	0.000	0.032	1596	-0.003
0.035	660	0.001	0.035	1020	0.000	0.035	1644	-0.004
0.037	684	0.001	0.037	1056	0.000	0.037	1692	-0.004
0.040	696	0.001	0.040	1080	0.000	0.040	1728	-0.004
0.042	708	0.001	0.042	1104	0.000	0.042	1764	-0.004
0.044	732	0.002	0.045	1116	0.000	0.044	1800	-0.004
0.047	732	0.002	0.047	1140	0.000	0.047	1836	-0.004
0.049	744	0.002	0.049	1164	0.000	0.049	1860	-0.005
0.052	756	0.003	0.052	1164	0.001	0.052	1872	-0.005
0.054	756	0.003	0.054	1188	0.001	0.054	1908	-0.005
0.057	768	0.003	0.057	1188	0.001	0.057	1932	-0.005
0.059	768	0.003	0.059	1188	0.001	0.059	1944	-0.005
0.061	768	0.004	0.061	1212	0.001	0.062	1980	-0.005
0.064	768	0.004	0.064	1212	0.001	0.064	2004	-0.006
0.066	756	0.004	0.066	1212	0.001	0.066	2004	-0.006
0.069	768	0.004	0.069	1224	0.001	0.069	2028	-0.006
0.071	756	0.005	0.071	1236	0.001	0.071	2052	-0.006
0.073	756	0.005	0.073	1236	0.001	0.074	2064	-0.006
0.076	756	0.005	0.076	1236	0.001	0.076	2076	-0.006
0.078	756	0.005	0.078	1236	0.001	0.078	2100	-0.006
0.081	756	0.006	0.081	1248	0.001	0.081	2124	-0.006
0.083	744	0.006	0.083	1248	0.001	0.083	2136	-0.007
0.086	732	0.006	0.085	1248	0.001	0.086	2148	-0.007
0.088	732	0.006	0.088	1248	0.001	0.088	2172	-0.007
0.090	732	0.006	0.090	1260	0.001	0.090	2172	-0.007
0.093	720	0.006	0.093	1260	0.001	0.093	2196	-0.007
0.095	720	0.006	0.095	1260	0.001	0.095	2196	-0.007
0.097	708	0.006	0.098	1260	0.001	0.098	2220	-0.007
0.100	708	0.006	0.100	1260	0.001	0.100	2220	-0.007
0.103	708	0.006	0.102	1260	0.001	0.102	2220	-0.008
0.105	708	0.006	0.105	1260	0.001	0.105	2244	-0.008
0.107	708	0.006	0.108	1248	0.001	0.107	2244	-0.008
0.110	696	0.006	0.110	1260	0.001	0.110	2256	-0.008
0.112	696	0.006	0.112	1260	0.001	0.112	2268	-0.008
0.115	684	0.006	0.115	1248	0.001	0.115	2268	-0.008
0.117	696	0.006	0.117	1260	0.001	0.117	2268	-0.008
0.119	696	0.006	0.120	1260	0.001	0.119	2292	-0.008
0.122	696	0.006	0.122	1260	0.001	0.122	2292	-0.009
0.124	696	0.006	0.124	1248	0.001	0.124	2292	-0.009
0.126	684	0.006	0.127	1260	0.001	0.127	2304	-0.009
0.129	684	0.006	0.129	1260	0.001	0.129	2316	-0.009
0.132	684	0.006	0.131	1260	0.001	0.131	2316	-0.009
0.134	684	0.006	0.134	1260	0.001	0.134	2316	-0.009
0.136	684	0.006	0.136	1260	0.001	0.136	2316	-0.009
0.138	684	0.006	0.139	1260	0.001	0.139	2340	-0.009
0.141	684	0.006	0.141	1260	0.001	0.141	2340	-0.009
0.144	684	0.006	0.144	1260	0.001	0.143	2340	-0.010
0.146	684	0.006	0.146	1260	0.000	0.146	2352	-0.010
0.148	684	0.006	0.148	1260	0.000	0.148	2364	-0.010
0.151	684	0.006	0.151	1260	0.000	0.151	2376	-0.010
0.153	684	0.006	0.153	1248	0.000	0.153	2364	-0.010
0.155	684	0.006	0.156	1248	0.000	0.156	2364	-0.010

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: **Summit - The Overlook** **Boring No.:** **TP-2-17**
No: **01628-021** **Sample:**
Location: Powder Mountain, UT **Depth:** **3.5'**

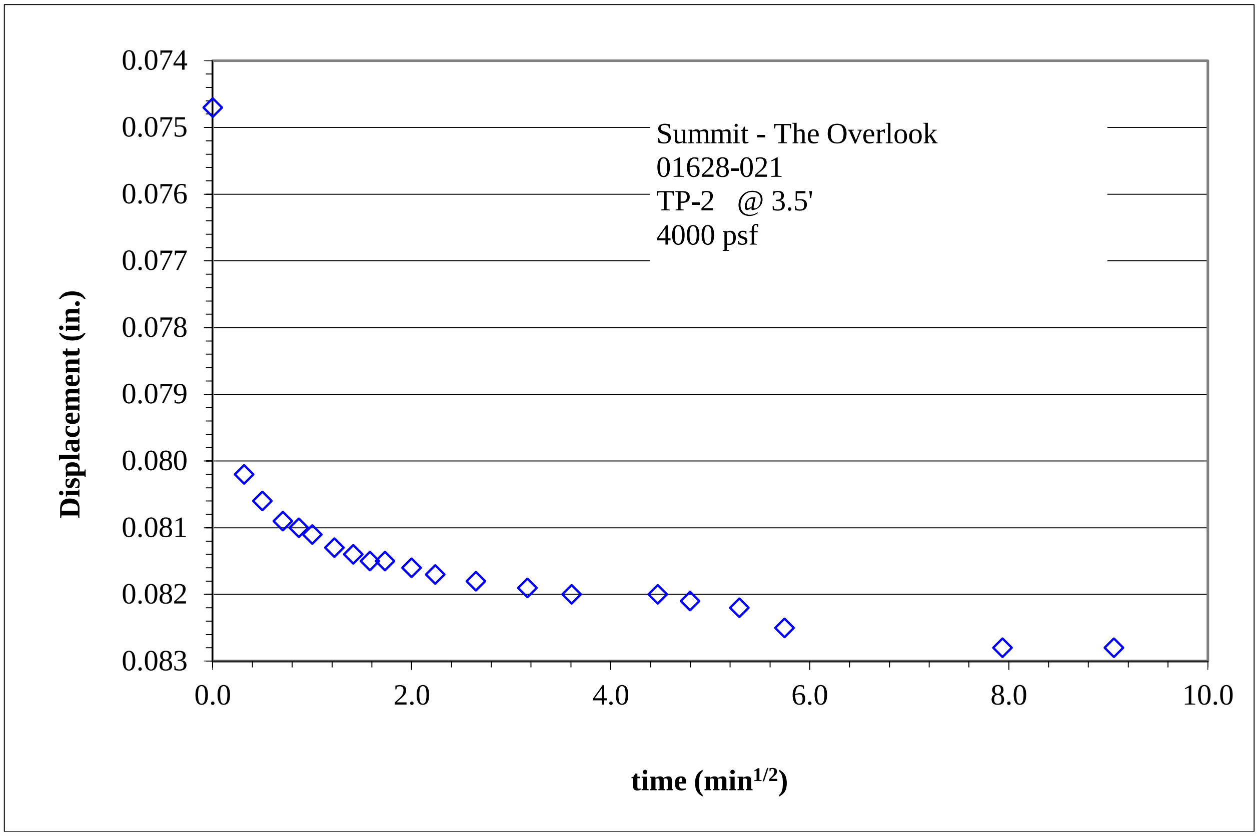
Nominal normal stress = 1000 psf			Nominal normal stress = 2000 psf			Nominal normal stress = 4000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.158	684	0.006	0.158	1248	0.000	0.158	2376	-0.010
0.161	684	0.006	0.160	1248	0.000	0.161	2388	-0.010
0.163	684	0.006	0.163	1248	0.000	0.163	2388	-0.010
0.165	684	0.006	0.165	1248	0.000	0.165	2388	-0.011
0.168	684	0.006	0.168	1248	0.000	0.168	2388	-0.011
0.170	684	0.006	0.170	1248	0.000	0.170	2400	-0.011
0.172	684	0.006	0.172	1248	0.000	0.173	2400	-0.011
0.175	684	0.006	0.175	1260	-0.001	0.175	2412	-0.011
0.177	684	0.006	0.177	1260	-0.001	0.177	2400	-0.011
0.180	684	0.006	0.180	1260	-0.001	0.180	2412	-0.011
0.182	684	0.006	0.183	1260	-0.001	0.183	2424	-0.011
0.185	684	0.006	0.185	1260	-0.001	0.185	2424	-0.011
0.187	684	0.006	0.187	1260	-0.001	0.187	2424	-0.011
0.189	684	0.006	0.189	1260	-0.001	0.190	2436	-0.011
0.192	672	0.006	0.192	1260	-0.001	0.192	2424	-0.012
0.194	684	0.006	0.194	1260	-0.001	0.194	2424	-0.012
0.197	672	0.006	0.197	1248	-0.001	0.197	2424	-0.012
0.199	672	0.006	0.199	1248	-0.001	0.199	2424	-0.012
0.202	684	0.006	0.202	1260	-0.001	0.201	2424	-0.012
0.204	672	0.006	0.204	1248	-0.001	0.204	2424	-0.012
0.206	672	0.006	0.206	1248	-0.002	0.207	2436	-0.012
0.209	684	0.006	0.209	1248	-0.002	0.209	2424	-0.012
0.211	672	0.006	0.211	1260	-0.002	0.211	2412	-0.012
0.213	672	0.006	0.214	1260	-0.002	0.214	2412	-0.013
0.216	672	0.006	0.216	1260	-0.002	0.216	2412	-0.013
0.219	684	0.006	0.219	1248	-0.002	0.218	2424	-0.013
0.221	672	0.006	0.221	1248	-0.002	0.221	2436	-0.013
0.223	684	0.006	0.223	1248	-0.002	0.223	2436	-0.013
0.226	672	0.006	0.226	1260	-0.002	0.226	2436	-0.013
0.228	672	0.006	0.228	1248	-0.002	0.228	2424	-0.013
0.230	672	0.006	0.230	1248	-0.002	0.231	2424	-0.013
0.233	672	0.005	0.233	1248	-0.003	0.233	2412	-0.013
0.235	684	0.005	0.235	1248	-0.003	0.235	2412	-0.013
0.238	684	0.005	0.238	1248	-0.003	0.238	2400	-0.014
0.240	672	0.005	0.240	1236	-0.003	0.240	2412	-0.014
0.242	684	0.005	0.243	1236	-0.003	0.243	2412	-0.014
0.245	684	0.005	0.245	1236	-0.003	0.245	2400	-0.014
0.248	684	0.005	0.248	1236	-0.003	0.247	2400	-0.014
0.250	684	0.005	0.250	1236	-0.003	0.250	2388	-0.014
0.252	684	0.005	0.252	1236	-0.003	0.252	2388	-0.014
0.255	684	0.005	0.255	1236	-0.004	0.255	2400	-0.014
0.257	684	0.005	0.257	1236	-0.004	0.257	2412	-0.014
0.259	684	0.005	0.259	1236	-0.004	0.260	2400	-0.015
0.262	684	0.005	0.262	1248	-0.004	0.262	2400	-0.015
0.264	684	0.005	0.264	1248	-0.004	0.265	2412	-0.015
0.267	684	0.005	0.267	1236	-0.004	0.267	2412	-0.015
0.269	684	0.005	0.269	1236	-0.004	0.269	2412	-0.015
0.271	684	0.005	0.272	1236	-0.004	0.271	2412	-0.015
0.274	684	0.005	0.274	1236	-0.004	0.274	2412	-0.015
0.276	684	0.005	0.277	1236	-0.005	0.276	2424	-0.015
0.279	684	0.005	0.279	1236	-0.005	0.279	2424	-0.015
0.281	684	0.005	0.281	1236	-0.005	0.281	2412	-0.015
0.284	684	0.005	0.284	1236	-0.005	0.284	2412	-0.016
0.286	684	0.004	0.286	1236	-0.005	0.286	2424	-0.016
0.289	684	0.004	0.289	1236	-0.005	0.289	2436	-0.016
0.291	672	0.004	0.291	1224	-0.005	0.291	2424	-0.016
0.293	660	0.004	0.293	1236	-0.005	0.293	2424	-0.016
0.295	660	0.004	0.296	1224	-0.006	0.296	2436	-0.016
0.298	660	0.004	0.298	1224	-0.006	0.298	2424	-0.016
0.301	660	0.004	0.301	1224	-0.006	0.301	2244	-0.017
0.301	660	0.004	0.301	1224	-0.006	0.302	2316	-0.017

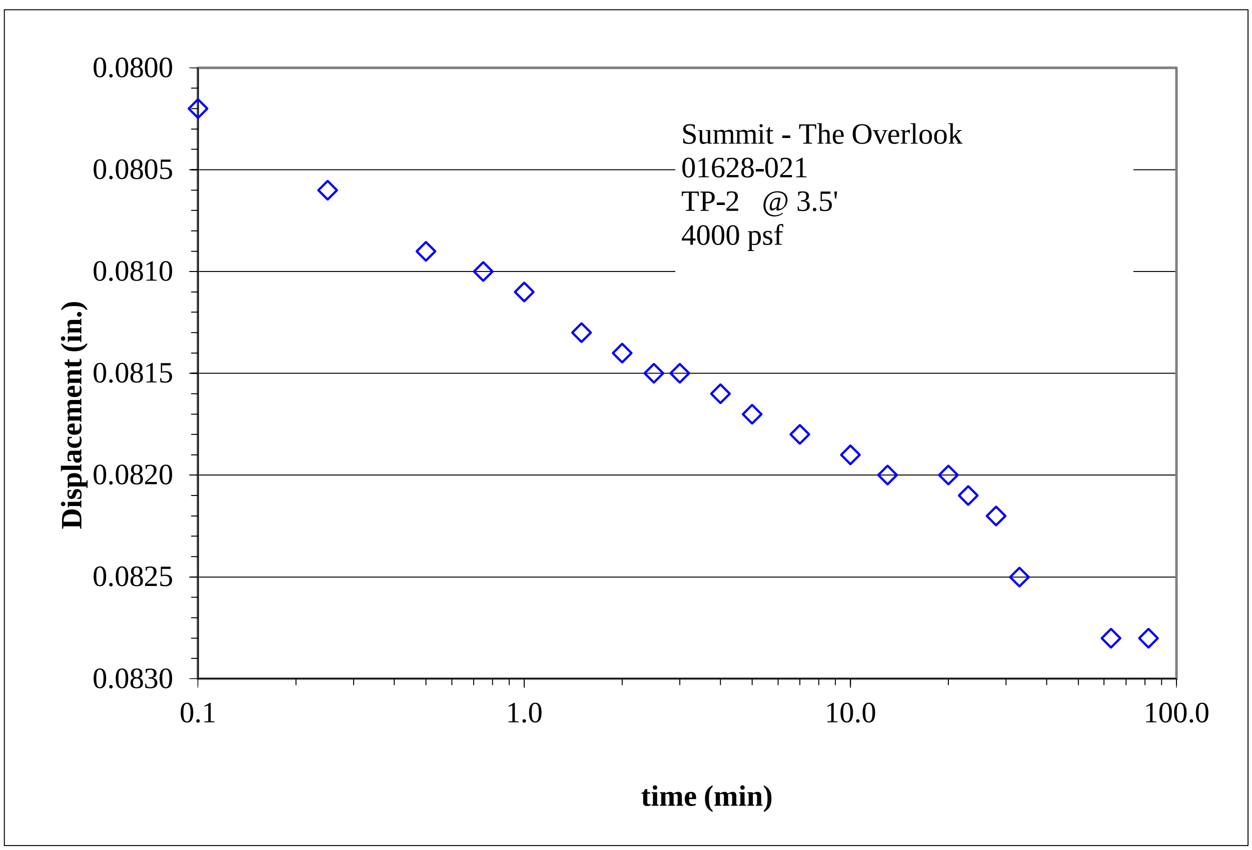
<u>Direct Shear Test for Soils Under Drained Conditions</u>

(ASTM D3080)

Project: Summit - The Overlook
No: 01628-021
Location: Powder Mountain, UT

Boring No.: TP-2-17
Sample:
Depth: 3.5'





Minimum Laboratory Soil Resistivity, pH of Soil for Use in Corrosion Testing, and Ions in Water by Chemically Suppressed Ion Chromatography *(AASHTO T 288, T 289, ASTM D4327, and C1580)*

IGES

Project: **Summit - The Overlook**
No: **01628-021**
Location: Powder Mountain, UT
Date: 12/22/2016
By: DKS

Section	Parameter	Sample 1	Sample 2
Sample info.	Boring No.	TP-1-17	
	Sample		
	Depth	5.0'	
Water content data	Wet soil + tare (g)	117.03	
	Dry soil + tare (g)	109.48	
	Tare (g)	37.28	
	Water content (%)	10.5	
Chem. data	pH	6.13	
	Soluble chloride* (ppm)	<5.21	
	Soluble sulfate** (ppm)	49.3	
Resistivity data	Pin method	2	
	Soil box	Miller Small	

Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)	Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)
As Is	66960	0.67	44863				
+3	37110	0.67	24864				
+6	27160	0.67	18197				
+9	27370	0.67	18338				

	Sample 1	Sample 2
Minimum resistivity (Ω-cm)	**18197**	

* Performed by AWAL using EPA 300.0

** Performed by AWAL using ASTM C1580

Entered by:___________
Reviewed:___________

Water Content and Unit Weight of Soil

(In General Accordance with ASTM D7263 Method B and D2216)

Project: **Overlook**
No: **01628-027**
Location: Powder Mountain
Date: 9/25/2018
By: JWB/BRR

Sample Info.	Boring No.	TP-3	TP-5	TP-7	TP-13	TP-20	TP-23		
	Sample:	26	26	11	22	19	25		
	Depth:	8.0'	6.0'	6.0'	9.5'	8.0'	10.0'		
Unit Weight Info.	Sample height, H (in)		2.395		4.515	5.280			
	Sample diameter, D (in)		2.420		2.418	2.427			
	Sample volume, V (ft^3)		0.0064		0.0120	0.0141			
	Mass rings + wet soil (g)		319.31		1452.64	820.67			
	Mass rings/tare (g)		0.00		754.52	0.00			
	Moist soil, Ws (g)		319.31		698.12	820.67			
	Moist unit wt., γ_m (pcf)		110.42		128.28	127.99			
Water Content	Wet soil + tare (g)	2090.44	459.54	436.03	433.87	559.17	1800.89		
	Dry soil + tare (g)	1697.32	361.16	361.56	379.88	485.11	1358.26		
	Tare (g)	330.79	140.55	128.49	128.52	150.73	467.87		
Water Content, w (%)		**28.8**	**44.6**	**32.0**	**21.5**	**22.1**	**49.7**		
Dry Unit Wt., γ_d (pcf)			**76.4**		**105.6**	**104.8**			

Entered by:___________
Reviewed:___________

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: **Overlook**
No: **01628-027**
Location: Powder Mountain
Date: 9/27/2018
By: BRR

Boring No.: **TP-3**
Station: **26**
Depth: **8.0'**
Description: Reddish brown fat clay

Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 1-1/2"
Estimated percent retained on No.40: Not requested
As-received water content (%): 28.8

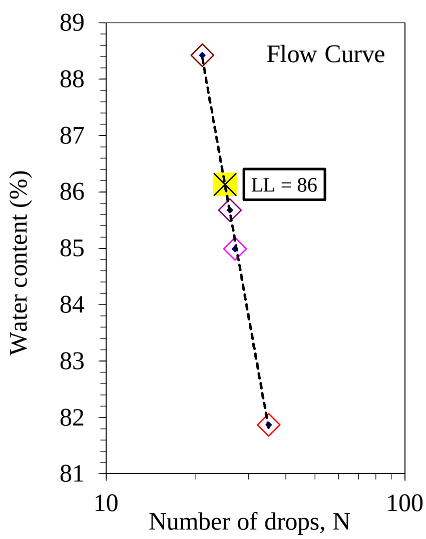
Plastic Limit

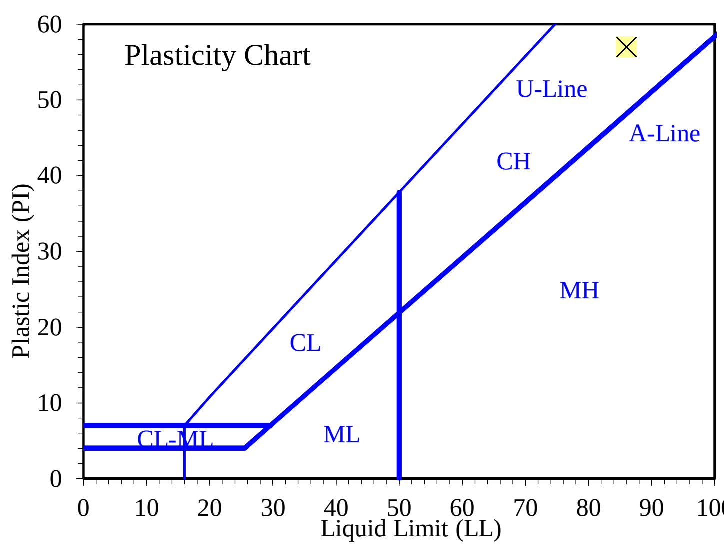
Determination No	1	2				
Wet Soil + Tare (g)	13.42	13.98				
Dry Soil + Tare (g)	11.98	12.46				
Water Loss (g)	1.44	1.52				
Tare (g)	7.06	7.30				
Dry Soil (g)	4.92	5.16				
Water Content, w (%)	29.27	29.46				

Liquid Limit

Determination No	1	2	3	4		
Number of Drops, N	35	27	26	21		
Wet Soil + Tare (g)	14.13	14.00	13.85	12.93		
Dry Soil + Tare (g)	10.97	10.83	10.74	10.18		
Water Loss (g)	3.16	3.17	3.11	2.75		
Tare (g)	7.11	7.10	7.11	7.07		
Dry Soil (g)	3.86	3.73	3.63	3.11		
Water Content, w (%)	81.87	84.99	85.67	88.42		
One-Point LL (%)		86	86	87		

Liquid Limit, LL (%)	**86**
Plastic Limit, PL (%)	**29**
Plasticity Index, PI (%)	**57**





Entered by:____________
Reviewed:____________

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/28/2018
By: BRR

Boring No.: TP-3
Station: 28
Depth: 12.0'
Description: Reddish brown fat clay

Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Preparation method: Air Dry
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Dry sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: Not requested
As-received water content (%): Not requested

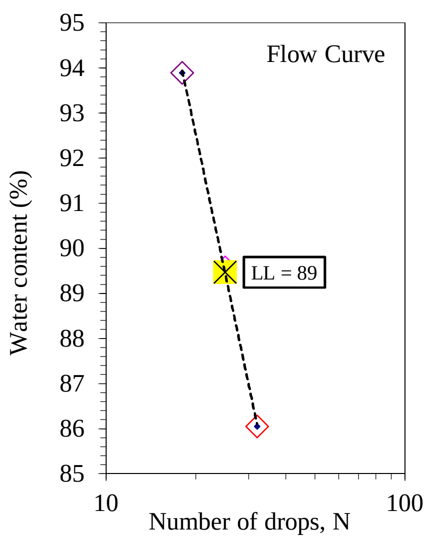
Plastic Limit

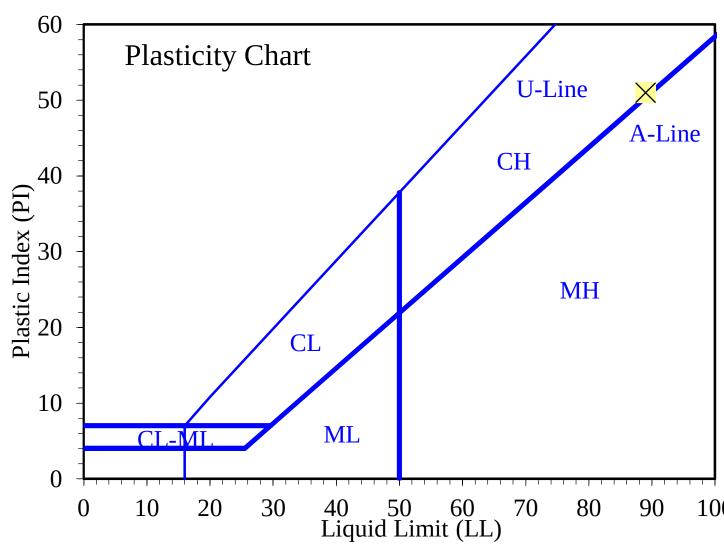
Determination No	1	2				
Wet Soil + Tare (g)	14.23	13.62				
Dry Soil + Tare (g)	12.28	11.82				
Water Loss (g)	1.95	1.80				
Tare (g)	7.10	7.06				
Dry Soil (g)	5.18	4.76				
Water Content, w (%)	37.64	37.82				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	25	18			
Wet Soil + Tare (g)	13.46	13.27	13.09			
Dry Soil + Tare (g)	10.50	10.35	10.17			
Water Loss (g)	2.96	2.92	2.92			
Tare (g)	7.06	7.09	7.06			
Dry Soil (g)	3.44	3.26	3.11			
Water Content, w (%)	86.05	89.57	93.89			
One-Point LL (%)		90				

Liquid Limit, LL (%)	**89**
Plastic Limit, PL (%)	**38**
Plasticity Index, PI (%)	**51**





Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[ALv2.xlsm]2

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

Project:	**Overlook**	**Boring No.:**	**TP-5**
No:	**01628-027**	**Station:**	**26**
Location:	Powder Mountain	**Depth:**	**6.0'**
Date:	9/27/2018	Description:	Reddish brown fat clay
By:	BRR		
Grooving tool type:	Plastic	Preparation method:	Wet
Liquid limit device:	Mechanical	Liquid limit test method:	Multipoint
Rolling method:	Hand	Screened over No.40:	Yes
		Larger particles removed:	Dry sieved
		Approximate maximum grain size:	No.10
		Estimated percent retained on No.40:	Not requested
		As-received water content (%):	44.6

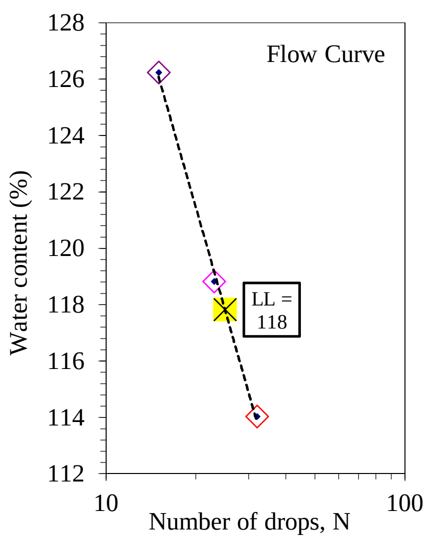
Plastic Limit

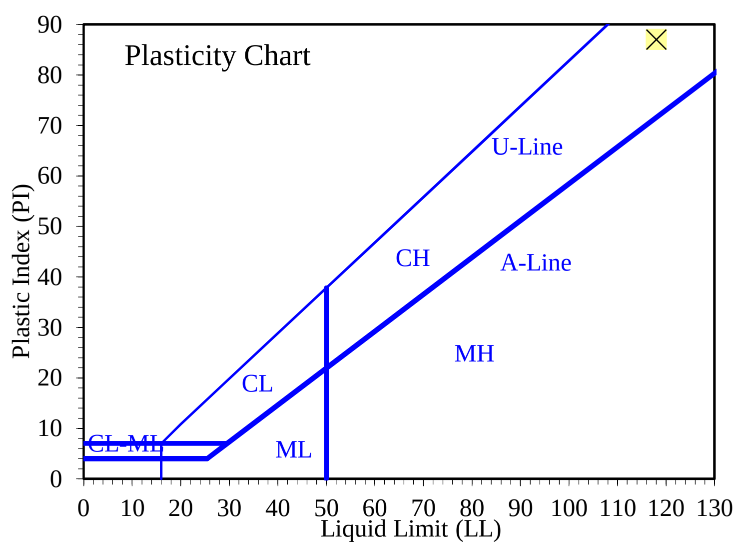
Determination No	1	2				
Wet Soil + Tare (g)	13.03	13.90				
Dry Soil + Tare (g)	11.48	12.28				
Water Loss (g)	1.55	1.62				
Tare (g)	6.42	7.00				
Dry Soil (g)	5.06	5.28				
Water Content, w (%)	30.63	30.68				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	23	15			
Wet Soil + Tare (g)	12.97	13.34	14.26			
Dry Soil + Tare (g)	9.80	9.93	10.41			
Water Loss (g)	3.17	3.41	3.85			
Tare (g)	7.02	7.06	7.36			
Dry Soil (g)	2.78	2.87	3.05			
Water Content, w (%)	114.03	118.82	126.23			
One-Point LL (%)		118				

Liquid Limit, LL (%)	**118**
Plastic Limit, PL (%)	**31**
Plasticity Index, PI (%)	**87**





Entered by:____________
Reviewed:____________

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/28/2018
By: BRR

Boring No.: TP-7
Station: 11
Depth: 6.0'
Description: Reddish brown fat clay

Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Preparation method: Air Dry
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Dry sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: Not requested
As-received water content (%): 32.0

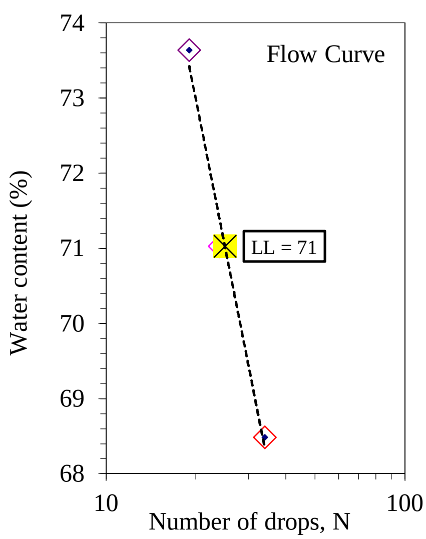
Plastic Limit

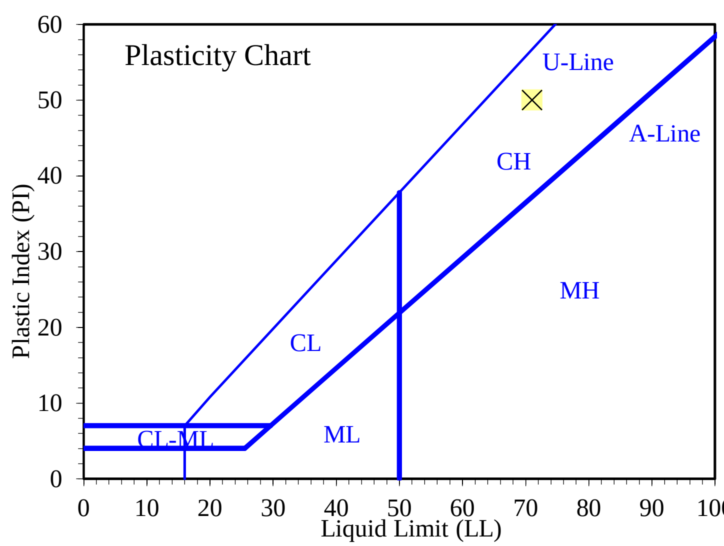
Determination No	1	2				
Wet Soil + Tare (g)	13.49	13.33				
Dry Soil + Tare (g)	12.36	12.24				
Water Loss (g)	1.13	1.09				
Tare (g)	7.06	7.10				
Dry Soil (g)	5.30	5.14				
Water Content, w (%)	21.32	21.21				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	24	19			
Wet Soil + Tare (g)	14.18	13.74	12.44			
Dry Soil + Tare (g)	11.29	10.97	10.15			
Water Loss (g)	2.89	2.77	2.29			
Tare (g)	7.07	7.07	7.04			
Dry Soil (g)	4.22	3.90	3.11			
Water Content, w (%)	68.48	71.03	73.63			
One-Point LL (%)		71				

Liquid Limit, LL (%)	**71**
Plastic Limit, PL (%)	**21**
Plasticity Index, PI (%)	**50**





Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[ALv2.xlsm]4

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/27/2018
By: BRR

Boring No.: TP-13
Station: 22
Depth: 9.5'
Description: Reddish brown fat clay

Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Preparation method: Air Dry
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Dry sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: Not requested
As-received water content (%): 21.5

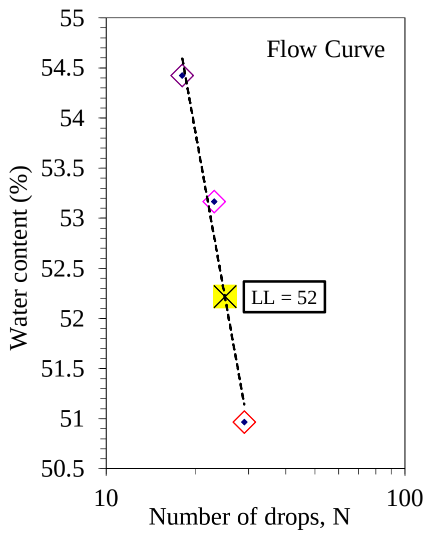
Plastic Limit

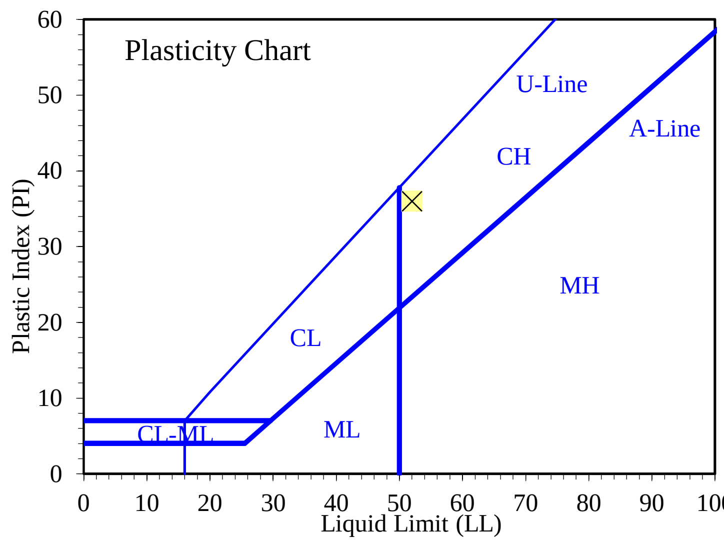
Determination No	1	2				
Wet Soil + Tare (g)	12.64	13.63				
Dry Soil + Tare (g)	11.76	12.70				
Water Loss (g)	0.88	0.93				
Tare (g)	6.42	6.99				
Dry Soil (g)	5.34	5.71				
Water Content, w (%)	16.48	16.29				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	29	23	18			
Wet Soil + Tare (g)	14.16	14.58	15.14			
Dry Soil + Tare (g)	11.78	12.06	12.31			
Water Loss (g)	2.38	2.52	2.83			
Tare (g)	7.11	7.32	7.11			
Dry Soil (g)	4.67	4.74	5.20			
Water Content, w (%)	50.96	53.16	54.42			
One-Point LL (%)	52	53				

Liquid Limit, LL (%)	**52**
Plastic Limit, PL (%)	**16**
Plasticity Index, PI (%)	**36**





Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[ALv2.xlsm]5

Liquid Limit, Plastic Limit, and Plasticity Index of Soils
(ASTM D4318)

IGES

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/27/2018
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.: TP-20
Station: 19
Depth: 8.0'
Description: Reddish brown fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Dry sieved
Approximate maximum grain size: No.10
Estimated percent retained on No.40: Not requested
As-received water content (%): Not requested

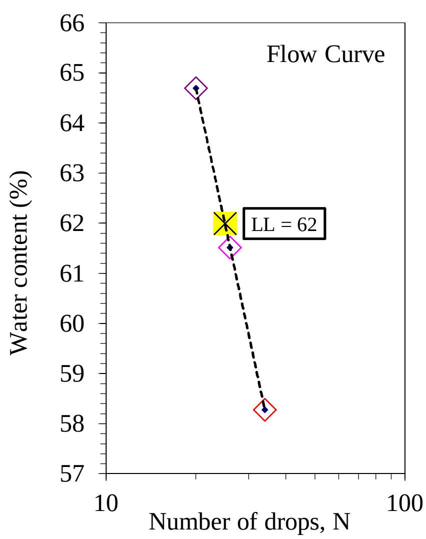
Plastic Limit

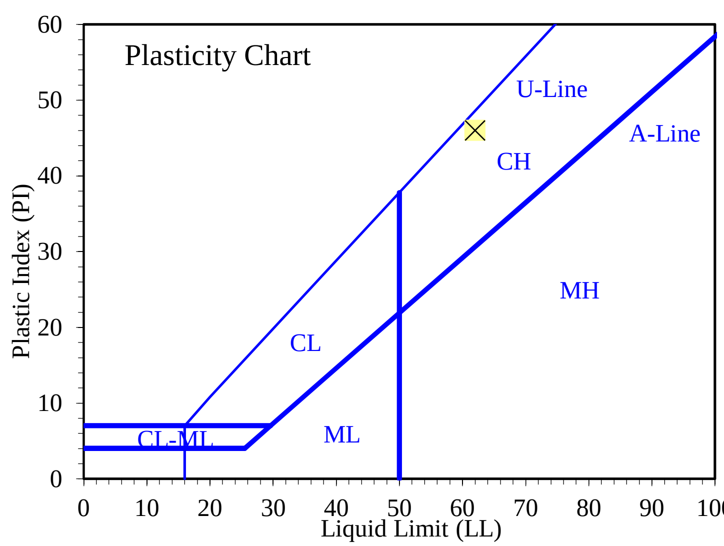
Determination No	1	2				
Wet Soil + Tare (g)	13.82	13.53				
Dry Soil + Tare (g)	12.88	12.64				
Water Loss (g)	0.94	0.89				
Tare (g)	7.05	7.08				
Dry Soil (g)	5.83	5.56				
Water Content, w (%)	16.12	16.01				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	26	20			
Wet Soil + Tare (g)	13.83	12.01	13.14			
Dry Soil + Tare (g)	11.33	10.14	10.74			
Water Loss (g)	2.50	1.87	2.40			
Tare (g)	7.04	7.10	7.03			
Dry Soil (g)	4.29	3.04	3.71			
Water Content, w (%)	58.28	61.51	64.69			
One-Point LL (%)		62	63			

Liquid Limit, LL (%)	**62**
Plastic Limit, PL (%)	**16**
Plasticity Index, PI (%)	**46**





Entered by:____________
Reviewed:____________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[ALv2.xlsm]6

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/26/2018
By: BRR
Grooving tool type: Plastic
Liquid limit device: Mechanical
Rolling method: Hand

Boring No.: TP-23
Station: 25
Depth: 10.0'
Description: Light brown fat clay

Preparation method: Wet
Liquid limit test method: Multipoint
Screened over No.40: Yes
Larger particles removed: Wet sieved
Approximate maximum grain size: 3/8"
Estimated percent retained on No.40: Not requested
As-received water content (%): 49.7

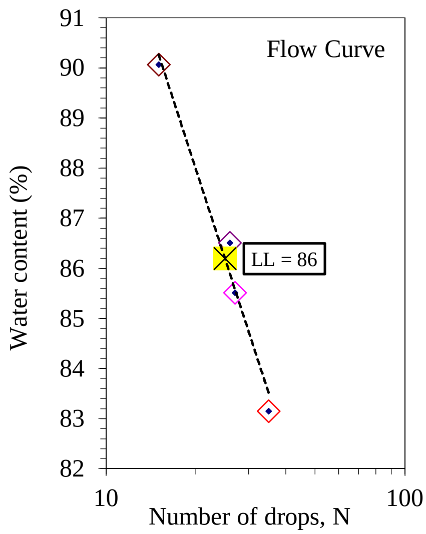
Plastic Limit

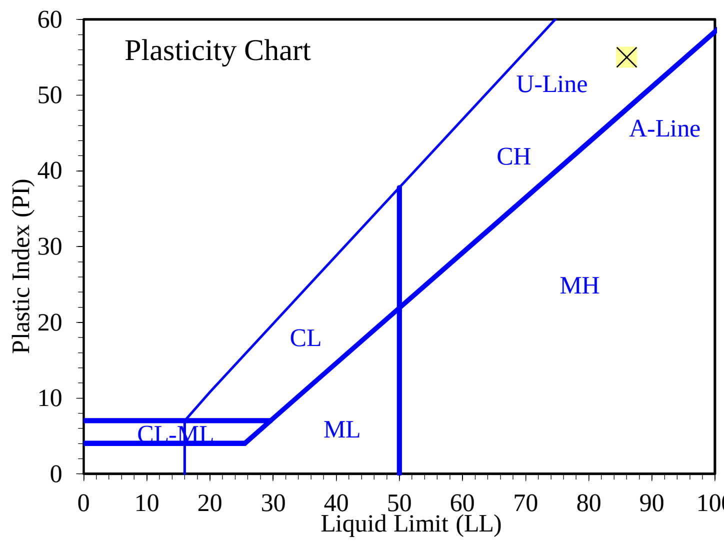
Determination No	1	2				
Wet Soil + Tare (g)	13.10	13.37				
Dry Soil + Tare (g)	11.66	11.87				
Water Loss (g)	1.44	1.50				
Tare (g)	7.07	7.08				
Dry Soil (g)	4.59	4.79				
Water Content, w (%)	31.37	31.32				

Liquid Limit

Determination No	1	2	3	4		
Number of Drops, N	35	27	26	15		
Wet Soil + Tare (g)	12.21	12.59	12.46	13.18		
Dry Soil + Tare (g)	9.99	10.17	9.96	10.28		
Water Loss (g)	2.22	2.42	2.50	2.90		
Tare (g)	7.32	7.34	7.07	7.06		
Dry Soil (g)	2.67	2.83	2.89	3.22		
Water Content, w (%)	83.15	85.51	86.51	90.06		
One-Point LL (%)		86	87			

Liquid Limit, LL (%)	**86**
Plastic Limit, PL (%)	**31**
Plasticity Index, PI (%)	**55**





Entered by:____________
Reviewed:____________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

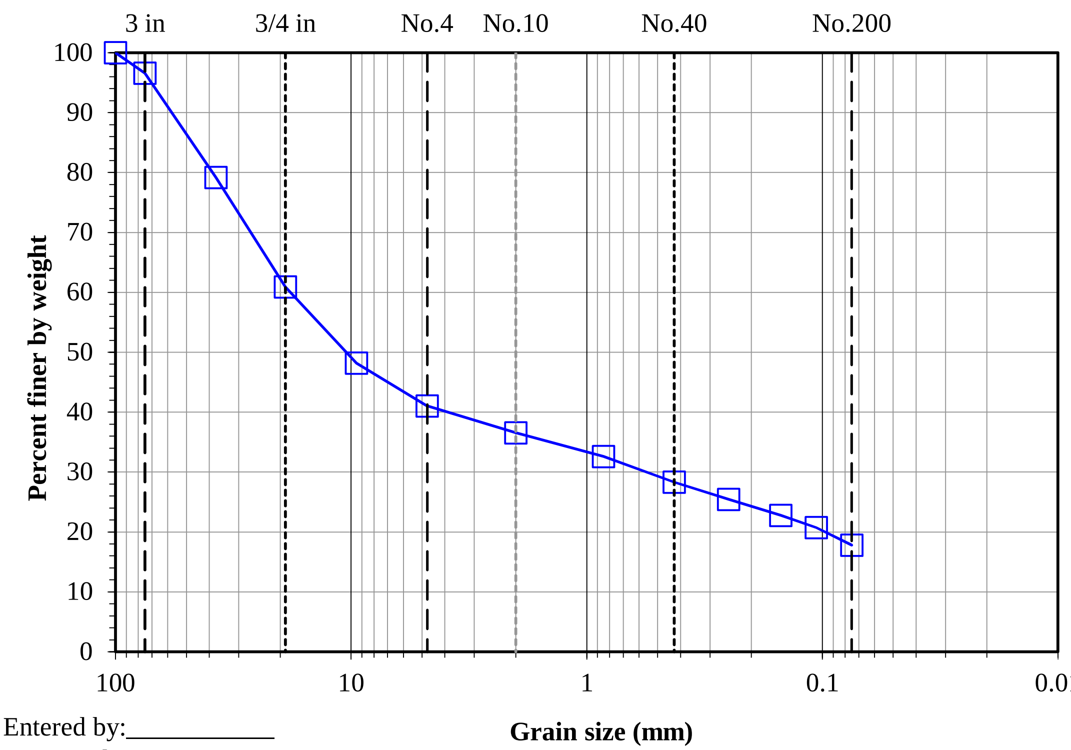
Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/20/2018
By: JWB

Boring No.: TP-1
Station: 16
Depth: 7.5'
Description: Red clayey gravel with sand

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	25028.20	24302.75
+3/8" Coarse fraction (g):	12711.80	12586.81
-3/8" Split fraction (g):	394.64	375.40
Split fraction:	0.482	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2859.95	566.82
Dry soil + tare (g):	2834.88	547.58
Tare (g):	310.19	172.18
Water content (%):	1.0	5.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	100.0	
3"	836.69	75	96.6	
1.5"	5061.94	37.5	79.2	
3/4"	9502.34	19	60.9	
3/8"	12586.81	9.5	48.2	←Split
No.4	55.82	4.75	41.0	
No.10	90.95	2	36.5	
No.20	121.79	0.85	32.6	
No.40	154.98	0.425	28.3	
No.60	177.20	0.25	25.5	
No.100	198.03	0.15	22.8	
No.140	213.81	0.106	20.8	
No.200	236.78	0.075	17.8	



Gravel (%): 59.0
Sand (%): 23.2
Fines (%): 17.8

Entered by:___________
Reviewed:___________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

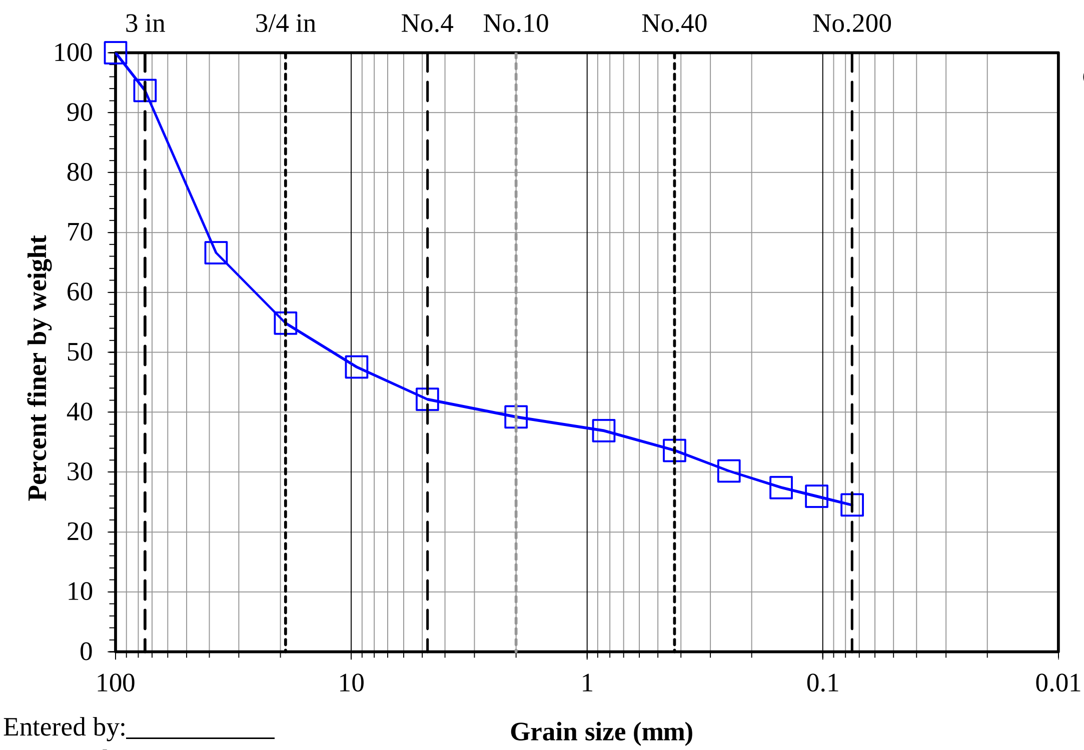
Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/20/2018
By: JWB

Boring No.: TP-4
Station: 21.5
Depth: 5.5'
Description: Brown clayey gravel with sand

	Moist	Dry
Split:	Yes	
Split sieve:	3/8"	
Total sample wt. (g):	22972.50	21775.36
+3/8" Coarse fraction (g):	11473.30	11425.82
-3/8" Split fraction (g):	359.08	323.18
Split fraction:	0.475	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	3318.20	585.69
Dry soil + tare (g):	3306.16	549.79
Tare (g):	408.54	226.61
Water content (%):	0.4	11.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	100.0	
3"	1377.68	75	93.7	
1.5"	7265.81	37.5	66.6	
3/4"	9832.74	19	54.8	
3/8"	11425.82	9.5	47.5	←Split
No.4	36.69	4.75	42.1	
No.10	56.55	2	39.2	
No.20	72.26	0.85	36.9	
No.40	94.80	0.425	33.6	
No.60	117.98	0.25	30.2	
No.100	136.90	0.15	27.4	
No.140	146.55	0.106	26.0	
No.200	156.62	0.075	24.5	



Gravel (%): 57.9
Sand (%): 17.6
Fines (%): 24.5

Entered by:___________
Reviewed:___________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

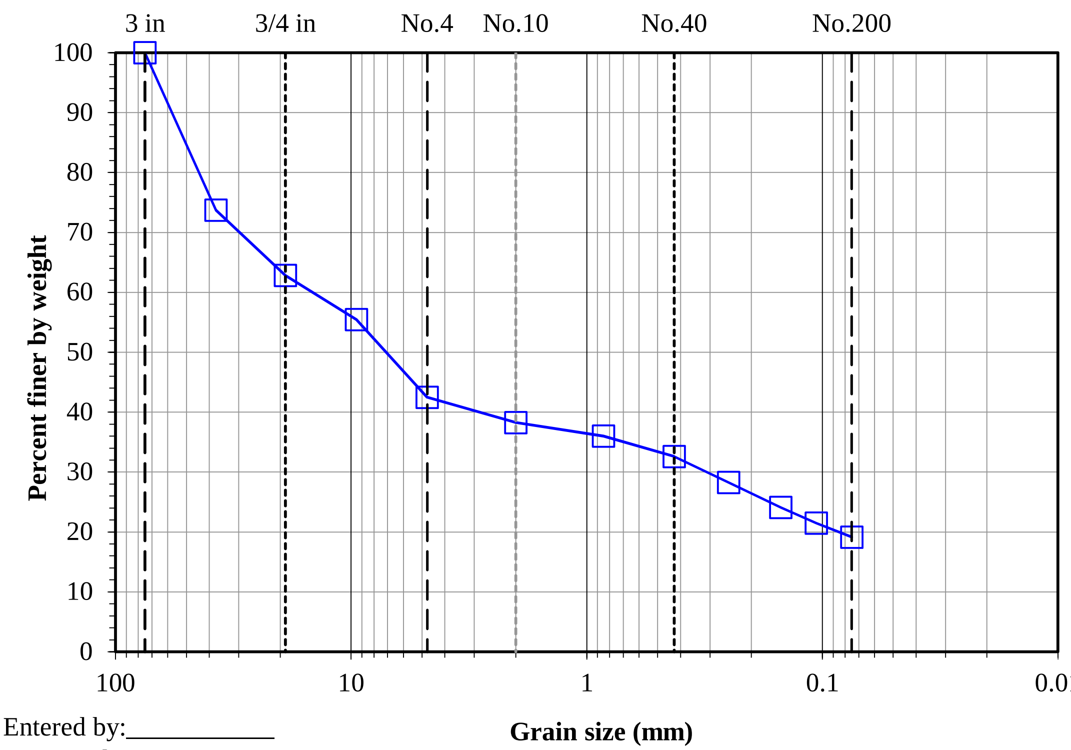
Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/20/2018
By: JWB

Boring No.: TP-10
Station: 13
Depth: 8.0'
Description: Red clayey gravel with sand

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	4617.92	4358.46
+3/8" Coarse fraction (g):	1977.17	1941.14
-3/8" Split fraction (g):	257.30	235.53
Split fraction:	0.555	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2596.35	475.79
Dry soil + tare (g):	2556.47	454.02
Tare (g):	407.89	218.49
Water content (%):	1.9	9.2

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	1144.69	37.5	73.7	
3/4"	1620.67	19	62.8	
3/8"	1941.14	9.5	55.5	←Split
No.4	55.22	4.75	42.5	
No.10	73.00	2	38.3	
No.20	82.66	0.85	36.0	
No.40	97.11	0.425	32.6	
No.60	115.54	0.25	28.3	
No.100	133.31	0.15	24.1	
No.140	144.28	0.106	21.5	
No.200	154.28	0.075	19.1	



Gravel (%): 57.5
Sand (%): 23.3
Fines (%): 19.1

Entered by:___________
Reviewed:___________

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

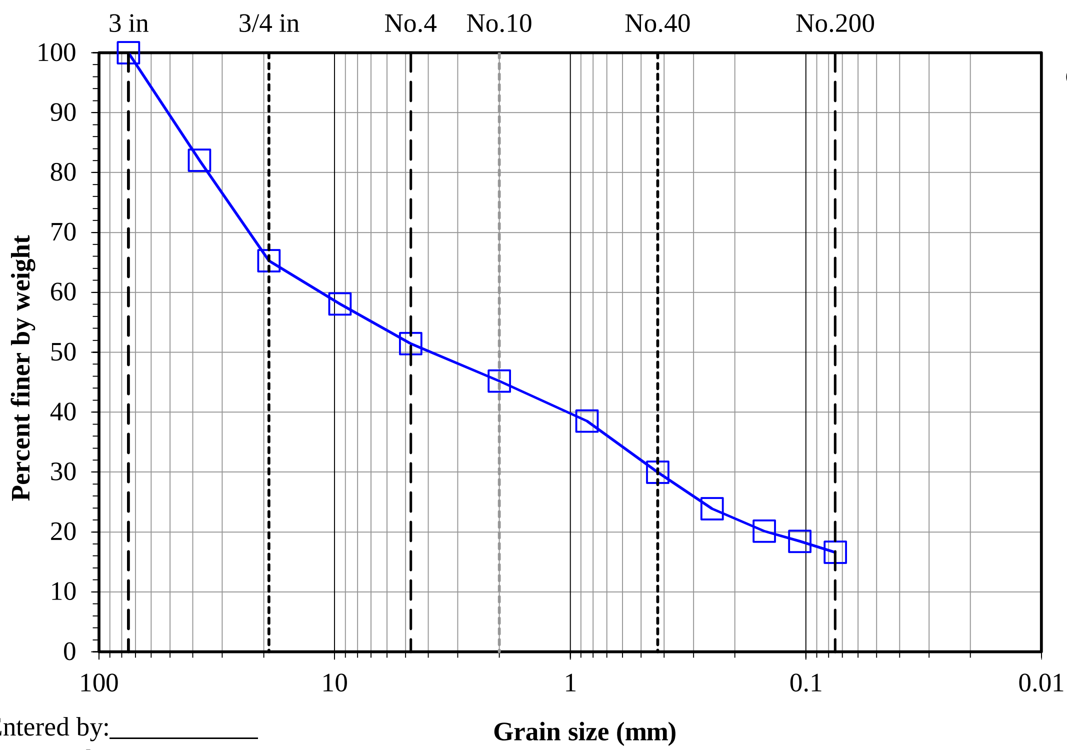
Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/21/2018
By: JWB

Boring No.: TP-15
Station: 25
Depth: 11.0'
Description: Red clayey gravel with sand

	Moist	Dry
Split:	Yes	
Split sieve:	3/8"	
Total sample wt. (g):	4332.46	4042.43
+3/8" Coarse fraction (g):	1754.98	1695.09
-3/8" Split fraction (g):	269.01	244.99
Split fraction:	0.581	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	2133.78	392.33
Dry soil + tare (g):	2072.25	368.31
Tare (g):	330.72	123.32
Water content (%):	3.5	9.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	725.48	37.5	82.1	
3/4"	1403.88	19	65.3	
3/8"	1695.09	9.5	58.1	←Split
No.4	27.85	4.75	51.5	
No.10	54.38	2	45.2	
No.20	82.59	0.85	38.5	
No.40	118.56	0.425	30.0	
No.60	144.33	0.25	23.9	
No.100	160.06	0.15	20.1	
No.140	167.33	0.106	18.4	
No.200	174.97	0.075	16.6	



Gravel (%): 48.5
Sand (%): 34.9
Fines (%): 16.6

Entered by:___________
Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[GSDv2.xlsx]4

Amount of Material in Soil Finer than the No. 200 (75µm) Sieve

(ASTM D1140)

IGES

Project: **Overlook**
No: **01628-027**
Location: Powder Mountain
Date: 9/26/2018
By: JWB/BRR/EH

Sample Info.	Boring No.	TP-3	TP-3	TP-5	TP-7	TP-23			
	Station	26	28	26	11	25			
	Depth	8.0'	12.0'	6.0'	6.0'	10.0'			
	Split	Yes	No	No	No	No			
	Split Sieve*	3/8"							
	Method	B	B	B	B	B			
	Specimen soak time (min)	360	310	320	310	360			
	Moist total sample wt. (g)	1342.00	184.74	318.99	307.54	153.11			
	Moist coarse fraction (g)	308.27							
	Moist split fraction + tare (g)	319.66							
	Split fraction tare (g)	128.56							
	Dry split fraction (g)	144.32							
	Dry retained No. 200 + tare (g)	165.38	143.75	157.99	171.83	144.29			
	Wash tare (g)	128.56	126.92	140.55	128.49	126.70			
	No. 200 Dry wt. retained (g)	36.82	16.83	17.44	43.34	17.59			
	Split sieve* Dry wt. retained (g)	297.44							
	Dry total sample wt. (g)	1078.12	115.04	220.69	233.07	103.49			
Coarse Fraction	Moist soil + tare (g)	473.63							
	Dry soil + tare (g)	462.80							
	Tare (g)	165.36							
	Water content (%)	3.64							
Split Fraction	Moist soil + tare (g)	319.66	311.66	459.54	436.03	279.81			
	Dry soil + tare (g)	272.88	241.96	361.24	361.56	230.19			
	Tare (g)	128.56	126.92	140.55	128.49	126.70			
	Water content (%)	32.41	60.59	44.54	31.95	47.95			
Percent passing split sieve* (%)		**72.4**							
Percent passing No. 200 sieve (%)		**53.9**	**85.4**	**92.1**	**81.4**	**83.0**			

Entered by:___________

Reviewed:___________

Z:\PROJECTS\01628_Powder_Mountain\027_Overlook\[FINESv3.xlsx]1

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/26/2018
By: EH

Boring No.: TP-3
Station: 28
Depth: 12.0'
Sample Description: Reddish brown fat clay
Sample type: Undisturbed-trimmed from thin-wall

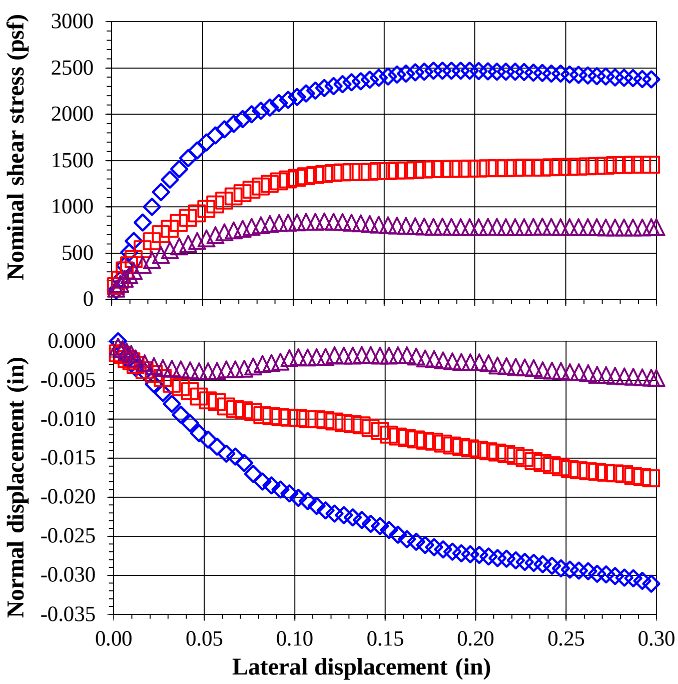
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0010
Specific gravity, Gs: 2.70 Assumed

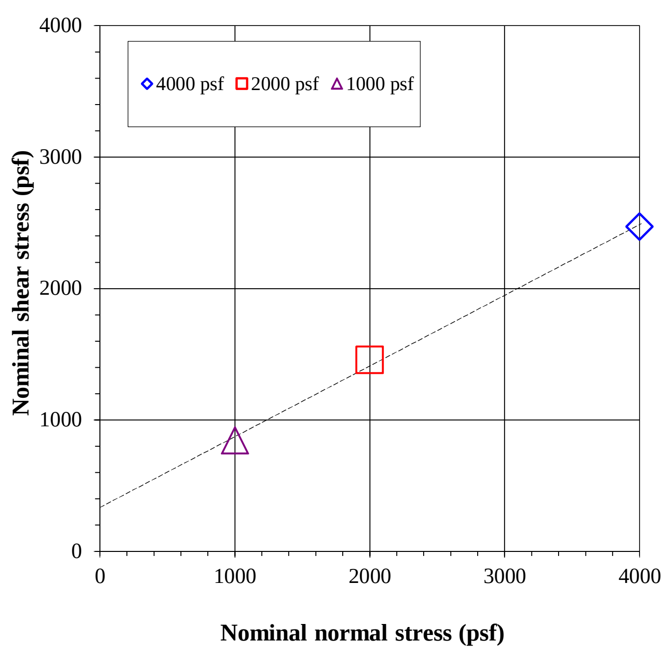
	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	4000		2000		1000	
Peak shear stress (psf)	2472		1455		843	
Lateral displacement at peak (in)	0.177		0.292		0.117	
Load Duration (min)	255		260		273	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.000	0.892	0.996	0.956	1.000	0.977
Sample diameter (in)	2.414	2.414	2.414	2.414	2.413	2.413
Wt. rings + wet soil (g)	158.10	156.75	162.76	163.01	164.96	165.71
Wt. rings (g)	45.79	45.79	45.22	45.22	45.76	45.76
Wet soil + tare (g)	311.66		311.66		311.66	
Dry soil + tare (g)	241.96		241.96		241.96	
Tare (g)	126.92		126.92		126.92	
Water content (%)	60.6	58.7	60.6	60.9	60.6	61.6
Dry unit weight (pcf)	58.2	65.2	61.2	63.7	61.8	63.3
Void ratio, e, for assumed Gs	1.90	1.58	1.76	1.65	1.73	1.66
Saturation (%)*	86.3	100.0	93.2	100.0	94.8	100.0

ϕ' (deg)	28
c' (psf)	335

Average of 3 samples	Initial	Pre-shear
Water content (%)	60.6	60.4
Dry unit weight (pcf)	60.4	64.1

*Pre-shear saturation set to 100% for phase calculations





Entered by:___________
Reviewed:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

IGES

Project: Overlook
No: 01628-027
Location: Powder Mountain

Boring No.: TP-3
Station: 28
Depth: 12.0'

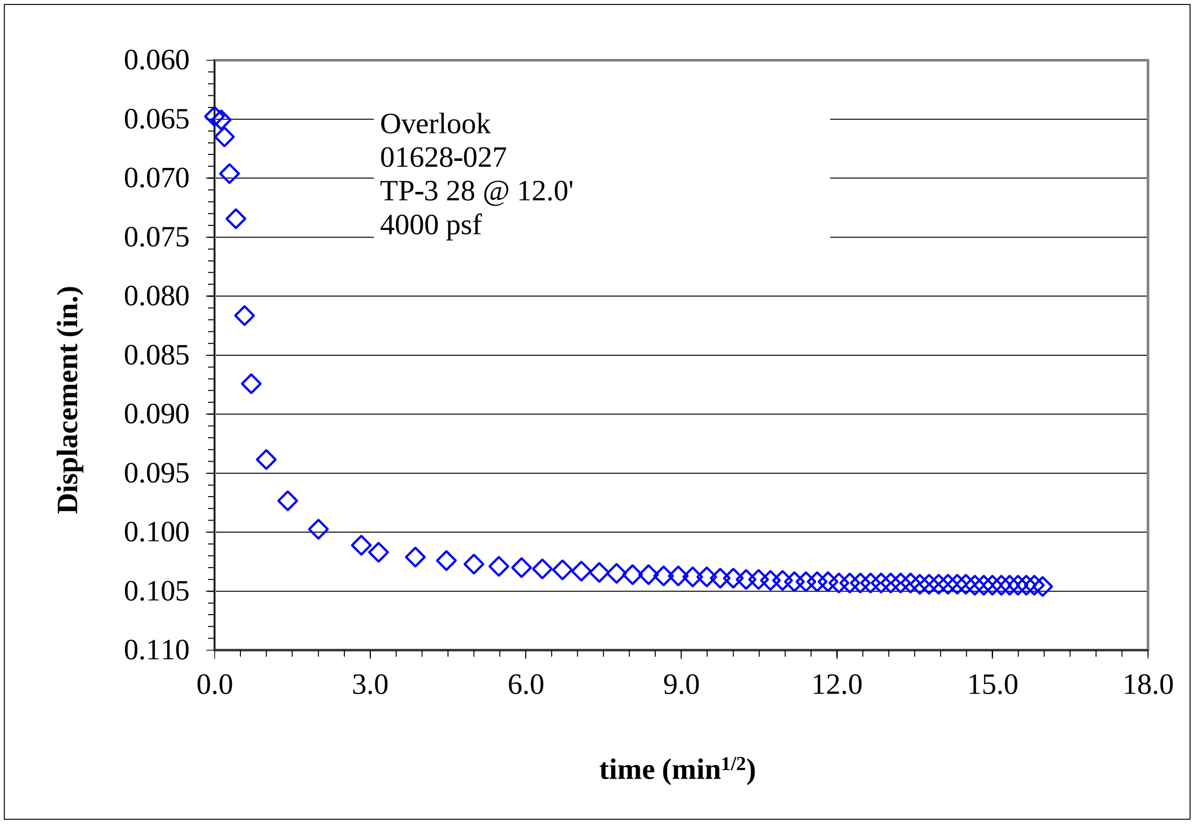
Nominal normal stress = 4000 psf			Nominal normal stress = 2000 psf			Nominal normal stress = 1000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.002	98	0.000	0.002	143	-0.002	0.002	117	-0.001
0.005	212	-0.001	0.005	214	-0.002	0.005	166	-0.001
0.007	367	-0.002	0.007	311	-0.002	0.007	223	-0.001
0.010	509	-0.003	0.010	369	-0.003	0.010	259	-0.002
0.012	631	-0.003	0.012	435	-0.003	0.012	307	-0.002
0.017	833	-0.004	0.017	541	-0.004	0.017	372	-0.003
0.022	1001	-0.006	0.022	626	-0.004	0.022	424	-0.003
0.027	1161	-0.007	0.027	702	-0.005	0.027	479	-0.003
0.032	1293	-0.008	0.032	761	-0.005	0.032	530	-0.004
0.037	1409	-0.009	0.037	823	-0.006	0.037	572	-0.004
0.042	1525	-0.011	0.042	881	-0.006	0.042	601	-0.004
0.047	1611	-0.012	0.047	929	-0.007	0.047	632	-0.004
0.052	1696	-0.013	0.052	978	-0.008	0.052	657	-0.004
0.057	1771	-0.014	0.057	1024	-0.008	0.057	693	-0.004
0.062	1836	-0.014	0.062	1065	-0.008	0.062	723	-0.004
0.067	1895	-0.015	0.067	1111	-0.009	0.067	744	-0.004
0.072	1950	-0.016	0.072	1145	-0.009	0.072	763	-0.004
0.077	2001	-0.017	0.077	1184	-0.009	0.077	783	-0.003
0.082	2040	-0.018	0.082	1218	-0.010	0.082	800	-0.003
0.087	2074	-0.019	0.087	1247	-0.010	0.087	813	-0.003
0.092	2120	-0.019	0.092	1274	-0.010	0.092	823	-0.003
0.097	2156	-0.020	0.097	1296	-0.010	0.097	827	-0.002
0.102	2187	-0.020	0.102	1313	-0.010	0.102	831	-0.002
0.107	2226	-0.021	0.107	1330	-0.010	0.107	836	-0.002
0.112	2255	-0.021	0.112	1344	-0.010	0.112	840	-0.002
0.117	2283	-0.022	0.117	1354	-0.010	0.117	843	-0.002
0.122	2306	-0.022	0.122	1364	-0.010	0.122	838	-0.002
0.127	2327	-0.022	0.127	1370	-0.011	0.127	834	-0.002
0.132	2345	-0.023	0.132	1373	-0.011	0.132	828	-0.002
0.137	2358	-0.023	0.137	1375	-0.011	0.137	821	-0.002
0.142	2374	-0.023	0.142	1379	-0.011	0.142	815	-0.002
0.147	2394	-0.024	0.147	1383	-0.012	0.147	808	-0.002
0.152	2410	-0.024	0.152	1385	-0.012	0.152	800	-0.002
0.157	2430	-0.025	0.157	1390	-0.012	0.157	796	-0.002
0.162	2441	-0.025	0.162	1393	-0.012	0.162	792	-0.002
0.167	2454	-0.026	0.167	1396	-0.013	0.167	789	-0.002
0.172	2461	-0.026	0.172	1401	-0.013	0.172	787	-0.002
0.177	2472	-0.026	0.177	1406	-0.013	0.177	784	-0.002
0.182	2469	-0.027	0.182	1406	-0.013	0.182	785	-0.002
0.187	2472	-0.027	0.187	1409	-0.013	0.187	784	-0.003
0.192	2469	-0.027	0.192	1410	-0.014	0.192	779	-0.003
0.197	2469	-0.027	0.197	1412	-0.014	0.197	780	-0.003
0.202	2467	-0.027	0.202	1412	-0.014	0.202	778	-0.003
0.207	2464	-0.028	0.207	1414	-0.014	0.207	782	-0.003
0.212	2461	-0.028	0.212	1415	-0.014	0.212	783	-0.003
0.217	2461	-0.028	0.217	1417	-0.014	0.217	781	-0.003
0.222	2459	-0.028	0.222	1420	-0.015	0.222	779	-0.003
0.227	2456	-0.028	0.227	1421	-0.015	0.227	780	-0.003
0.232	2449	-0.028	0.232	1423	-0.015	0.232	783	-0.003
0.237	2446	-0.029	0.237	1424	-0.016	0.237	786	-0.004
0.242	2441	-0.029	0.242	1426	-0.016	0.242	783	-0.004
0.247	2438	-0.029	0.247	1428	-0.016	0.247	780	-0.004
0.252	2430	-0.029	0.252	1431	-0.016	0.252	781	-0.004
0.257	2425	-0.029	0.257	1433	-0.017	0.257	778	-0.004
0.262	2418	-0.030	0.262	1435	-0.017	0.262	778	-0.004
0.267	2412	-0.030	0.267	1440	-0.017	0.267	778	-0.004
0.272	2407	-0.030	0.272	1445	-0.017	0.272	776	-0.004
0.277	2399	-0.030	0.277	1449	-0.017	0.277	775	-0.004
0.282	2394	-0.030	0.282	1449	-0.017	0.282	777	-0.005
0.287	2392	-0.030	0.287	1452	-0.017	0.287	776	-0.005
0.292	2381	-0.031	0.292	1455	-0.017	0.292	777	-0.005
0.297	2376	-0.031	0.297	1455	-0.018	0.297	779	-0.005
0.302	2371	-0.031	0.300	1455	-0.018	0.300	780	-0.005

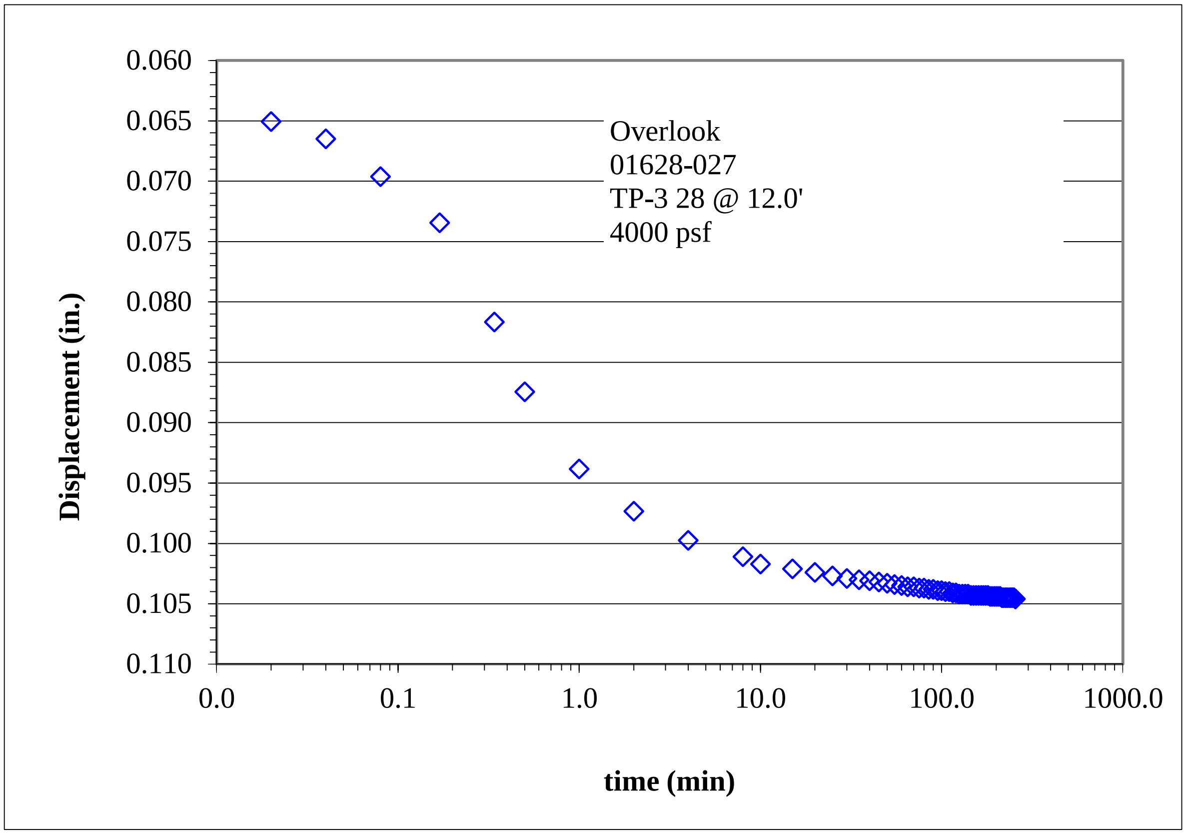
Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: Overlook
No: 01628-027
Location: Powder Mountain

Boring No.: TP-3
Station: 28
Depth: 12.0'





Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils (ASTM 6467)

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 10/10/2018
By: NB/JDF

Boring No.: TP-3
Station: 26
Depth: 8.0'
Sample Description: Reddish brown fat clay with sand
Engineering Classification: Not requested

Sample preparation: Screened over No.40 / remolded near liquid limit
Test type: Residual with multi-staged sample
Ring friction remarks: Modified upper platen
Ring shear device: Bromhead type, WF 25850 #2
Sample presheared: Yes
Failure surface location: Near top

inner/outter/avg. dia. (mm)	70	100	85
inner/outter/avg. radii (mm)	35	50	42.5
Thickness (mm)/area (cm^2):	5	40.1	

LL (%):	86	CF [a] (%):	N/A
PL (%):	29	Gs assum.:	2.8
% Finer No. 200 (tested sample):			82.8

LL, PL = liquid and plastic limits, respectively
[a]CF = %<0.002 mm and passing No. 10

	τ stress	σ stress	Horz. def	Vert. def
Units:	(psf)	(psf)	(deg.)	(in)
Conversion:	20885.434	2048.2	1	3.94E-05

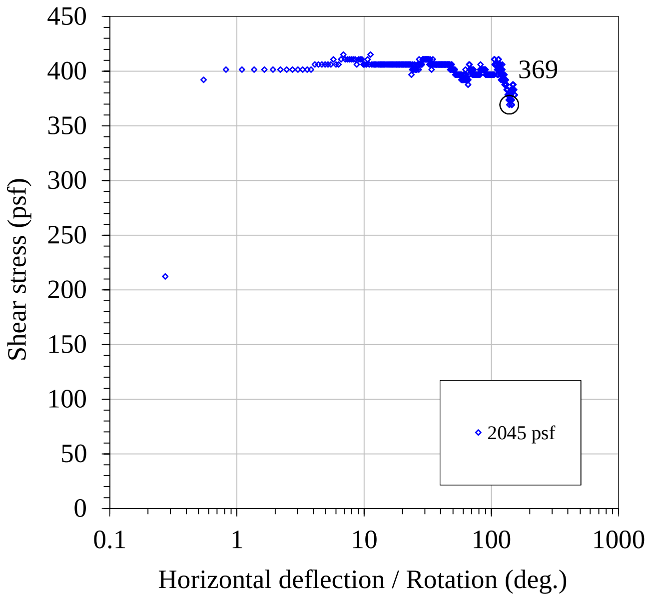
	Sample 1 Initial	Sample 1 Final
Sample thickness (mm)	5.00	3.00
Wt. container + wet soil (g)	626.66	
Wt. container (g)	594.92	
Wet soil + tare (g)	34.04	32.30
Dry soil + tare (g)	29.21	25.82
Tare (g)	23.41	12.71
Water content (%)	83.3	49.4
Dry density (g/cm^3)	0.86	1.44
Saturation (%)	1.0	1.5

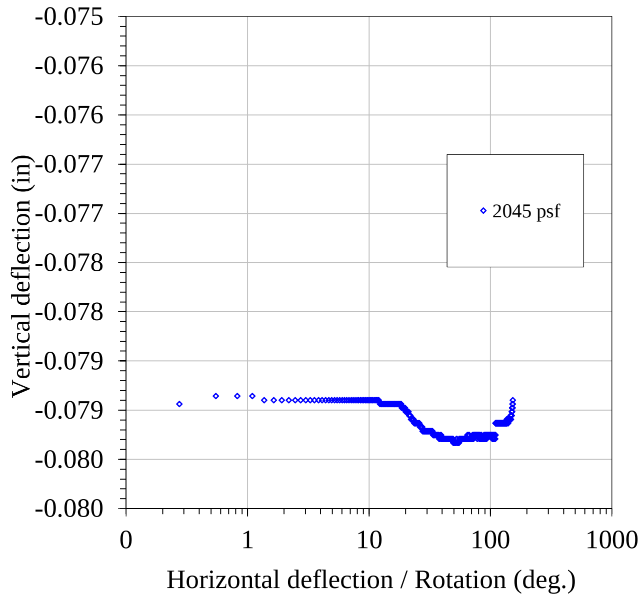
	Sample 1
Normal load on lever arm (kg)	4
Conversion factor (kg/cm^2) to (psf):	2048.1614
Residual deformation (deg.)	138.644
Normal stress (psf)	2045
Residual shear stress (psf)	369
Peak shear stress (psf)	415
Secant residual friction angle (deg)	10.2
Secant peak friction angle (deg)	11.5

Entered by:___________
Reviewed:___________

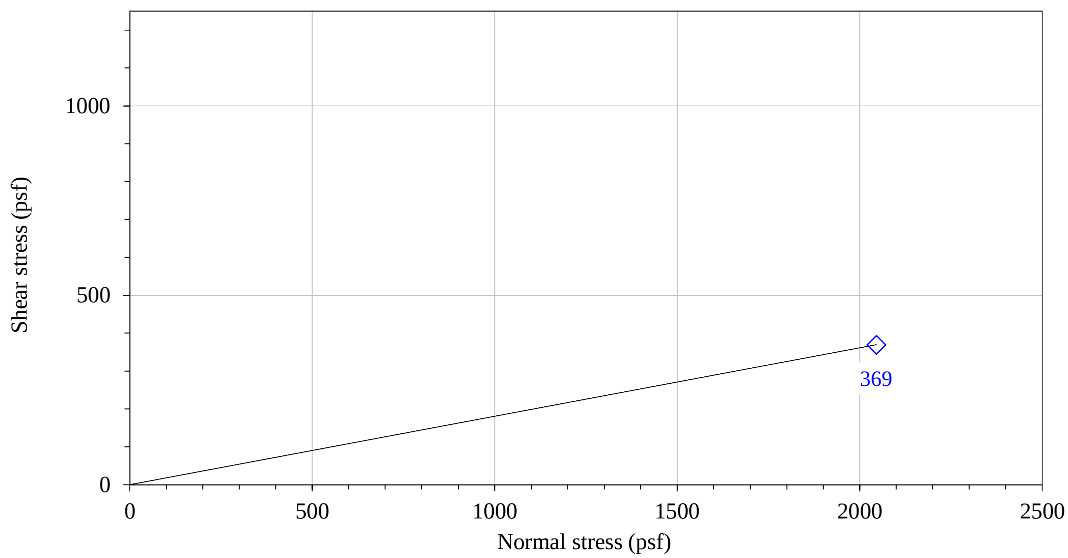
Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils

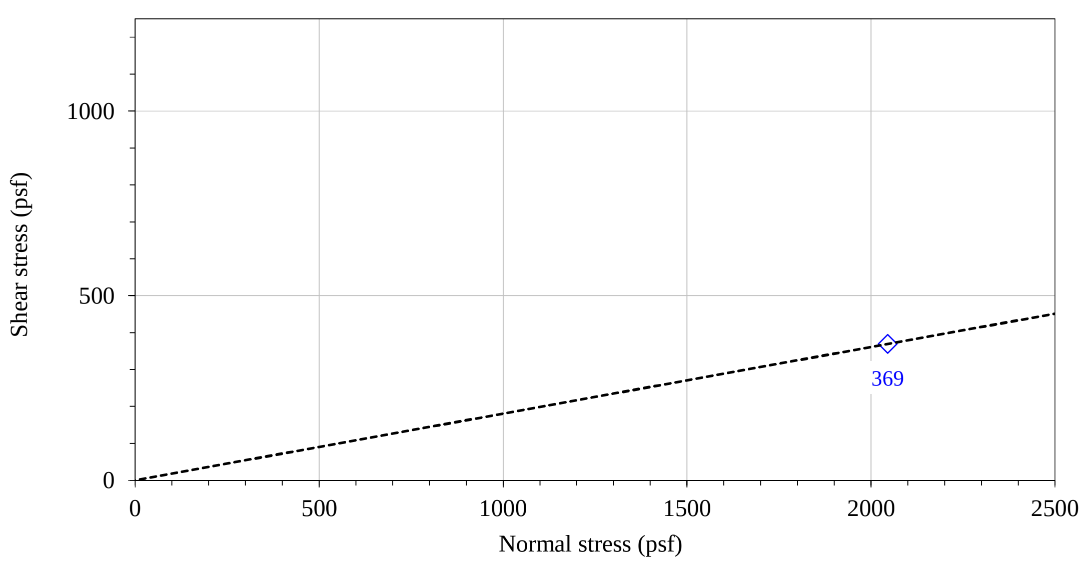
(*ASTM 6467*)





*Horizontal deflection (in) = Degrees rotation * 0.0292*





Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils (*ASTM 6467*)

IGES

Project: **Overlook**
No: **01628-027**
Location: Powder Mountain
Date: 10/10/2018
By: NB/JDF

Boring No.: **TP-23**
Station: **25**
Depth: **10.0'**
Sample Description: Light grey fat clay
Engineering Classification: Not requested

Sample preparation: Screened over No.40 / remolded near liquid limit
Test type: Residual with multi-staged sample
Ring friction remarks: Modified upper platen
Ring shear device: Bromhead type, WF 25850 #3
Sample presheared: Yes
Failure surface location: Near top

inner/outter/avg. dia. (mm)	70	100	85
inner/outter/avg. radii (mm)	35	50	42.5
Thickness (mm)/area (cm^2):	5	40.1	

LL (%):	86	CF [a] (%):	N/A
PL (%):	31	Gs assum.:	2.85
		% Finer No. 200 (tested sample):	89.1

LL, PL = liquid and plastic limits, respectively
[a]CF = %<0.002 mm and passing No. 10

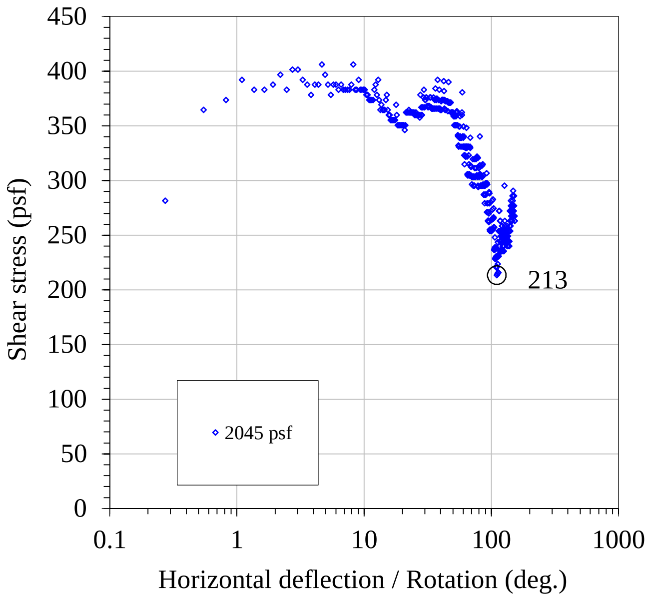
	τ stress	σ stress	Horz. def	Vert. def
Units:	(psf)	(psf)	(deg.)	(in)
Conversion:	20885.434	2048.2	1	3.94E-05

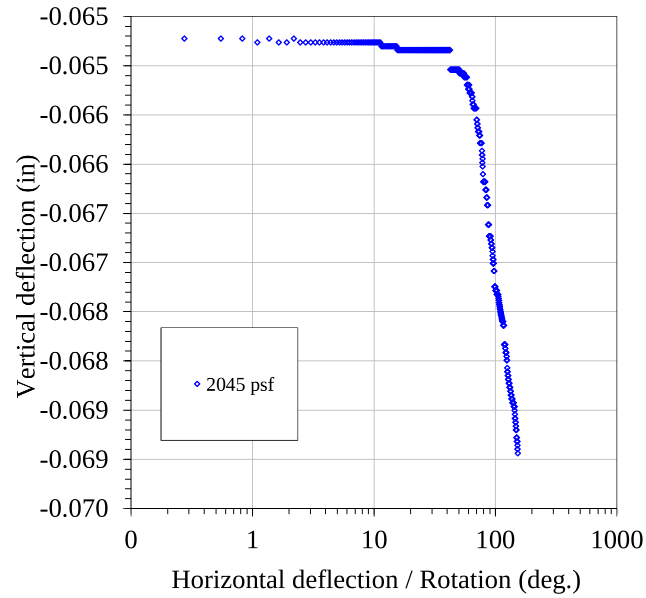
	Sample 1	
	Initial	Final
Sample thickness (mm)	5.00	3.25
Wt. container + wet soil (g)	627.67	
Wt. container (g)	594.63	
Wet soil + tare (g)	26.90	27.68
Dry soil + tare (g)	20.30	22.08
Tare (g)	12.48	12.45
Water content (%)	84.4	58.2
Dry density (g/cm^3)	0.89	1.38
Saturation (%)	1.1	1.5

	Sample 1
Normal load on lever arm (kg)	4
Conversion factor (kg/cm^2) to (psf):	2048.1614
Residual deformation (deg.)	110.422
Normal stress (psf)	2045
Residual shear stress (psf)	213
Peak shear stress (psf)	406
Secant residual friction angle (deg)	6.0
Secant peak friction angle (deg)	11.2

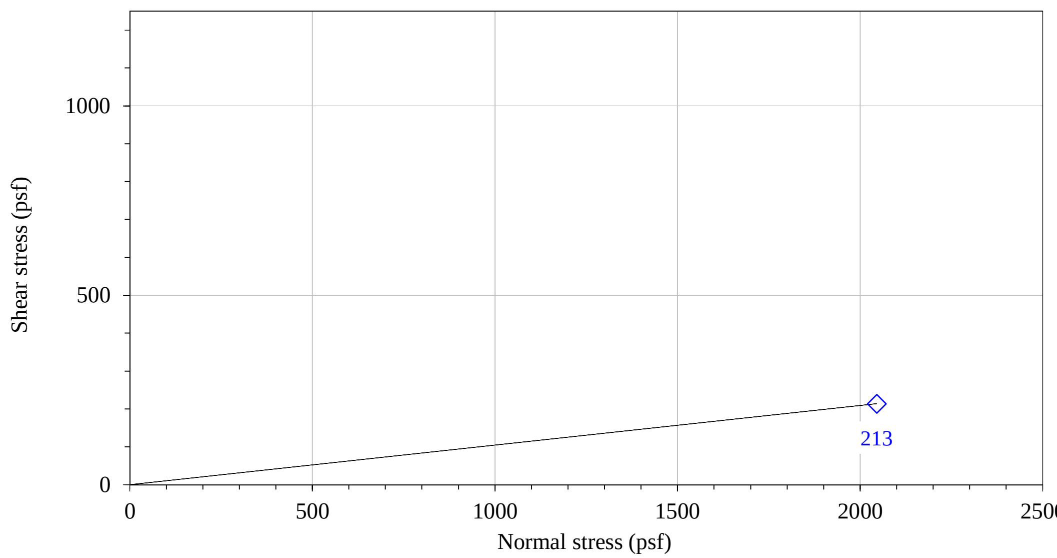
Entered by:___________
Reviewed:___________

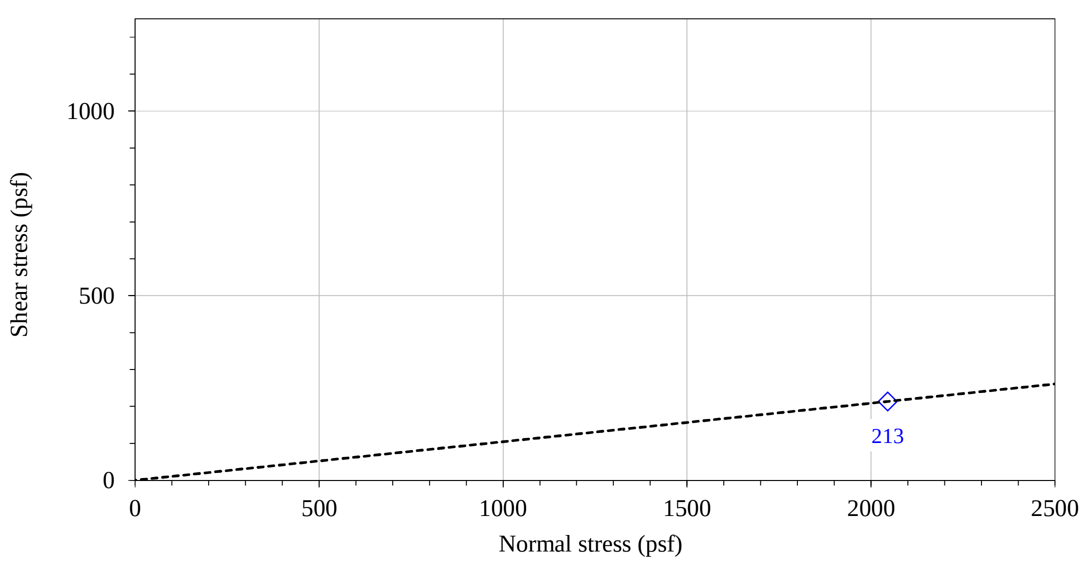
Torsional Ring Shear Test to Determine Drained Residual Shear Strength of Cohesive Soils (ASTM 6467)





*Horizontal deflection (in) = Degrees rotation * 0.0292*





Minimum Laboratory Soil Resistivity, pH of Soil for Use in Corrosion Testing, and Ions in Water by Chemically Suppressed Ion Chromatography *(AASHTO T 288, T 289, ASTM D4327, and C1580)*

Project: Overlook
No: 01628-027
Location: Powder Mountain
Date: 9/25/2018
By: JWB

Sample info.	Boring No.	TP-5							
	Station	34							
	Depth	7.0'							
Water content data	Wet soil + tare (g)	126.42							
	Dry soil + tare (g)	108.14							
	Tare (g)	37.58							
	Water content (%)	25.9							
Chem. data	pH*	5.86							
	Soluble chloride* (ppm)	38.5							
	Soluble sulfate** (ppm)	386							
Resistivity data	Pin method	2							
	Soil box	Miller Small							
		Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)	Approximate Soil condition (%)	Resistance Reading (Ω)	Soil Box Multiplier (cm)	Resistivity (Ω-cm)
		As Is	2666	0.67	1786				
		+3	1453	0.67	974				
		+6	1008	0.67	675				
		+9	865	0.67	580				
		+12	853	0.67	572				
		+15	799	0.67	535				
		+18	841	0.67	563				
	Minimum resistivity (Ω-cm)	**535**							

* Performed by AWAL using EPA 300.0

** Performed by AWAL using ASTM C1580

Entered by:___________

Reviewed:___________

APPENDIX C

USGS Design Maps Summary Report

User–Specified Input

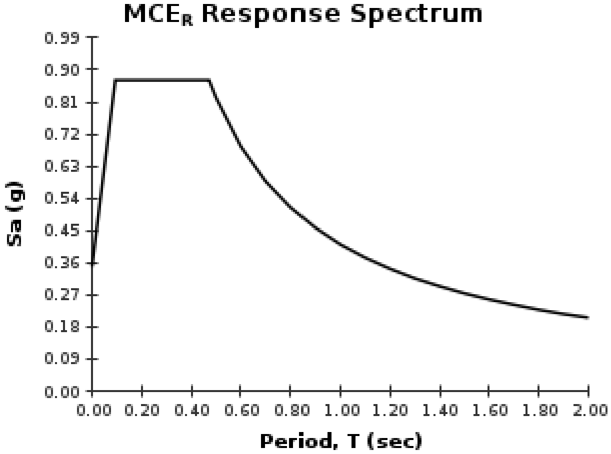
Report Title	The Overlook Fri January 27, 2017 18:56:30 UTC
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	41.3645°N, 111.7436°W
Site Soil Classification	Site Class C – “Very Dense Soil and Soft Rock”
Risk Category	I/II/III

USGS–Provided Output

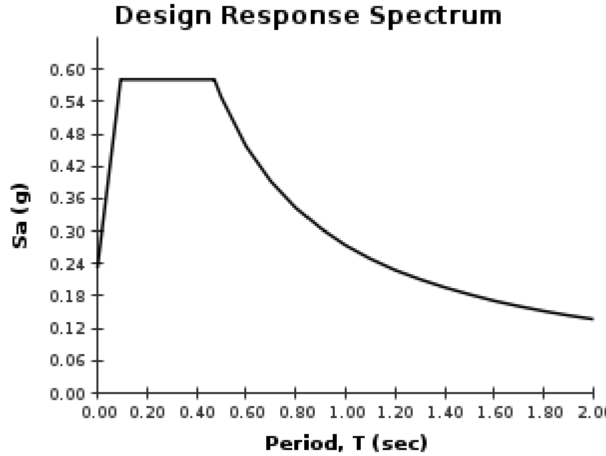
S_S =	0.810 g	S_{MS} =	0.871 g	S_{DS} =	0.581 g
S_1 =	0.268 g	S_{M1} =	0.411 g	S_{D1} =	0.274 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



USGS Design Maps Detailed Report

2012/2015 International Building Code (41.3645°N, 111.7436°W)

Site Class C – “Very Dense Soil and Soft Rock”, Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2012/2015 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(1) [1] S_S = 0.810 g

From Figure 1613.3.1(2) [2] S_1 = 0.268 g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class C, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = C and S_S = 0.810 g, F_a = 1.076

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1–s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = C and S_1 = 0.268 g, F_v = 1.532

Equation (16-37): $S_{MS} = F_aS_S = 1.076 \times 0.810 = 0.871$ g

---

Equation (16-38): $S_{M1} = F_vS_1 = 1.532 \times 0.268 = 0.411$ g

---

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = ⅔\ S_{MS} = ⅔ \times 0.871 = 0.581$ g

---

Equation (16-40): $S_{D1} = ⅔\ S_{M1} = ⅔ \times 0.411 = 0.274$ g

---

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.581 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.274 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

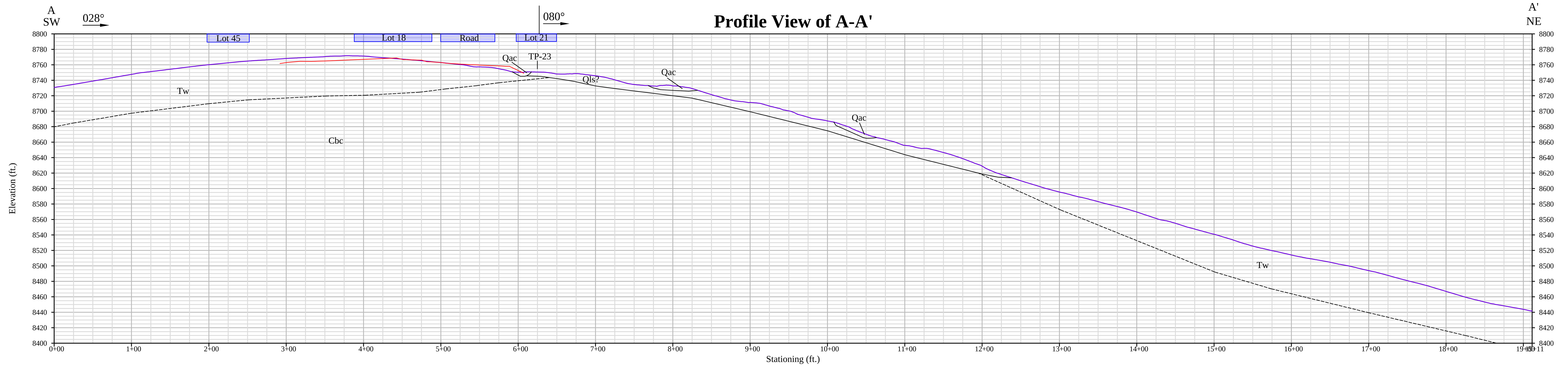
Seismic Design Category ≡ “the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)” = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

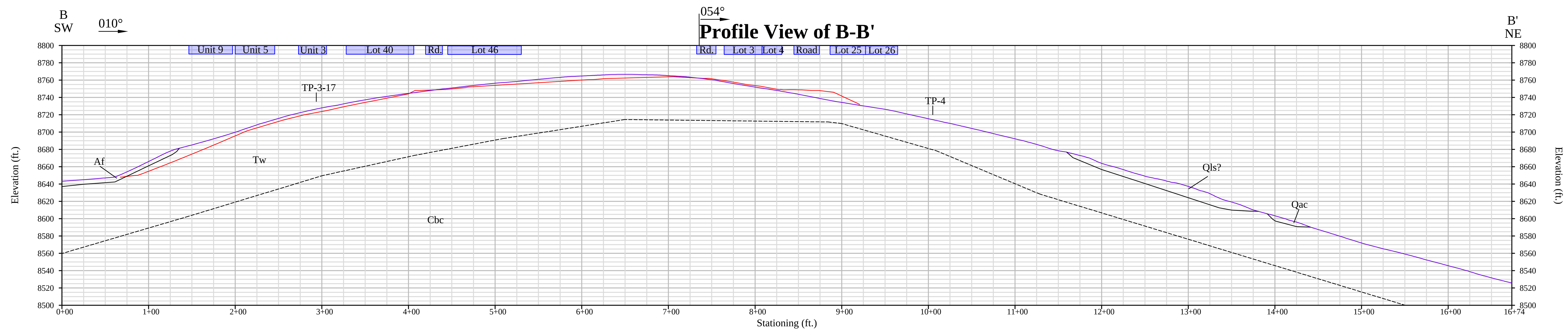
References

1. *Figure 1613.3.1(1)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(1).pdf
2. *Figure 1613.3.1(2)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(2).pdf

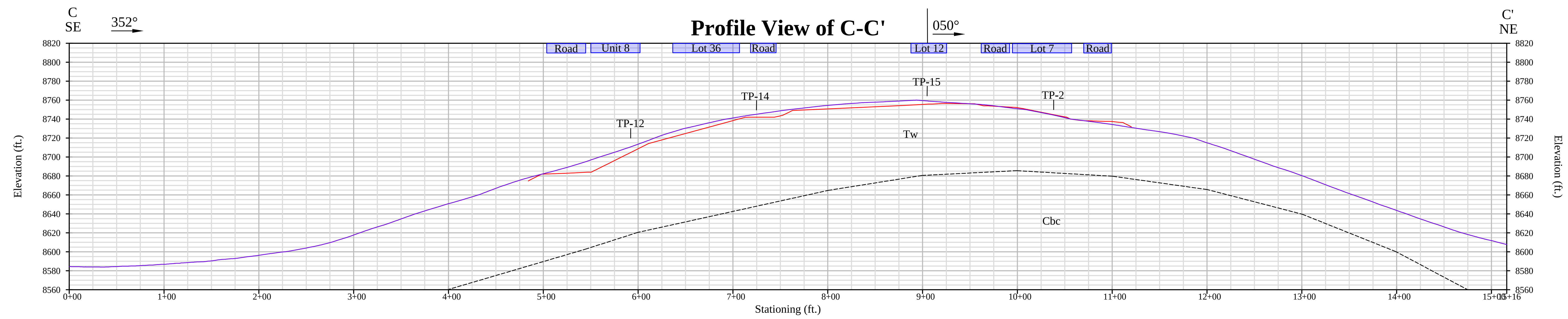
APPENDIX D



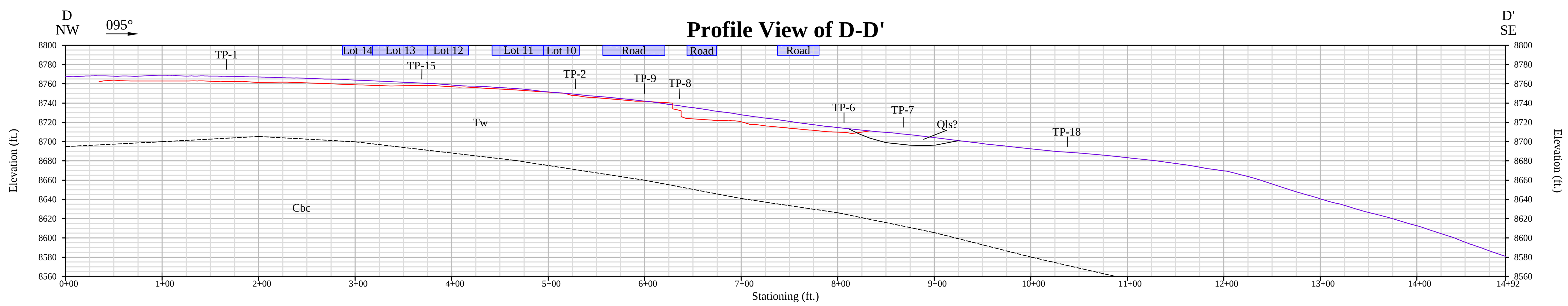
Profile View of A-A'



Profile View of B-B'



Profile View of C-C'



Profile View of D-D'

LEGEND

Qac: Alluvium and Colluvium

Qls: Landslide deposits (queried where uncertian)

Tw: Wasatch Formation

Cbc: Calls Fort Shale

Existing Grade

Planned Final Grade

*All Geologic Contacts Approximate

No Vertical Exaggeration

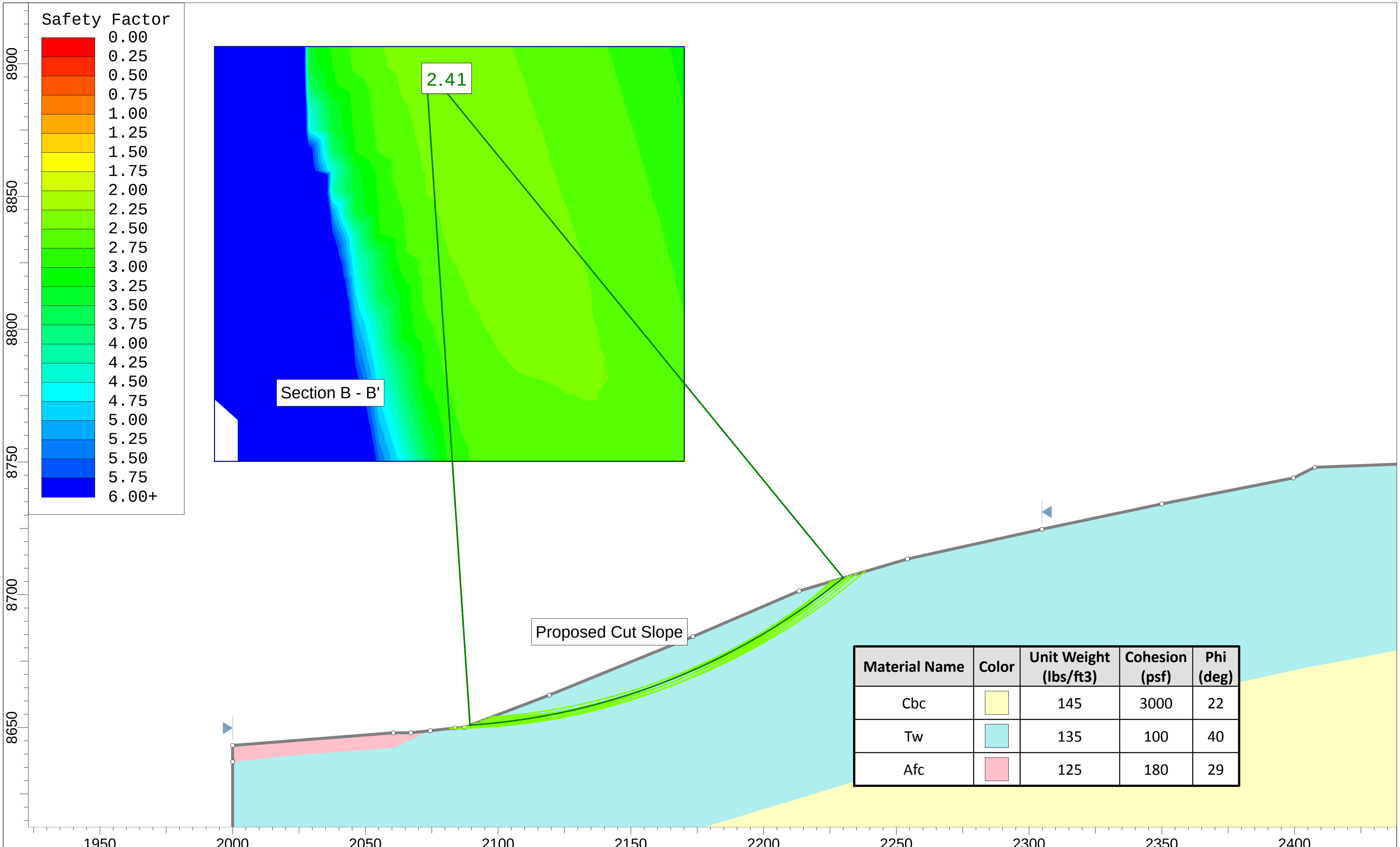
0 80 160
FEET
1"=80'

IGES®
Project No: 01628-027

Geotechnical and Geologic Hazards Assessment
The Overlook - Phase II & III
Summit Powder Mountain Resort
Weber County, Utah

Geologic Cross-Sections

Plate
D-1



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Afc		125	180	29

IGES®

SLIDEINTERPRET 8.018

Project	Summit Powder Mountain Resort - The Overlook - Phase I & II
Analysis Description	Method : Spencer
Drawn By	JKW
Scale	1:600
Company	IGES, Inc.
Date	10-5-2018
File Name	Section BB.slim

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase I & II

Project Summary – BB Static

Slide Modeler Version:	8.018
Compute Time:	00h:00m:00.533s

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer
Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Create Tension Crack
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Property	Cbc	Tw	Qls	Afc

Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	120	125
Cohesion [psf]	3000	100	150	180
Friction Angle [°]	22	40	30	29
Water Surface	None	None	None	None
Ru Value	0	0	0	0

Global Minimums

Method: spencer

FS	2.408790
Center:	2072.777, 8898.680
Radius:	248.429
Left Slip Surface Endpoint:	2089.408, 8650.808
Right Slip Surface Endpoint:	2230.023, 8706.350
Resisting Moment:	3.65246e+07 lb-ft
Driving Moment:	1.5163e+07 lb-ft
Resisting Horizontal Force:	135710 lb
Driving Horizontal Force:	56339.4 lb
Total Slice Area:	1236.35 ft2
Surface Horizontal Width:	140.616 ft
Surface Average Height:	8.79239 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 4740

Number of Invalid Surfaces: 111

Error Codes:

- Error Code -102 reported for 1 surface
- Error Code -106 reported for 63 surfaces
- Error Code -108 reported for 46 surfaces
- Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

- -102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
- -111 = safety factor equation did not converge

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 2.40879**

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.68719	453.49	4.38065	Tw	100	40	82.2278	198.07	116.875	0	116.875	123.174	123.174
2	4.68719	1332.18	5.46573	Tw	100	40	150.677	362.95	313.371	0	313.371	327.789	327.789
3	4.68719	2154.12	6.55279	Tw	100	40	212.77	512.519	491.62	0	491.62	516.061	516.061
4	4.68719	2918.98	7.64222	Tw	100	40	268.724	647.3	652.246	0	652.246	688.303	688.303
5	4.68719	3626.35	8.73444	Tw	100	40	318.741	767.78	795.829	0	795.829	844.799	844.799
6	4.68719	4275.75	9.82986	Tw	100	40	363.006	874.406	922.902	0	922.902	985.799	985.799
7	4.68719	4880.94	10.9289	Tw	100	40	402.744	970.126	1036.98	0	1036.98	1114.74	1114.74
8	4.68719	5481.45	12.0321	Tw	100	40	440.982	1062.23	1146.74	0	1146.74	1240.74	1240.74

9	4.68719	6027.43	13.1398	Tw	100	40	474.192	1142.23	1242.08	0	1242.08	1352.77	1352.77
10	4.68719	6512.8	14.2525	Tw	100	40	502.119	1209.5	1322.26	0	1322.26	1449.8	1449.8
11	4.68719	6936.7	15.3708	Tw	100	40	524.903	1264.38	1387.66	0	1387.66	1531.95	1531.95
12	4.68719	7298.15	16.4951	Tw	100	40	542.662	1307.16	1438.64	0	1438.64	1599.33	1599.33
13	4.68719	7596.1	17.6259	Tw	100	40	555.503	1338.09	1475.5	0	1475.5	1652	1652
14	4.68719	7829.39	18.7639	Tw	100	40	563.54	1357.45	1498.57	0	1498.57	1690.01	1690.01
15	4.68719	7996.73	19.9097	Tw	100	40	566.861	1365.45	1508.1	0	1508.1	1713.41	1713.41
16	4.68719	8096.72	21.0638	Tw	100	40	565.558	1362.31	1504.36	0	1504.36	1722.18	1722.18
17	4.68719	8127.83	22.2269	Tw	100	40	559.717	1348.24	1487.59	0	1487.59	1716.32	1716.32
18	4.68719	8088.55	23.3997	Tw	100	40	549.425	1323.45	1458.05	0	1458.05	1695.8	1695.8
19	4.68719	8013.33	24.5831	Tw	100	40	537.004	1293.53	1422.39	0	1422.39	1668.06	1668.06
20	4.68719	7890.6	25.7777	Tw	100	40	521.835	1256.99	1378.85	0	1378.85	1630.86	1630.86
21	4.68719	7691.2	26.9845	Tw	100	40	502.285	1209.9	1322.73	0	1322.73	1578.49	1578.49
22	4.68719	7412.67	28.2044	Tw	100	40	478.419	1152.41	1254.21	0	1254.21	1510.78	1510.78
23	4.68719	7052.33	29.4384	Tw	100	40	450.277	1084.62	1173.43	0	1173.43	1427.54	1427.54
24	4.68719	6607.2	30.6876	Tw	100	40	417.917	1006.67	1080.53	0	1080.53	1328.55	1328.55
25	4.68719	6074.02	31.9532	Tw	100	40	381.382	918.669	975.651	0	975.651	1213.53	1213.53
26	4.68719	5449.16	33.2365	Tw	100	40	340.715	820.712	858.912	0	858.912	1082.18	1082.18
27	4.68719	4669.33	34.5389	Tw	100	40	292.727	705.117	721.15	0	721.15	922.628	922.628
28	4.68719	3494.77	35.862	Tw	100	40	225.013	542.009	526.765	0	526.765	689.42	689.42
29	4.68719	2174.79	37.2077	Tw	100	40	151.854	365.784	316.749	0	316.749	432.044	432.044
30	4.68719	743.913	38.5777	Tw	100	40	76.1136	183.342	99.3227	0	99.3227	160.035	160.035

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 2.40879**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2089.41	8650.81	0	0	0
2	2094.09	8651.17	343.457	124.788	19.9676
3	2098.78	8651.62	909.173	330.331	19.9677
4	2103.47	8652.15	1641.79	596.512	19.9676
5	2108.16	8652.78	2491.15	905.113	19.9677
6	2112.84	8653.5	3412.08	1239.71	19.9676
7	2117.53	8654.31	4364.06	1585.6	19.9677
8	2122.22	8655.22	5313.29	1930.48	19.9676
9	2126.91	8656.22	6234.64	2265.24	19.9677
10	2131.59	8657.31	7098.24	2579.01	19.9676
11	2136.28	8658.5	7877.52	2862.15	19.9677
12	2140.97	8659.79	8549.88	3106.44	19.9677
13	2145.65	8661.18	9096.69	3305.11	19.9677
14	2150.34	8662.67	9503.17	3452.79	19.9676
15	2155.03	8664.26	9758.36	3545.51	19.9676
16	2159.72	8665.96	9855.18	3580.69	19.9676
17	2164.4	8667.76	9790.37	3557.14	19.9676
18	2169.09	8669.68	9564.6	3475.12	19.9677
19	2173.78	8671.71	9182.53	3336.3	19.9677
20	2178.46	8673.85	8649.58	3142.66	19.9676
21	2183.15	8676.12	7974.35	2897.33	19.9677
22	2187.84	8678.5	7171.79	2605.73	19.9676
23	2192.53	8681.02	6261.53	2275.01	19.9677
24	2197.21	8683.66	5268.09	1914.06	19.9676
25	2201.9	8686.44	4221.28	1533.72	19.9676
26	2206.59	8689.37	3156.53	1146.87	19.9677
27	2211.27	8692.44	2115.43	768.6	19.9676
28	2215.96	8695.66	1161	421.828	19.9677
29	2220.65	8699.05	430.893	156.557	19.9677
30	2225.34	8702.61	15.4385	5.6093	19.9677
31	2230.02	8706.35	0	0	0

Entity Information

External Boundary

X	Y
2000	8500
3550.37	8500
3673.57	8500
3673.57	8525.75
3625	8538.9
3500	8571.94
3440.99	8590.28
3432.09	8593.71
3411.76	8600
3391.43	8605.55
3380.27	8608.62
3375.18	8610
3326.79	8628
3275	8643.45
3251.92	8648.59
3227.3	8656
3198.29	8664.55
3186.04	8670
3159.63	8676.9
3152.43	8678
3130.89	8684.05
3100.94	8692
3050	8704.2
3000	8715.47
2952.01	8726
2925	8730.24
2920.74	8732
2890.63	8746
2874.89	8747.95
2848.69	8748.87
2833.09	8748.69
2829.54	8749.26
2828.43	8748.8
2806.35	8752.97
2791.67	8754.72
2747.03	8762
2732.26	8762.6
2725	8762.89
2706.07	8764
2675	8763.15
2600	8760
2575	8758.57
2550	8757.04
2525	8755.51
2500	8753.98
2468.76	8752.06
2445.16	8749.44
2407.56	8748
2399.57	8744
2350	8734.24
2304.84	8724.68
2254.15	8713.49
2213.39	8701.43
2173.4	8684.28
2119.31	8662.24
2087.31	8650
2083.77	8649.87
2074.44	8648.83
2067.1	8648
2060.54	8648
2000	8643.28
2000	8637.11
2000	8559.84

Material Boundary

X	Y
2000	8637.11
2025.07	8639.82
2061.1	8642.42
2074.44	8648.83

Material Boundary

X	Y
3159.63	8676.9
3166.97	8670.46
3199.94	8656.85
3250.18	8640.59
3335.64	8612.64
3350.15	8609.92

3371.27	8608.75
3380.27	8608.62

Material Boundary

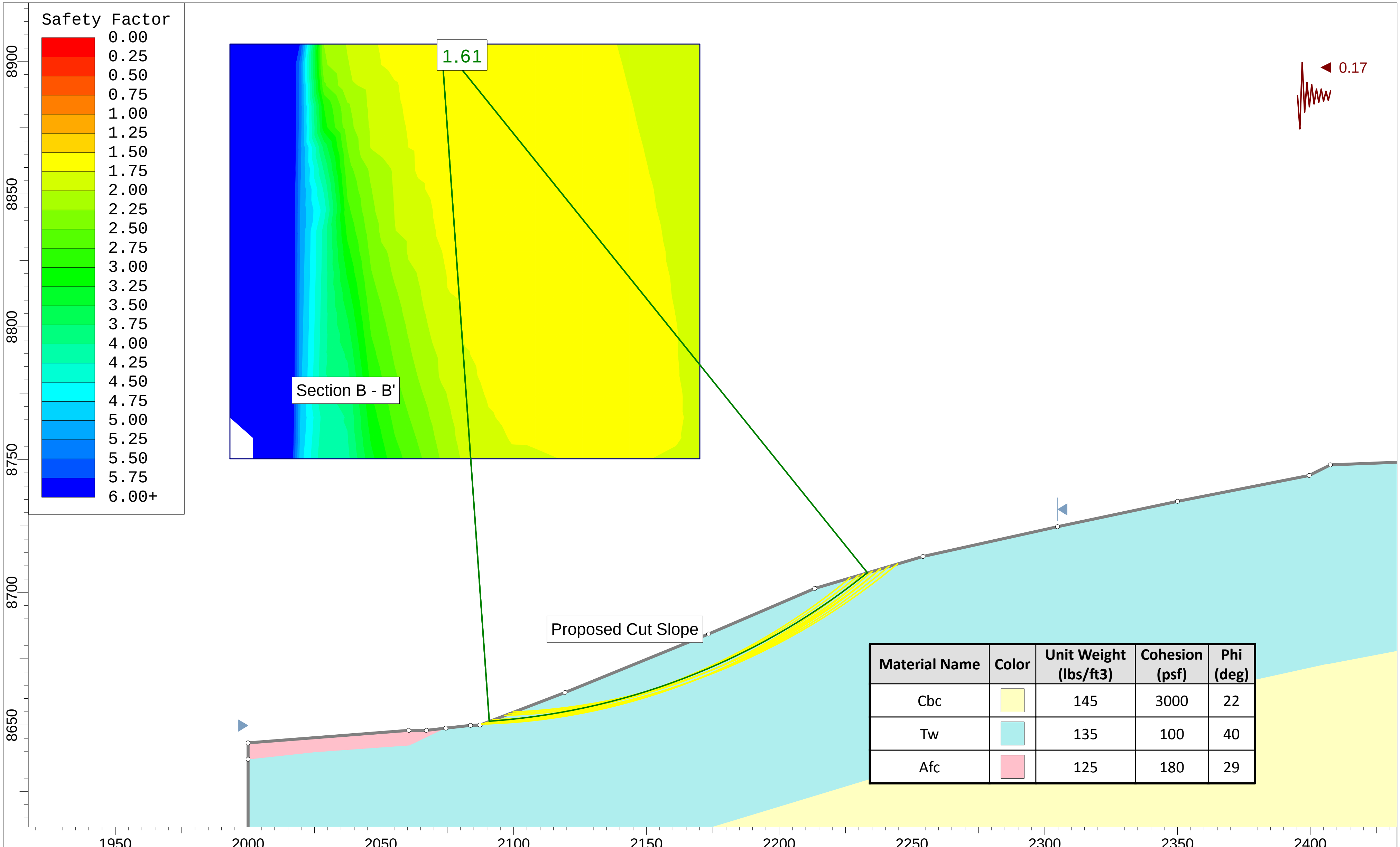
X	Y
3391.38	8605.53
3397.63	8599.29
3400.66	8597.24
3425.17	8590.81
3440.99	8590.28

Material Boundary

X	Y
2000	8559.84
2144.41	8602.3
2300.69	8649.75
2406.89	8673.07
2509.14	8692.53
2649.76	8714.51
2884.36	8711.73
2899.69	8709.96
3009.53	8678.34
3128.42	8628.52
3550.37	8500

Material Boundary

X	Y
2732.26	8762.6
2737.4	8762
2755.52	8759.58
2790.29	8753.49
2838.88	8745.69
2893.01	8735.41
2925	8730.24



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Afc		125	180	29

IGES®

SLIDEINTERPRET 8.018

Project
Summit Powder Mountain Resort - The Overlook - Phase I & II

Analysis Description
Method : Spencer

Drawn By JKW
Scale 1:600
Company IGES, Inc.

Date 10-5-2018
File Name Section BB.slim

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase I & II

Project Summary – BB Seismic

Slide Modeler Version:	8.018
Compute Time:	00h:00m:00.616s

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer
Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Create Tension Crack
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Seismic Load Coefficient (Horizontal): 0.17

Materials

Property	Cbc	Tw	Qls	Afc
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	120	125
Cohesion [psf]	3000	100	150	180
Friction Angle [°]	22	40	30	29
Water Surface	None	None	None	None
Ru Value	0	0	0	0

Global Minimums

Method: spencer

FS	1.606220
Center:	2072.777, 8906.490
Radius:	255.780
Left Slip Surface Endpoint:	2090.818, 8651.347
Right Slip Surface Endpoint:	2233.236, 8707.301
Resisting Moment:	3.63953e+07 lb-ft
Driving Moment:	2.2659e+07 lb-ft
Resisting Horizontal Force:	131595 lb
Driving Horizontal Force:	81928.4 lb
Total Slice Area:	1266.79 ft2
Surface Horizontal Width:	142.418 ft
Surface Average Height:	8.89488 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 4776

Number of Invalid Surfaces: 75

Error Codes:

- Error Code -102 reported for 1 surface
- Error Code -106 reported for 63 surfaces
- Error Code -108 reported for 11 surfaces

Error Codes

The following errors were encountered during the computation:

- -102 = Two surface / slope intersections, but resulting arc is actually outside soil region.
- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.60622**

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.74726	459.91	4.57822	Tw	100	40	138.048	221.736	145.079	0	145.079	156.133	156.133
2	4.74726	1351.15	5.64594	Tw	100	40	243.965	391.861	347.826	0	347.826	371.945	371.945
3	4.74726	2185.09	6.71562	Tw	100	40	338.126	543.105	528.071	0	528.071	567.885	567.885
4	4.74726	2961.36	7.78767	Tw	100	40	421.209	676.554	687.111	0	687.111	744.717	744.717
5	4.74726	3679.57	8.86246	Tw	100	40	493.833	793.205	826.13	0	826.13	903.13	903.13
6	4.74726	4339.21	9.94041	Tw	100	40	556.569	893.972	946.219	0	946.219	1043.76	1043.76

7	4.74726	4977.69	11.0219	Tw	100	40	614.049	986.298	1056.25	0	1056.25	1175.85	1175.85
8	4.74726	5594.48	12.1074	Tw	100	40	666.495	1070.54	1156.64	0	1156.64	1299.62	1299.62
9	4.74726	6150.85	13.1974	Tw	100	40	710.152	1140.66	1240.21	0	1240.21	1406.74	1406.74
10	4.74726	6646.01	14.2922	Tw	100	40	745.446	1197.35	1307.77	0	1307.77	1497.68	1497.68
11	4.74726	7079.09	15.3924	Tw	100	40	772.777	1241.25	1360.09	0	1360.09	1572.84	1572.84
12	4.74726	7449.15	16.4984	Tw	100	40	792.507	1272.94	1397.85	0	1397.85	1632.58	1632.58
13	4.74726	7755.14	17.6108	Tw	100	40	804.977	1292.97	1421.73	0	1421.73	1677.25	1677.25
14	4.74726	7995.88	18.7301	Tw	100	40	810.512	1301.86	1432.32	0	1432.32	1707.13	1707.13
15	4.74726	8170.13	19.8569	Tw	100	40	809.397	1300.07	1430.18	0	1430.18	1722.49	1722.49
16	4.74726	8276.48	20.9917	Tw	100	40	801.914	1288.05	1415.86	0	1415.86	1723.56	1723.56
17	4.74726	8313.42	22.1353	Tw	100	40	788.323	1266.22	1389.85	0	1389.85	1710.52	1710.52
18	4.74726	8291.16	23.2882	Tw	100	40	769.876	1236.59	1354.54	0	1354.54	1685.91	1685.91
19	4.74726	8244.26	24.4511	Tw	100	40	749.754	1204.27	1316.02	0	1316.02	1656.93	1656.93
20	4.74726	8127.6	25.6249	Tw	100	40	724.403	1163.55	1267.49	0	1267.49	1614.95	1614.95
21	4.74726	7933.86	26.8104	Tw	100	40	693.597	1114.07	1208.52	0	1208.52	1559.04	1559.04
22	4.74726	7660.65	28.0084	Tw	100	40	657.529	1056.14	1139.48	0	1139.48	1489.22	1489.22
23	4.74726	7305.33	29.2199	Tw	100	40	616.39	990.058	1060.73	0	1060.73	1405.5	1405.5
24	4.74726	6865.02	30.4459	Tw	100	40	570.355	916.115	972.607	0	972.607	1307.85	1307.85
25	4.74726	6336.51	31.6875	Tw	100	40	519.59	834.576	875.434	0	875.434	1196.18	1196.18
26	4.74726	5709.72	32.946	Tw	100	40	463.794	744.955	768.629	0	768.629	1069.2	1069.2
27	4.74726	4725.54	34.2226	Tw	100	40	385.545	619.27	618.842	0	618.842	881.081	881.081
28	4.74726	3505.61	35.519	Tw	100	40	294.79	473.498	445.116	0	445.116	655.536	655.536
29	4.74726	2180.84	36.8366	Tw	100	40	201.259	323.267	266.08	0	266.08	416.842	416.842
30	4.74726	745.805	38.1773	Tw	100	40	102.833	165.173	77.6699	0	77.6699	158.526	158.526

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.60622**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2090.82	8651.35	0	0	0
2	2095.57	8651.73	523.384	292.847	29.2282
3	2100.31	8652.2	1291.03	722.364	29.2281
4	2105.06	8652.76	2232.9	1249.37	29.2282
5	2109.81	8653.4	3287.13	1839.23	29.2281
6	2114.55	8654.14	4399.34	2461.54	29.2281
7	2119.3	8654.98	5522.14	3089.78	29.2281
8	2124.05	8655.9	6620.4	3704.28	29.2281
9	2128.8	8656.92	7662.08	4287.13	29.2281
10	2133.54	8658.03	8614.12	4819.82	29.2281
11	2138.29	8659.24	9448.93	5286.92	29.2281
12	2143.04	8660.55	10144.2	5675.92	29.228
13	2147.79	8661.96	10682.4	5977.1	29.2282
14	2152.53	8663.46	11051.1	6183.36	29.2281
15	2157.28	8665.07	11242	6290.18	29.2281
16	2162.03	8666.79	11251.5	6295.52	29.2282
17	2166.77	8668.61	11080.4	6199.74	29.228
18	2171.52	8670.54	10733.4	6005.6	29.2281
19	2176.27	8672.58	10218.6	5717.55	29.2281
20	2181.02	8674.74	9543.04	5339.58	29.2282
21	2185.76	8677.02	8721.33	4879.81	29.2281
22	2190.51	8679.42	7772.78	4349.07	29.2281
23	2195.26	8681.94	6721.21	3760.69	29.2281
24	2200.01	8684.6	5595	3130.55	29.2282
25	2204.75	8687.39	4427.34	2477.21	29.2281
26	2209.5	8690.32	3256.43	1822.05	29.2281
27	2214.25	8693.39	2127.4	1190.34	29.2282
28	2218.99	8696.62	1159.94	649.017	29.2282
29	2223.74	8700.01	458.052	256.292	29.2281
30	2228.49	8703.57	98.5211	55.1251	29.2281
31	2233.24	8707.3	0	0	0

Entity Information

External Boundary

X	Y
2000	8500
3550.37	8500
3673.57	8500
3673.57	8525.75
3625	8538.9
3500	8571.94
3440.99	8590.28
3432.09	8593.71
3411.76	8600
3391.43	8605.55
3380.27	8608.62
3375.18	8610
3326.79	8628
3275	8643.45
3251.92	8648.59
3227.3	8656
3198.29	8664.55
3186.04	8670
3159.63	8676.9
3152.43	8678
3130.89	8684.05
3100.94	8692
3050	8704.2
3000	8715.47
2952.01	8726
2925	8730.24
2920.74	8732
2890.63	8746
2874.89	8747.95
2848.69	8748.87
2833.09	8748.69
2829.54	8749.26
2828.43	8748.8
2806.35	8752.97
2791.67	8754.72
2747.03	8762
2732.26	8762.6
2725	8762.89
2706.07	8764
2675	8763.15
2600	8760
2575	8758.57
2550	8757.04
2525	8755.51
2500	8753.98
2468.76	8752.06
2445.16	8749.44
2407.56	8748
2399.57	8744
2350	8734.24
2304.84	8724.68
2254.15	8713.49
2213.39	8701.43
2173.4	8684.28
2119.31	8662.24
2087.31	8650
2083.77	8649.87
2074.44	8648.83
2067.1	8648
2060.54	8648
2000	8643.28
2000	8637.11
2000	8559.84

Material Boundary

X	Y
2000	8637.11
2025.07	8639.82
2061.1	8642.42
2074.44	8648.83

Material Boundary

X	Y

3159.63	8676.9
3166.97	8670.46
3199.94	8656.85
3250.18	8640.59
3335.64	8612.64
3350.15	8609.92
3371.27	8608.75
3380.27	8608.62

Material Boundary

X	Y
3391.38	8605.53
3397.63	8599.29
3400.66	8597.24
3425.17	8590.81
3440.99	8590.28

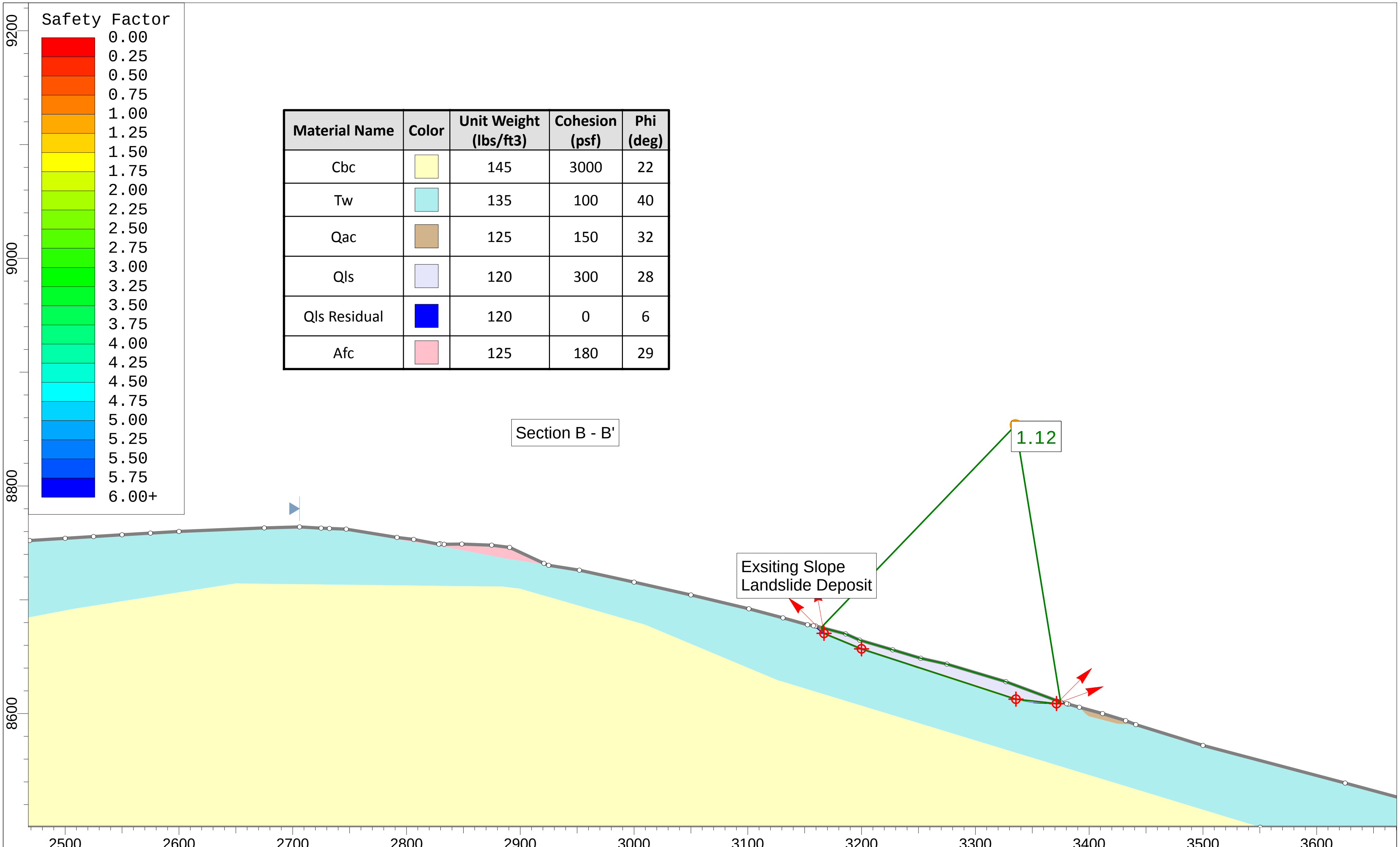
Material Boundary

X	Y
2000	8559.84
2144.41	8602.3
2300.69	8649.75
2406.89	8673.07
2509.14	8692.53
2649.76	8714.51
2884.36	8711.73
2899.69	8709.96
3009.53	8678.34
3128.42	8628.52
3550.37	8500

Material Boundary

X	Y
2732.26	8762.6
2737.4	8762

2755.52	8759.58
2790.29	8753.49
2838.88	8745.69
2893.01	8735.41
2925	8730.24



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Qac		125	150	32
Qls		120	300	28
Qls Residual		120	0	6
Afc		125	180	29

IGES®

SLIDEINTERPRET 8.008

Project	Summit Powder Mountain Resort - The Overlook - Phase I & II
Analysis Description	Method : Spencer
Drawn By	JKW/EBF
Scale	1:1400
Company	IGES, Inc.
Date	10-5-2018
File Name	Section BB.slim

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase I & II

Project Summary

Slide Modeler Version: 8.008

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type: Vertical

Analysis Methods Used
Spencer

Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [°]:	100
Left Projection Angle (End Angle) [°]:	135
Right Projection Angle (Start Angle) [°]:	20
Right Projection Angle (End Angle) [°]:	45
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Property	Cbc	Tw	Qac	Qls	Qls Residual	Afc
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	125	120	120	125
Cohesion [psf]	3000	100	150	300	0	180
Friction Angle [°]	22	40	32	28	6	29
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0

Global Minimums

Method: spencer

FS	1.124370
Axis Location:	3335.267, 8853.256
Left Slip Surface Endpoint:	3164.541, 8675.618
Right Slip Surface Endpoint:	3374.942, 8610.093
Resisting Moment:	1.67309e+07 lb-ft
Driving Moment:	1.48803e+07 lb-ft
Resisting Horizontal Force:	67575.4 lb
Driving Horizontal Force:	60100.8 lb
Total Slice Area:	1848.7 ft2
Surface Horizontal Width:	210.4 ft
Surface Average Height:	8.78657 ft

Global Minimum Coordinates

Method: spencer

X	Y
3164.54	8675.62
3166.97	8670.46
3199.94	8656.85
3335.64	8612.64
3371.27	8608.75
3374.94	8610.09

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 5000
Number of Invalid Surfaces: 0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.12437

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.42913	660.055	-64.8037	Qls	300	28	217.426	244.468	-104.441	0	-104.441	357.69	357.69
2	6.59343	3978.82	-22.4301	Qls	300	28	486.116	546.574	463.737	0	463.737	664.398	664.398
3	6.59343	4770.07	-22.4301	Qls	300	28	534.088	600.513	565.183	0	565.183	785.646	785.646
4	6.59343	5555.74	-22.4301	Qls	300	28	581.724	654.073	665.915	0	665.915	906.042	906.042
5	6.59343	5767.99	-22.4301	Qls	300	28	594.593	668.542	693.128	0	693.128	938.566	938.566
6	6.59343	5621.78	-22.4301	Qls	300	28	585.728	658.575	674.382	0	674.382	916.162	916.162
7	7.53912	6633.88	-18.0422	Qls Residual	0	6.00001	76.2551	85.739	815.752	0	815.752	840.591	840.591
8	7.53912	6846.92	-18.0422	Qls Residual	0	6.00001	78.704	88.4924	841.95	0	841.95	867.586	867.586
9	7.53912	7059.96	-18.0422	Qls Residual	0	6.00001	81.1528	91.2458	868.146	0	868.146	894.58	894.58
10	7.53912	7269.87	-18.0422	Qls Residual	0	6.00001	83.5657	93.9588	893.959	0	893.959	921.179	921.179
11	7.53912	7446.52	-18.0422	Qls Residual	0	6.00001	85.5963	96.2419	915.68	0	915.68	943.562	943.562
12	7.53912	7614.19	-18.0422	Qls Residual	0	6.00001	87.5237	98.409	936.298	0	936.298	964.808	964.808
13	7.53912	7784.83	-18.0422	Qls Residual	0	6.00001	89.4848	100.614	957.282	0	957.282	986.43	986.43
14	7.53912	8273.78	-18.0422	Qls Residual	0	6.00001	95.1057	106.934	1017.41	0	1017.41	1048.39	1048.39
15	7.53912	8977.1	-18.0422	Qls Residual	0	6.00001	103.19	116.024	1103.89	0	1103.89	1137.5	1137.5
16	7.53912	9679.92	-18.0422	Qls Residual	0	6.00001	111.269	125.107	1190.32	0	1190.32	1226.56	1226.56
17	7.53912	10103.3	-18.0422	Qls Residual	0	6.00001	116.135	130.579	1242.37	0	1242.37	1280.2	1280.2
18	7.53912	10290.6	-18.0422	Qls Residual	0	6.00001	118.289	133.001	1265.42	0	1265.42	1303.95	1303.95
19	7.53912	10478	-18.0422	Qls Residual	0	6.00001	120.443	135.423	1288.46	0	1288.46	1327.69	1327.69
20	7.53912	10665.4	-18.0422	Qls Residual	0	6.00001	122.597	137.844	1311.5	0	1311.5	1351.44	1351.44
21	7.53912	10852.8	-18.0422	Qls Residual	0	6.00001	124.751	140.266	1334.54	0	1334.54	1375.18	1375.18
22	7.53912	11040.2	-18.0422	Qls Residual	0	6.00001	126.905	142.688	1357.59	0	1357.59	1398.92	1398.92
23	7.53912	11220	-18.0422	Qls Residual	0	6.00001	128.972	145.012	1379.69	0	1379.69	1421.71	1421.71
24	7.53912	11076.1	-18.0422	Qls Residual	0	6.00001	127.318	143.152	1362	0	1362	1403.47	1403.47
25	7.12646	9519.83	-6.22881	Qls	300	28	926.646	1041.89	1395.3	0	1395.3	1496.44	1496.44
26	7.12646	7918	-6.22881	Qls	300	28	817.755	919.459	1165.03	0	1165.03	1254.28	1254.28
27	7.12646	6316.16	-6.22881	Qls	300	28	708.864	797.025	934.768	0	934.768	1012.14	1012.14
28	7.12646	4714.33	-6.22881	Qls	300	28	599.972	674.591	704.503	0	704.503	769.986	769.986
29	7.12646	3112.5	-6.22881	Qls	300	28	491.081	552.157	474.239	0	474.239	527.838	527.838
30	3.66753	594.811	20.0541	Qls	300	28	495.333	556.938	483.23	0	483.23	302.414	302.414

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.12437

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3164.54	8675.62	0	0	0
2	3166.97	8670.46	-1068.23	-221.786	11.7291
3	3173.56	8667.73	-3016.34	-626.254	11.7291
4	3180.16	8665.01	-5005.16	-1039.17	11.7291
5	3186.75	8662.29	-7034.4	-1460.49	11.7292
6	3193.34	8659.57	-9074.57	-1884.06	11.7291
7	3199.94	8656.85	-11107.2	-2306.08	11.7291
8	3207.48	8654.39	-9679.73	-2009.71	11.7291
9	3215.02	8651.94	-8206.42	-1703.82	11.7291
10	3222.56	8649.48	-6687.26	-1388.41	11.7291
11	3230.09	8647.02	-5122.94	-1063.63	11.7292
12	3237.63	8644.57	-3520.6	-730.948	11.7291
13	3245.17	8642.11	-1882.18	-390.779	11.7291
14	3252.71	8639.66	-207.048	-42.9873	11.7291
15	3260.25	8637.2	1573.3	326.649	11.7291
16	3267.79	8634.75	3504.98	727.706	11.7291
17	3275.33	8632.29	5587.9	1160.16	11.7291
18	3282.87	8629.83	7761.91	1611.53	11.7291
19	3290.41	8627.38	9976.25	2071.27	11.7291
20	3297.95	8624.92	12230.9	2539.39	11.7292
21	3305.49	8622.47	14525.9	3015.87	11.7291
22	3313.02	8620.01	16861.2	3500.73	11.7291
23	3320.56	8617.55	19236.8	3993.95	11.7291
24	3328.1	8615.1	21651.1	4495.21	11.7291
25	3335.64	8612.64	24034.5	4990.05	11.7291
26	3342.77	8611.87	18505.6	3842.13	11.7291
27	3349.89	8611.09	13574.8	2818.4	11.7291
28	3357.02	8610.31	9242.16	1918.86	11.7291
29	3364.15	8609.53	5507.66	1143.5	11.7291
30	3371.27	8608.75	2371.3	492.331	11.7292
31	3374.94	8610.09	0	0	0

Entity Information

External Boundary

X	Y
2000	8500
3550.37	8500
3673.57	8500
3673.57	8525.75
3625	8538.9
3500	8571.94
3440.99	8590.28
3432.09	8593.71
3411.76	8600
3391.43	8605.55
3381.71	8608.23
3380.27	8608.62
3375.18	8610
3326.79	8628
3275	8643.45
3251.92	8648.59
3227.3	8656
3198.29	8664.55
3186.04	8670
3159.63	8676.9

3157.68	8677.2
3152.43	8678
3130.89	8684.05
3100.94	8692
3050	8704.2
3000	8715.47
2952.01	8726
2925	8730.24
2920.74	8732
2890.63	8746
2874.89	8747.95
2848.69	8748.87
2833.09	8748.69
2829.54	8749.26
2828.43	8748.8
2806.35	8752.97
2791.67	8754.72
2747.03	8762
2732.26	8762.6
2725	8762.89
2706.07	8764
2675	8763.15
2600	8760
2575	8758.57
2550	8757.04
2525	8755.51
2500	8753.98
2468.76	8752.06
2445.16	8749.44
2407.56	8748
2399.57	8744
2350	8734.24
2304.84	8724.68
2254.15	8713.49
2213.39	8701.43
2173.4	8684.28
2119.31	8662.24
2087.31	8650
2083.77	8649.87
2074.44	8648.83
2067.1	8648
2060.54	8648
2000	8643.28
2000	8637.11
2000	8559.84

Material Boundary

X	Y
2000	8637.11
2025.07	8639.82
2061.1	8642.42
2074.44	8648.83

Material Boundary

X	Y
3159.63	8676.9
3166.97	8670.46
3199.94	8656.85
3250.18	8640.59
3335.64	8612.64
3350.15	8609.92
3371.27	8608.75
3380.27	8608.62

Material Boundary

X	Y
3391.43	8605.55
3397.63	8599.29
3400.66	8597.24
3425.17	8590.81
3440.99	8590.28

Material Boundary

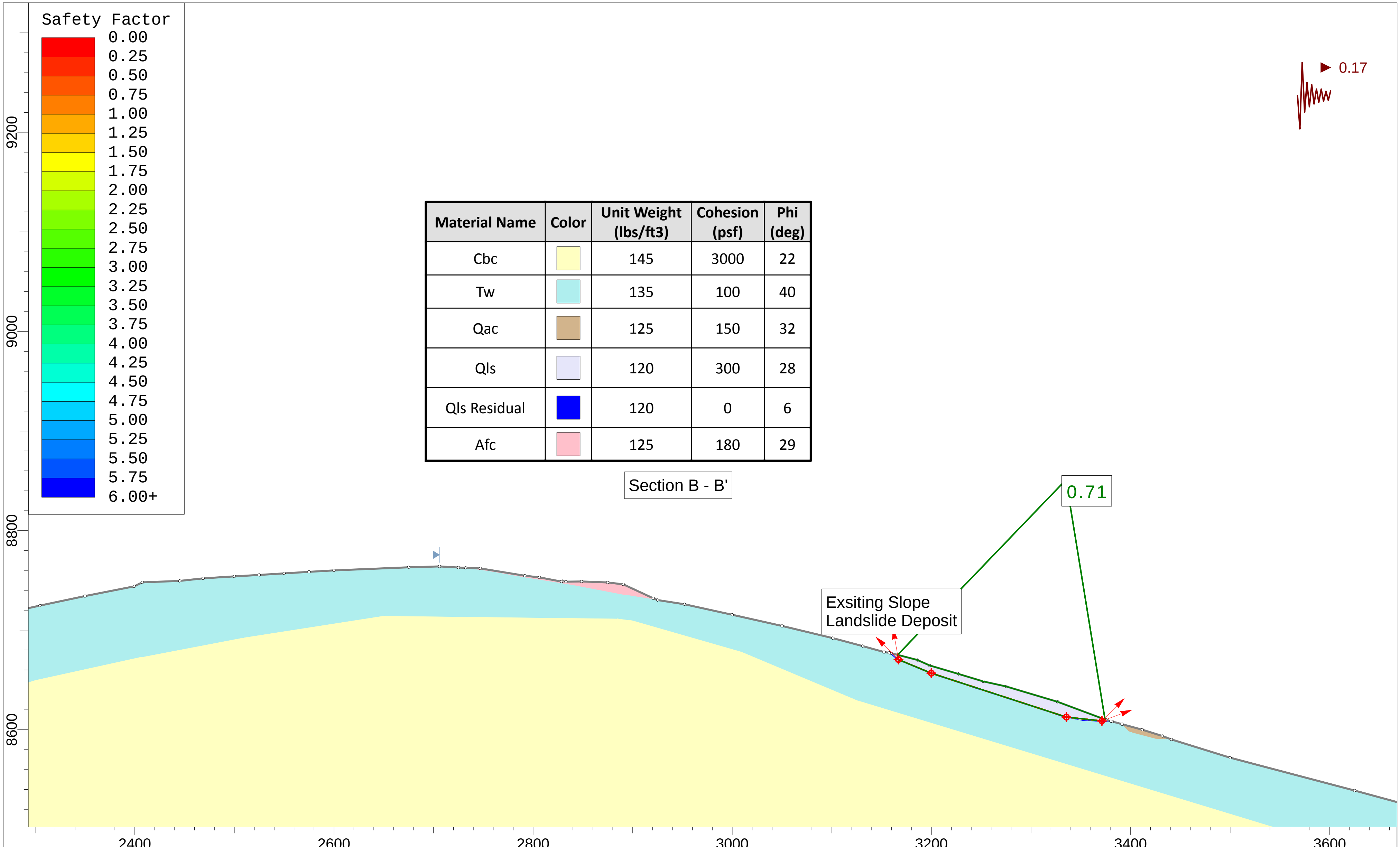
X	Y
2000	8559.84
2144.41	8602.3
2300.69	8649.75
2406.89	8673.07
2509.14	8692.53
2649.76	8714.51
2884.36	8711.73
2899.69	8709.96
3009.53	8678.34
3128.42	8628.52
3550.37	8500

Material Boundary

X	Y
2732.26	8762.6
2737.4	8762
2755.52	8759.58
2790.29	8753.49
2838.88	8745.69
2893.01	8735.41
2925	8730.24

Material Boundary

X	Y
3157.68	8677.2
3166.21	8670.04
3199.59	8656.17
3249.96	8639.86
3335.37	8611.97
3349.98	8609.28
3371.32	8608.23
3381.71	8608.23



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Qac		125	150	32
Qls		120	300	28
Qls Residual		120	0	6
Afc		125	180	29

IGES®

Project	Summit Powder Mountain Resort - The Overlook - Phase I & II		
Analysis Description	Method : Spencer		
Drawn By JKW/EBF	*Scale* 1:1600	*Company*	IGES, Inc.
Date	10-5-2018	*File Name*	Section BB.slim

SLIDEINTERPRET 8.008

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase I & II

Project Summary

Slide Modeler Version: 8.008

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type: Vertical

Analysis Methods Used
Spencer

Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [°]:	100
Left Projection Angle (End Angle) [°]:	135
Right Projection Angle (Start Angle) [°]:	20
Right Projection Angle (End Angle) [°]:	45
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.17

Materials

Property	Cbc	Tw	Qac	Qls	Qls Residual	Afc
Color						
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	125	120	120	125
Cohesion [psf]	3000	100	150	300	0	180
Friction Angle [°]	22	40	32	28	6	29
Water Surface	None	None	None	None	None	None
Ru Value	0	0	0	0	0	0

Global Minimums

Method: spencer

FS	0.714580
Axis Location:	3335.162, 8851.015
Left Slip Surface Endpoint:	3166.125, 8675.205
Right Slip Surface Endpoint:	3374.388, 8610.299
Resisting Moment:	1.60402e+07 lb-ft
Driving Moment:	2.2447e+07 lb-ft
Resisting Horizontal Force:	66119.3 lb
Driving Horizontal Force:	92529 lb
Total Slice Area:	1844.36 ft2
Surface Horizontal Width:	208.263 ft
Surface Average Height:	8.85594 ft

Global Minimum Coordinates

Method: spencer

X	Y
3166.13	8675.2
3166.97	8670.46
3199.94	8656.85
3335.64	8612.64
3371.27	8608.75
3374.39	8610.3

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 4596
Number of Invalid Surfaces: 404

Error Codes:

Error Code -112 reported for 404 surfaces

Error Codes

The following errors were encountered during the computation:

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 0.71458

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.845411	229.719	-79.907	Qls	300	28	175.226	125.213	-328.727	0	-328.727	655.688	655.688
2	6.59343	3978.82	-22.4301	Qls	300	28	717.556	512.751	400.126	0	400.126	696.322	696.322
3	6.59343	4770.07	-22.4301	Qls	300	28	787.097	562.444	493.585	0	493.585	818.487	818.487
4	6.59343	5555.74	-22.4301	Qls	300	28	856.149	611.787	586.385	0	586.385	939.79	939.79
5	6.59343	5767.99	-22.4301	Qls	300	28	874.803	625.117	611.456	0	611.456	972.561	972.561
6	6.59343	5621.78	-22.4301	Qls	300	28	861.954	615.935	594.187	0	594.187	949.988	949.988
7	7.53912	6633.88	-18.0422	Qls Residual	0	6.00001	115.056	82.2168	782.241	0	782.241	819.719	819.719
8	7.53912	6846.92	-18.0422	Qls Residual	0	6.00001	118.751	84.8571	807.362	0	807.362	846.043	846.043
9	7.53912	7059.96	-18.0422	Qls Residual	0	6.00001	122.446	87.4973	832.482	0	832.482	872.367	872.367
10	7.53912	7269.87	-18.0422	Qls Residual	0	6.00001	126.087	90.0989	857.234	0	857.234	898.305	898.305
11	7.53912	7446.52	-18.0422	Qls Residual	0	6.00001	129.15	92.2882	878.064	0	878.064	920.133	920.133
12	7.53912	7614.19	-18.0422	Qls Residual	0	6.00001	132.058	94.3662	897.834	0	897.834	940.85	940.85
13	7.53912	7784.83	-18.0422	Qls Residual	0	6.00001	135.018	96.4811	917.957	0	917.957	961.937	961.937
14	7.53912	8273.78	-18.0422	Qls Residual	0	6.00001	143.498	102.541	975.611	0	975.611	1022.35	1022.35
15	7.53912	8977.1	-18.0422	Qls Residual	0	6.00001	155.696	111.257	1058.54	0	1058.54	1109.26	1109.26
16	7.53912	9679.92	-18.0422	Qls Residual	0	6.00001	167.886	119.968	1141.42	0	1141.42	1196.1	1196.1
17	7.53912	10103.3	-18.0422	Qls Residual	0	6.00001	175.227	125.214	1191.34	0	1191.34	1248.41	1248.41
18	7.53912	10290.6	-18.0422	Qls Residual	0	6.00001	178.478	127.537	1213.43	0	1213.43	1271.57	1271.57
19	7.53912	10478	-18.0422	Qls Residual	0	6.00001	181.728	129.859	1235.53	0	1235.53	1294.72	1294.72
20	7.53912	10665.4	-18.0422	Qls Residual	0	6.00001	184.979	132.182	1257.63	0	1257.63	1317.88	1317.88
21	7.53912	10852.8	-18.0422	Qls Residual	0	6.00001	188.228	134.504	1279.72	0	1279.72	1341.03	1341.03
22	7.53912	11040.2	-18.0422	Qls Residual	0	6.00001	191.479	136.827	1301.82	0	1301.82	1364.19	1364.19
23	7.53912	11220	-18.0422	Qls Residual	0	6.00001	194.597	139.055	1323.02	0	1323.02	1386.4	1386.4
24	7.53912	11076.1	-18.0422	Qls Residual	0	6.00001	192.1	137.271	1306.05	0	1306.05	1368.63	1368.63
25	7.12646	9519.83	-6.22881	Qls	300	28	1462.36	1044.97	1401.09	0	1401.09	1560.7	1560.7
26	7.12646	7918	-6.22881	Qls	300	28	1292.36	923.492	1172.62	0	1172.62	1313.67	1313.67
27	7.12646	6316.16	-6.22881	Qls	300	28	1122.35	802.011	944.145	0	944.145	1066.64	1066.64
28	7.12646	4714.33	-6.22881	Qls	300	28	952.348	680.529	715.671	0	715.671	819.614	819.614
29	7.12646	3112.5	-6.22881	Qls	300	28	782.343	559.047	487.197	0	487.197	572.585	572.585
30	3.11363	504.977	26.3885	Qls	300	28	1290.3	922.025	1169.86	0	1169.86	529.671	529.671

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 0.71458

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	3166.13	8675.2	0	0	0
2	3166.97	8670.46	-1671.16	-347.214	11.7373
3	3173.56	8667.73	-4662.18	-968.653	11.7373
4	3180.16	8665.01	-7725.29	-1605.07	11.7373
5	3186.75	8662.29	-10860	-2256.36	11.7372
6	3193.34	8659.57	-14014	-2911.67	11.7373
7	3199.94	8656.85	-17154.7	-3564.21	11.7373
8	3207.48	8654.39	-14978	-3111.96	11.7373
9	3215.02	8651.94	-12731.4	-2645.19	11.7373
10	3222.56	8649.48	-10415	-2163.9	11.7372
11	3230.09	8647.02	-8029.59	-1668.29	11.7372
12	3237.63	8644.57	-5586.26	-1160.65	11.7373
13	3245.17	8642.11	-3087.91	-641.57	11.7373
14	3252.71	8639.66	-533.576	-110.86	11.7372
15	3260.25	8637.2	2181.19	453.182	11.7373
16	3267.79	8634.75	5126.73	1065.17	11.7372
17	3275.33	8632.29	8302.88	1725.07	11.7372
18	3282.87	8629.83	11617.9	2413.83	11.7373
19	3290.41	8627.38	14994.5	3115.37	11.7372
20	3297.95	8624.92	18432.5	3829.68	11.7372
21	3305.49	8622.47	21932	4556.77	11.7372
22	3313.02	8620.01	25493	5296.63	11.7372
23	3320.56	8617.55	29115.5	6049.27	11.7372
24	3328.1	8615.1	32797	6814.16	11.7372
25	3335.64	8612.64	36431.2	7569.24	11.7372
26	3342.77	8611.87	28662.2	5955.09	11.7372
27	3349.89	8611.09	21661.2	4500.51	11.7373
28	3357.02	8610.31	15428.2	3205.48	11.7372
29	3364.15	8609.53	9963.13	2070.02	11.7372
30	3371.27	8608.75	5266.07	1094.12	11.7372
31	3374.39	8610.3	0	0	0

Entity Information

External Boundary

X	Y
2000	8500
3550.37	8500
3673.57	8500
3673.57	8525.75
3625	8538.9
3500	8571.94
3440.99	8590.28
3432.09	8593.71
3411.76	8600
3391.43	8605.55
3381.71	8608.23
3380.27	8608.62
3375.18	8610
3326.79	8628
3275	8643.45
3251.92	8648.59
3227.3	8656
3198.29	8664.55
3186.04	8670
3159.63	8676.9
3157.68	8677.2

3152.43	8678
3130.89	8684.05
3100.94	8692
3050	8704.2
3000	8715.47
2952.01	8726
2925	8730.24
2920.74	8732
2890.63	8746
2874.89	8747.95
2848.69	8748.87
2833.09	8748.69
2829.54	8749.26
2828.43	8748.8
2806.35	8752.97
2791.67	8754.72
2747.03	8762
2732.26	8762.6
2725	8762.89
2706.07	8764
2675	8763.15
2600	8760
2575	8758.57
2550	8757.04
2525	8755.51
2500	8753.98
2468.76	8752.06
2445.16	8749.44
2407.56	8748
2399.57	8744
2350	8734.24
2304.84	8724.68
2254.15	8713.49
2213.39	8701.43
2173.4	8684.28
2119.31	8662.24
2087.31	8650
2083.77	8649.87
2074.44	8648.83
2067.1	8648
2060.54	8648
2000	8643.28
2000	8637.11
2000	8559.84

Material Boundary

X	Y
2000	8637.11
2025.07	8639.82
2061.1	8642.42
2074.44	8648.83

Material Boundary

X	Y
3159.63	8676.9
3166.97	8670.46
3199.94	8656.85
3250.18	8640.59
3335.64	8612.64
3350.15	8609.92
3371.27	8608.75
3380.27	8608.62

Material Boundary

X	Y
3391.43	8605.55
3397.63	8599.29
3400.66	8597.24
3425.17	8590.81
3440.99	8590.28

Material Boundary

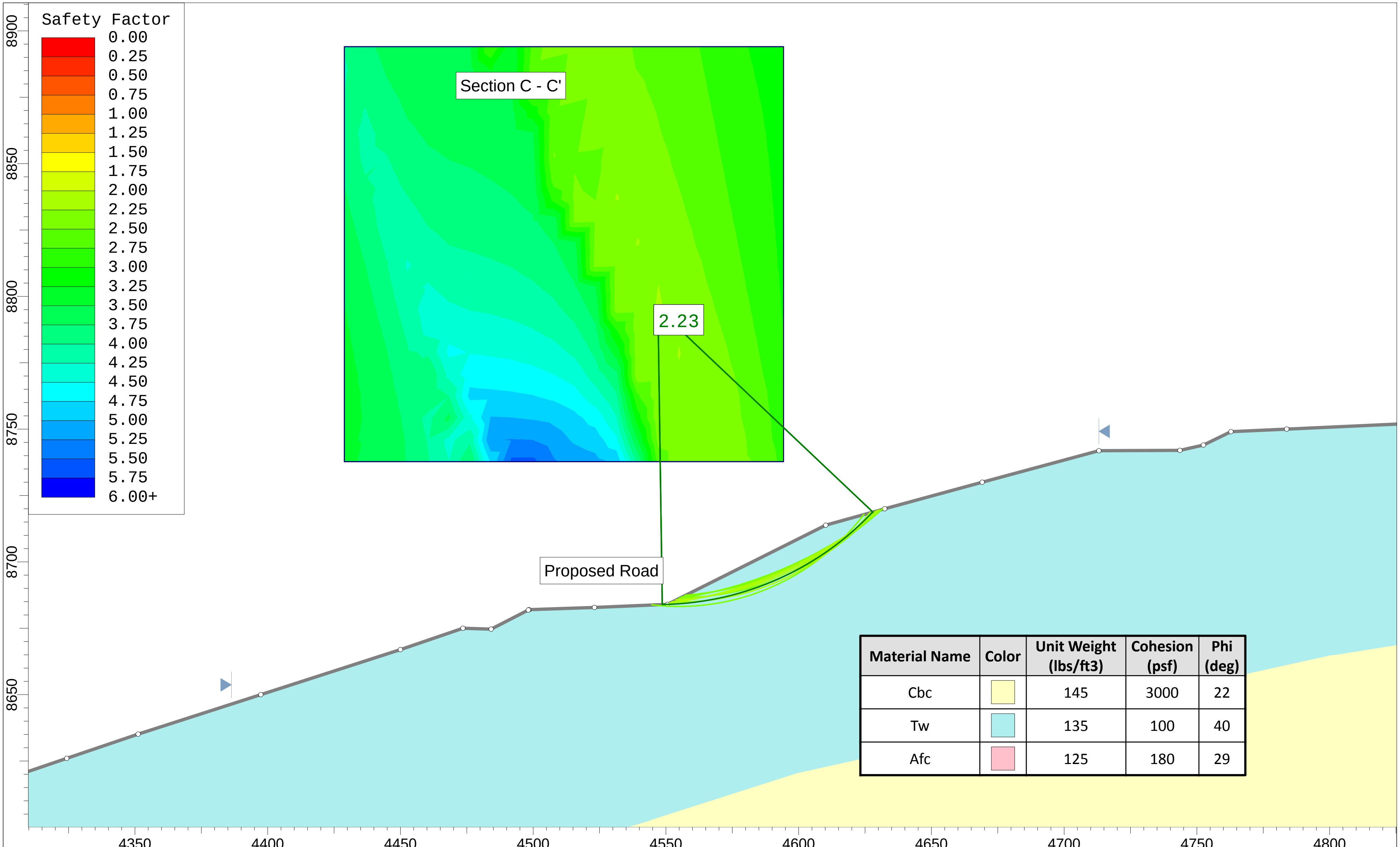
X	Y
2000	8559.84
2144.41	8602.3
2300.69	8649.75
2406.89	8673.07
2509.14	8692.53
2649.76	8714.51
2884.36	8711.73
2899.69	8709.96
3009.53	8678.34
3128.42	8628.52
3550.37	8500

Material Boundary

X	Y
2732.26	8762.6
2737.4	8762
2755.52	8759.58
2790.29	8753.49
2838.88	8745.69
2893.01	8735.41
2925	8730.24

Material Boundary

X	Y
3157.68	8677.2
3166.21	8670.04
3199.59	8656.17
3249.96	8639.86
3335.37	8611.97
3349.98	8609.28
3371.32	8608.23
3381.71	8608.23



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Afc		125	180	29

IGES®

SLIDEINTERPRET 8.018

Project	Summit Powder Mountain Resort - The Overlook - Phase II & III
Analysis Description	Method : Spencer
Drawn By	JKW
Scale	1:600
Company	IGES, Inc.
Date	10-5-2018
File Name	Section CC.slim

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase II & III

Project Summary – CC Static

Slide Modeler Version:	8.018
Compute Time:	00h:00m:00.514s

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer
Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Create Tension Crack
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Property	Cbc	Tw	Afc

Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	125
Cohesion [psf]	3000	100	180
Friction Angle [°]	22	40	29
Water Surface	None	None	None
Ru Value	0	0	0

Global Minimums

Method: spencer

FS	2.226140
Center:	4547.023, 8795.336
Radius:	111.431
Left Slip Surface Endpoint:	4548.614, 8683.917
Right Slip Surface Endpoint:	4627.971, 8718.758
Resisting Moment:	8.01787e+06 lb-ft
Driving Moment:	3.6017e+06 lb-ft
Resisting Horizontal Force:	65003.6 lb
Driving Horizontal Force:	29200.2 lb
Total Slice Area:	596.847 ft2
Surface Horizontal Width:	79.3575 ft
Surface Average Height:	7.52099 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	4836
Number of Invalid Surfaces:	4

Error Codes:

- Error Code -106 reported for 2 surfaces
- Error Code -108 reported for 2 surfaces

Error Codes

The following errors were encountered during the computation:

- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 2.22614**

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.64525	21.338	1.4981	Tw	100	40	56.0841	124.851	29.6164	0	29.6164	31.0831	31.0831
2	2.64525	337.111	2.85935	Tw	100	40	106.403	236.869	163.114	0	163.114	168.428	168.428
3	2.64525	751.123	4.22223	Tw	100	40	170.166	378.813	332.277	0	332.277	344.839	344.839
4	2.64525	1142.52	5.5875	Tw	100	40	227.797	507.108	485.173	0	485.173	507.458	507.458
5	2.64525	1511.16	6.95597	Tw	100	40	279.606	622.441	622.621	0	622.621	656.734	656.734
6	2.64525	1856.86	8.32844	Tw	100	40	325.87	725.432	745.361	0	745.361	793.065	793.065
7	2.64525	2179.41	9.70574	Tw	100	40	366.843	816.643	854.06	0	854.06	916.804	916.804
8	2.64525	2478.52	11.0887	Tw	100	40	402.751	896.58	949.326	0	949.326	1028.26	1028.26
9	2.64525	2753.9	12.4783	Tw	100	40	433.802	965.704	1031.71	0	1031.71	1127.71	1127.71
10	2.64525	3005.18	13.8754	Tw	100	40	460.182	1024.43	1101.69	0	1101.69	1215.37	1215.37

11	2.64525	3231.94	15.2809	Tw	100	40	482.062	1073.14	1159.74	0	1159.74	1291.45	1291.45
12	2.64525	3433.7	16.696	Tw	100	40	499.596	1112.17	1206.25	0	1206.25	1356.1	1356.1
13	2.64525	3609.93	18.1216	Tw	100	40	512.919	1141.83	1241.61	0	1241.61	1409.47	1409.47
14	2.64525	3760.02	19.5589	Tw	100	40	522.164	1162.41	1266.13	0	1266.13	1451.64	1451.64
15	2.64525	3883.3	21.0091	Tw	100	40	527.442	1174.16	1280.14	0	1280.14	1482.7	1482.7
16	2.64525	3978.99	22.4737	Tw	100	40	528.857	1177.31	1283.89	0	1283.89	1502.67	1502.67
17	2.64525	4046.24	23.9538	Tw	100	40	526.508	1172.08	1277.65	0	1277.65	1511.56	1511.56
18	2.64525	4084.08	25.4512	Tw	100	40	520.47	1158.64	1261.64	0	1261.64	1509.35	1509.35
19	2.64525	4091.44	26.9675	Tw	100	40	510.83	1137.18	1236.06	0	1236.06	1495.97	1495.97
20	2.64525	4067.09	28.5044	Tw	100	40	497.646	1107.83	1201.09	0	1201.09	1471.34	1471.34
21	2.64525	4009.67	30.0641	Tw	100	40	480.985	1070.74	1156.89	0	1156.89	1435.3	1435.3
22	2.64525	3917.61	31.6489	Tw	100	40	460.9	1026.03	1103.6	0	1103.6	1387.68	1387.68
23	2.64525	3789.16	33.2611	Tw	100	40	437.437	973.795	1041.35	0	1041.35	1328.27	1328.27
24	2.64525	3569.97	34.9037	Tw	100	40	405.306	902.269	956.108	0	956.108	1238.89	1238.89
25	2.64525	3161.39	36.5799	Tw	100	40	355.356	791.073	823.591	0	823.591	1087.31	1087.31
26	2.64525	2700.32	38.2934	Tw	100	40	302.269	672.893	682.748	0	682.748	921.408	921.408
27	2.64525	2192.78	40.0483	Tw	100	40	247.02	549.901	536.171	0	536.171	743.801	743.801
28	2.64525	1635.11	41.8498	Tw	100	40	189.665	422.221	384.009	0	384.009	553.886	553.886
29	2.64525	1023.04	43.7036	Tw	100	40	130.265	289.989	226.421	0	226.421	350.92	350.92
30	2.64525	351.407	45.6167	Tw	100	40	71.4986	159.166	70.5112	0	70.5112	143.566	143.566

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 2.22614**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	4548.61	8683.92	0	0	0
2	4551.26	8683.99	146.213	61.8991	22.9453
3	4553.9	8684.12	405.946	171.857	22.9453
4	4556.55	8684.31	790.901	334.827	22.9453
5	4559.19	8684.57	1267.54	536.611	22.9453
6	4561.84	8684.9	1805.75	764.464	22.9454
7	4564.49	8685.28	2378.58	1006.97	22.9453
8	4567.13	8685.73	2961.94	1253.93	22.9453
9	4569.78	8686.25	3534.47	1496.31	22.9453
10	4572.42	8686.84	4077.31	1726.12	22.9453
11	4575.07	8687.49	4573.95	1936.38	22.9454
12	4577.71	8688.21	5010.16	2121.04	22.9453
13	4580.36	8689.01	5373.81	2275	22.9453
14	4583	8689.87	5654.89	2393.99	22.9453
15	4585.65	8690.81	5845.36	2474.62	22.9453
16	4588.29	8691.83	5939.19	2514.35	22.9453
17	4590.94	8692.92	5932.34	2511.45	22.9453
18	4593.58	8694.1	5822.71	2465.03	22.9453
19	4596.23	8695.36	5610.26	2375.09	22.9453
20	4598.87	8696.7	5297.02	2242.48	22.9452
21	4601.52	8698.14	4887.19	2068.99	22.9454
22	4604.16	8699.67	4387.3	1857.36	22.9453
23	4606.81	8701.3	3806.33	1611.4	22.9452
24	4609.45	8703.04	3155.94	1336.06	22.9453
25	4612.1	8704.88	2462.8	1042.62	22.9452
26	4614.75	8706.85	1785.42	755.855	22.9453
27	4617.39	8708.93	1158.51	490.452	22.9452
28	4620.04	8711.16	619.378	262.213	22.9453
29	4622.68	8713.53	210.953	89.3065	22.9453
30	4625.33	8716.06	-17.112	-7.24434	22.9453
31	4627.97	8718.76	0	0	0

Entity Information

External Boundary

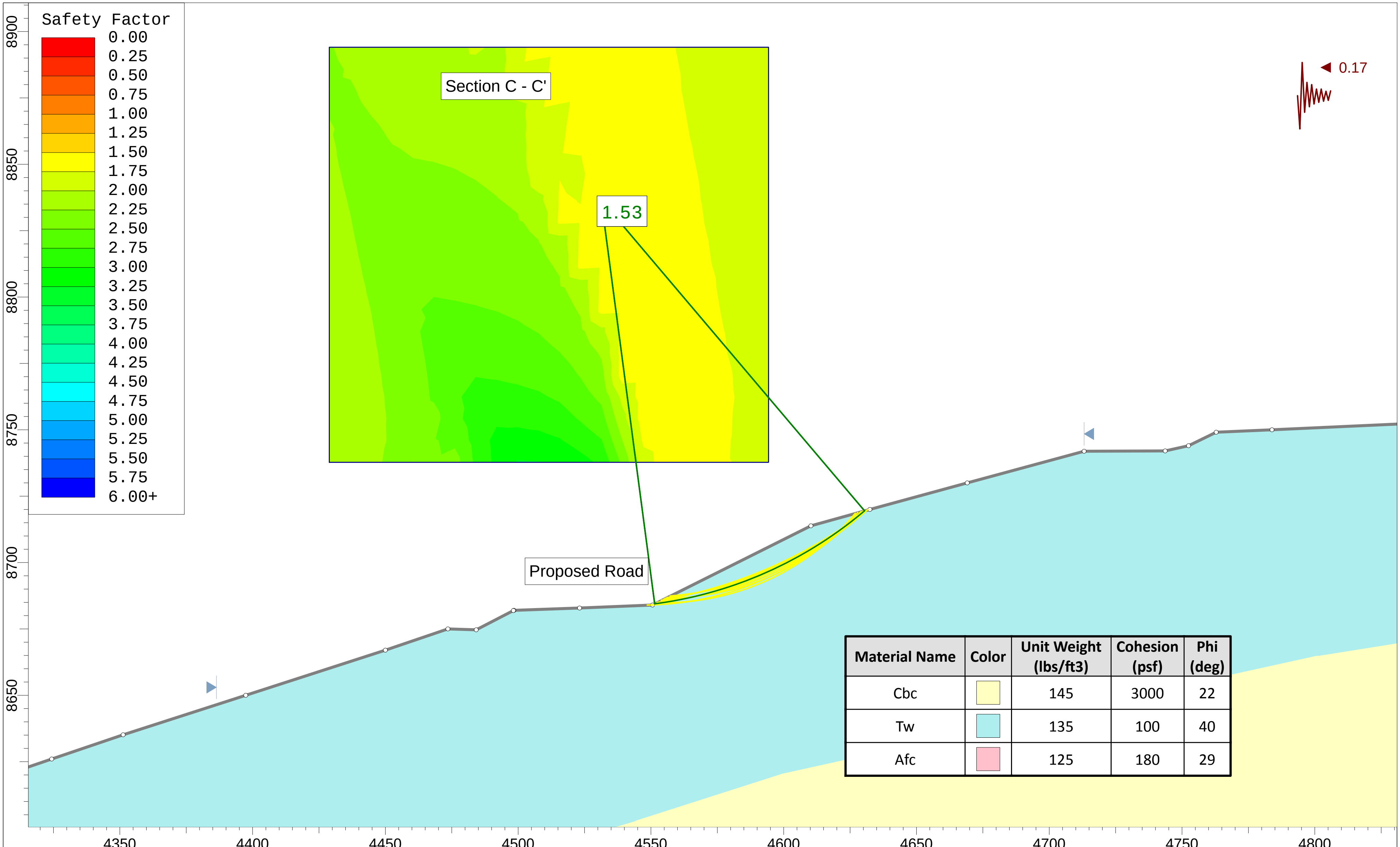
X	Y
4000	8560
4399.61	8560
5474.79	8560
5516.1	8560
5516.1	8607.68
5500	8611.77
5484.23	8615.7
5428.61	8633.42
5354.15	8660
5260.11	8694
5185.31	8720
5124.22	8730.51
5120.1	8731.86
5111.19	8736.37
5097.39	8737.59
5069.84	8738.33
5055.99	8740
5052.01	8742
4998.79	8752.32
4994.03	8752.52
4964.39	8754.01
4955	8756.19
4921.92	8756.57
4875.19	8754.16
4783.85	8750
4762.84	8749.04
4752.45	8744
4743.65	8742.01
4713.09	8741.88
4669.11	8730
4632.44	8720
4610.23	8713.83
4550.59	8684
4523.1	8682.85
4498.42	8682
4498.18	8681.88
4484.19	8674.65
4473.53	8675
4450	8666.97
4397.42	8650
4351.22	8635.11
4324.32	8626
4289.09	8614
4250.33	8604
4199.85	8596.27
4148.99	8590.29
4100.46	8586.77
4050.95	8584.45
4000	8585

Material Boundary

X	Y
4399.61	8560
4544.16	8602.66
4599.51	8620.39
4800.41	8664.75
4899.4	8680.53
4999.29	8685.6
5100.44	8679.7
5200.45	8665.6
5300.34	8639.66
5399.18	8600.16
5474.79	8560

Material Boundary

X	Y
5069.84	8738.33
5124.22	8730.51



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Cbc		145	3000	22
Tw		135	100	40
Afc		125	180	29

IGES®

Project	Summit Powder Mountain Resort - The Overlook - Phase II & III		
Analysis Description	Method : Spencer		
Drawn By JKW	*Scale* 1:600	*Company*	IGES, Inc.
Date	10-5-2018	*File Name*	Section CC.slim

SLIDEINTERPRET 8.018

Slide Analysis Information

Summit Powder Mountain Resort - The Overlook - Phase II & III

Project Summary - CC Seismic

Slide Modeler Version:	8.018
Compute Time:	00h:00m:00.524s

General Settings

Units of Measurement:	Imperial Units
Time Units:	seconds
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer
Number of slices:	30
Tolerance:	0.005
Maximum number of iterations:	50
Check malpha < 0.2:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Create Tension Crack
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Seismic Load Coefficient (Horizontal):	0.17

Materials

Property	Cbc	Tw	Afc
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	145	135	125
Cohesion [psf]	3000	100	180
Friction Angle [°]	22	40	29
Water Surface	None	None	None
Ru Value	0	0	0

Global Minimums

Method: spencer

FS	1.532710
Center:	4531.269, 8836.469
Radius:	153.398
Left Slip Surface Endpoint:	4551.379, 8684.395
Right Slip Surface Endpoint:	4630.449, 8719.446
Resisting Moment:	8.66449e+06 lb-ft
Driving Moment:	5.65307e+06 lb-ft
Resisting Horizontal Force:	51474.8 lb
Driving Horizontal Force:	33584.2 lb
Total Slice Area:	492.139 ft2
Surface Horizontal Width:	79.0702 ft
Surface Average Height:	6.22408 ft

Valid/Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 4801

Number of Invalid Surfaces: 39

Error Codes:

- Error Code -106 reported for 2 surfaces
- Error Code -111 reported for 37 surfaces

Error Codes

The following errors were encountered during the computation:

- -106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- -111 = safety factor equation did not converge

Slice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.53271**

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.63567	168.377	8.03007	Tw	100	40	121.032	185.507	101.904	0	101.904	118.978	118.978
2	2.63567	496.8	9.02557	Tw	100	40	190.512	292	228.817	0	228.817	259.078	259.078
3	2.63567	808.493	10.0238	Tw	100	40	253.303	388.24	343.511	0	343.511	388.284	388.284
4	2.63567	1103.31	11.0252	Tw	100	40	309.749	474.756	446.617	0	446.617	506.967	506.967
5	2.63567	1381.08	12.03	Tw	100	40	360.171	552.038	538.719	0	538.719	615.473	615.473
6	2.63567	1641.62	13.0385	Tw	100	40	404.863	620.537	620.351	0	620.351	714.107	714.107
7	2.63567	1884.74	14.0512	Tw	100	40	444.099	680.675	692.022	0	692.022	803.17	803.17
8	2.63567	2110.19	15.0683	Tw	100	40	478.134	732.841	754.19	0	754.19	882.917	882.917
9	2.63567	2317.75	16.0904	Tw	100	40	507.206	777.399	807.292	0	807.292	953.597	953.597

10	2.63567	2507.14	17.1177	Tw	100	40	531.534	814.687	851.732	0	851.732	1015.43	1015.43
11	2.63567	2678.06	18.1508	Tw	100	40	551.325	845.021	887.882	0	887.882	1068.62	1068.62
12	2.63567	2830.19	19.19	Tw	100	40	566.769	868.693	916.093	0	916.093	1113.35	1113.35
13	2.63567	2963.19	20.2358	Tw	100	40	578.048	885.98	936.696	0	936.696	1149.79	1149.79
14	2.63567	3076.68	21.2887	Tw	100	40	585.329	897.14	949.993	0	949.993	1178.07	1178.07
15	2.63567	3170.24	22.3492	Tw	100	40	588.769	902.412	956.279	0	956.279	1198.34	1198.34
16	2.63567	3243.43	23.4178	Tw	100	40	588.516	902.024	955.816	0	955.816	1210.71	1210.71
17	2.63567	3295.75	24.4951	Tw	100	40	584.708	896.188	948.862	0	948.862	1215.27	1215.27
18	2.63567	3326.69	25.5818	Tw	100	40	577.477	885.105	935.65	0	935.65	1212.1	1212.1
19	2.63567	3335.65	26.6784	Tw	100	40	566.944	868.961	916.414	0	916.414	1201.29	1201.29
20	2.63567	3322.02	27.7856	Tw	100	40	553.227	847.936	891.356	0	891.356	1182.86	1182.86
21	2.63567	3285.1	28.9043	Tw	100	40	536.433	822.196	860.68	0	860.68	1156.86	1156.86
22	2.63567	3224.15	30.0352	Tw	100	40	516.667	791.901	824.574	0	824.574	1123.3	1123.3
23	2.63567	3091.5	31.1791	Tw	100	40	487.62	747.38	771.519	0	771.519	1066.59	1066.59
24	2.63567	2782.72	32.337	Tw	100	40	435.996	668.255	677.219	0	677.219	953.239	953.239
25	2.63567	2435.87	33.5099	Tw	100	40	381.416	584.6	577.522	0	577.522	830.071	830.071
26	2.63567	2061.2	34.699	Tw	100	40	325.495	498.889	475.377	0	475.377	700.752	700.752
27	2.63567	1657.51	35.9054	Tw	100	40	268.298	411.223	370.9	0	370.9	565.155	565.155
28	2.63567	1223.48	37.1305	Tw	100	40	209.889	321.699	264.21	0	264.21	423.124	423.124
29	2.63567	757.61	38.3758	Tw	100	40	150.332	230.416	155.424	0	155.424	274.473	274.473
30	2.63567	258.262	39.6429	Tw	100	40	88.3025	135.342	42.1191	0	42.1191	115.281	115.281

Interslice Data

- **Global Minimum Query (spencer) - Safety Factor: 1.53271**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	4551.38	8684.39	0	0	0
2	4554.01	8684.77	253.083	150.719	30.7751
3	4556.65	8685.19	575.9	342.966	30.7751
4	4559.29	8685.65	947.298	564.146	30.7751
5	4561.92	8686.16	1348.31	802.963	30.7752
6	4564.56	8686.73	1762.02	1049.34	30.7752
7	4567.19	8687.34	2173.39	1294.32	30.7751
8	4569.83	8688	2569.18	1530.03	30.7752
9	4572.46	8688.71	2937.84	1749.58	30.7752
10	4575.1	8689.47	3269.39	1947.03	30.7752
11	4577.74	8690.28	3555.37	2117.34	30.7752
12	4580.37	8691.14	3788.76	2256.32	30.7751
13	4583.01	8692.06	3963.88	2360.62	30.7752
14	4585.64	8693.03	4076.44	2427.65	30.7751
15	4588.28	8694.06	4123.38	2455.6	30.7751
16	4590.91	8695.14	4102.91	2443.41	30.7751
17	4593.55	8696.28	4014.47	2390.74	30.7751
18	4596.19	8697.48	3858.72	2297.99	30.7751
19	4598.82	8698.75	3637.49	2166.24	30.7751
20	4601.46	8700.07	3353.84	1997.32	30.7752
21	4604.09	8701.46	3012.05	1793.77	30.7751
22	4606.73	8702.91	2617.61	1558.87	30.7751
23	4609.36	8704.44	2177.27	1296.63	30.7751
24	4612	8706.03	1708.83	1017.66	30.7751
25	4614.64	8707.7	1257.06	748.622	30.7752
26	4617.27	8709.45	842.259	501.591	30.7751
27	4619.91	8711.27	483.813	288.126	30.7751
28	4622.54	8713.18	202.719	120.725	30.775
29	4625.18	8715.18	21.7155	12.9323	30.7752
30	4627.81	8717.26	-34.5102	-20.5519	30.7751
31	4630.45	8719.45	0	0	0

Entity Information

External Boundary

X	Y
4000	8560
4399.61	8560
5474.79	8560
5516.1	8560
5516.1	8607.68
5500	8611.77
5484.23	8615.7
5428.61	8633.42
5354.15	8660
5260.11	8694
5185.31	8720
5124.22	8730.51
5120.1	8731.86
5111.19	8736.37
5097.39	8737.59
5069.84	8738.33
5055.99	8740
5052.01	8742
4998.79	8752.32
4994.03	8752.52
4964.39	8754.01
4955	8756.19
4921.92	8756.57
4875.19	8754.16
4783.85	8750
4762.84	8749.04
4752.45	8744
4743.65	8742.01
4713.09	8741.88
4669.11	8730
4632.44	8720
4610.23	8713.83
4550.59	8684
4523.1	8682.85
4498.42	8682
4498.18	8681.88
4484.19	8674.65
4473.53	8675
4450	8666.97
4397.42	8650
4351.22	8635.11
4324.32	8626
4289.09	8614
4250.33	8604
4199.85	8596.27
4148.99	8590.29
4100.46	8586.77
4050.95	8584.45
4000	8585

Material Boundary

X	Y
4399.61	8560
4544.16	8602.66
4599.51	8620.39
4800.41	8664.75
4899.4	8680.53
4999.29	8685.6
5100.44	8679.7
5200.45	8665.6
5300.34	8639.66
5399.18	8600.16
5474.79	8560

Material Boundary

X	Y
5069.84	8738.33
5124.22	8730.51

The Outlook
01628-027
10/4/2018

c'	150	psf	Effective Cohesion
ϕ'	29	deg	Effective Friction Angle
Υ_{sat}	135	pcf	Saturated Unit Weight of Soil
Υ_w	62.4	pcf	Unit weight of water
h	4	ft	Depth to shear surface
β	18.4	deg	Slope Gradient (3H:1V)

FS	1.82	

(yellow)	Input Variable
(green)	Calculated Value

This model assumes c>0 and the face of the slope is saturated to depth h