

HILLSIDE REVIEW BOARD AGENDA REPORT: 11/2/2022

Caliber Collision Hillside Development Permit (Case No. 2022-HS-016)		
Request:	A Hillside Development Permit to allow disturbance of areas in the 20-30%, 30-40% and 40% and above slope areas. This application is in anticipation of the construction of a new hotel.	
Applicant:	Scott Cervenak	
Representative:	Chris Bick	
Location:	South-East of Foremaster & Riverside Dr.	
General Plan:	MDR (Multi-Family Residential)	
Existing Zoning:	General Commercial (C-3)	
Surrounding Zoning:	North	RE-20 (Residential Estates, 20,000 sq ft lots)
	South	(PD-R) Planned Development Residential
	East	RE-20 (Residential Estates, 20,000 sq ft lots)
	West	(C-3) General Commercial
Land Area:	Approximately 2.04 acres	



BACKGROUND

This is a request to obtain a hillside permit for the property located at the south-east intersection of Foremaster and Riverside Drives. The applicants are proposing to build a new commercial development on this property, specifically an auto repair shop. This property is in the hillside overlay. Section 10-13A-7 of the Zoning Regulations requires that all major development (i.e., cut greater than 4', etc.) on slopes above 20% requires a 'hillside development permit' granted by the City Council upon recommendation from the Hillside Review Board and the Planning Commission.

APPLICABLE ORDINANCE(S) *(Selected portions)*

10-13A-1: Density and Disturbance Standards

- A. The hillside development overlay zone (HDOZ) limits development densities and provides specific development incentives to transfer underlying zone densities from hillsides (sending areas) to less steep slopes or more safe development areas (receiving areas), within a development.
- B. For those portions of a proposed development with natural slopes twenty percent (20%) or less, development density follows the density and development standards in the underlying zone.
- C. For those portions of a proposed development with natural slopes from twenty-one percent (21%) to thirty percent (30%), development activity shall not disturb more than thirty percent (30%) of the parcel within this slope category.
- D. For those portions of a proposed development with natural slopes from thirty-one percent (31%) to forty percent (40%), development activity shall not disturb more than five percent (5%) of the area within this slope category.
- E. A proposed development may not disturb slopes in excess of forty percent (40%).

10-13A-2: Slope and Slope Areas Determined

- A. Slope shall be determined for each significant portion of a development parcel.
- B. *Procedure:* The applicant shall map the location of the natural slope by using the following procedure:
 - 1. *Preparation of Contour Maps:* The applicant shall submit an accurate, current contour map, prepared and certified by a licensed professional engineer or surveyor, which shows all land contours at intervals no greater than five feet (5'), drawn at a one inch equals one hundred feet (1" = 100') scale maximum.

2. *Verification through Field Surveys:* The city engineer or designee may require the applicant to submit a field survey to verify the accuracy of the contour map.

C. *Determination of Slope Areas:* Using the contour map, natural slopes shall be calculated using points identified as natural slopes of twenty percent (20%), thirty percent (30%), and forty percent (40%), and shall be located on the contour map and connected by a continuous line. That area bounded by said lines and intersecting property lines shall be used for determining project density. Small washes or outcrops, which have slopes distinctly different from surrounding property, and are not part of the contiguous topography, may be excluded from the slope determination.

EXHIBITS PROVIDED

1. Exhibit A – Site Plan
“Exhibit A” in the packet shows the location of the new commercial development.
2. Exhibit B –Grading Plan
“Exhibit B” in the packet shows the proposed preliminary grading plan.
3. Exhibit C – Slope Analysis Map
“Exhibit C” in the packet shows the overall slope analysis for the area to be disturbed.
4. Exhibit D – Geotechnical Report
“Exhibit D” – This is the Geotechnical report for Commerce Point.

RECOMMENDATION

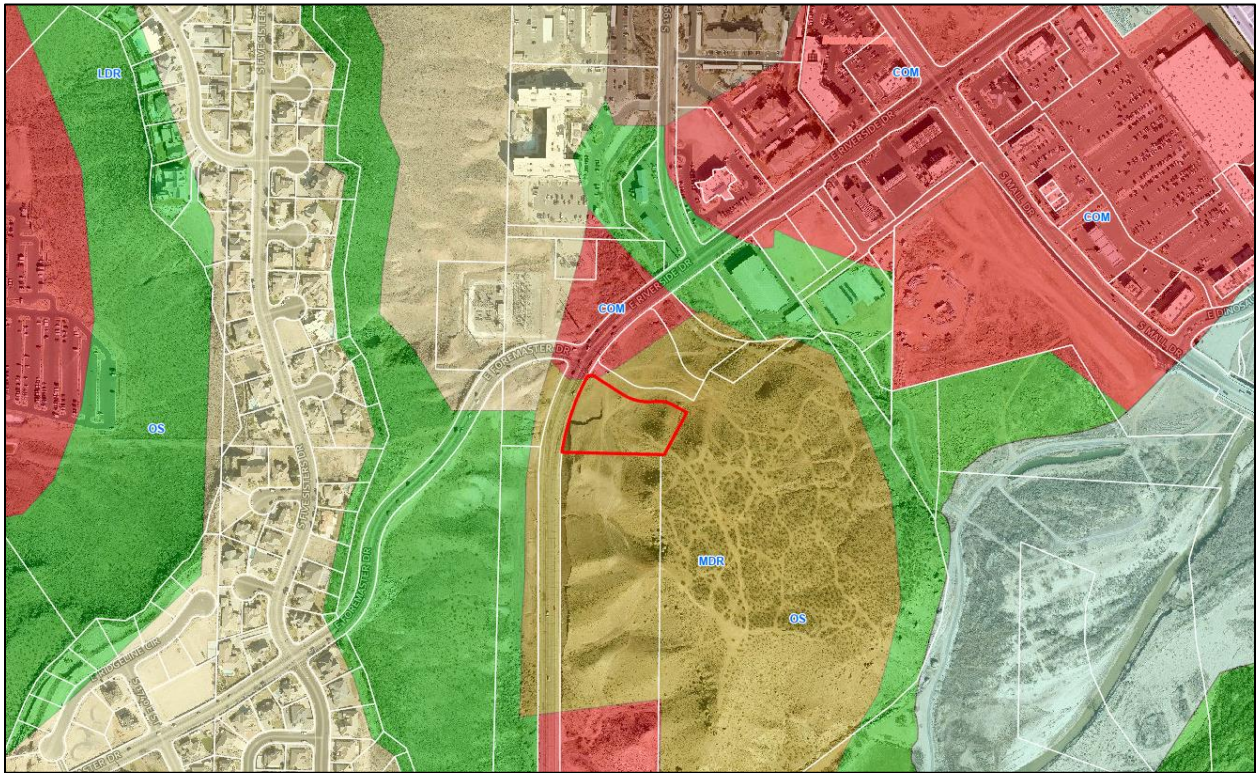
Section 10-13A-8(B)(1) of the “Hillside Review Board Powers and Duties” states that the hillside board can make recommendations to “adopt, modify or reject a proposal” to the Planning Commission (PC).

EXAMPLE MOTION

The hillside board recommends _____ of the request for a Hillside Development Permit as it pertains to slope encroachment as requested and outlined the staff report and has the following comments:

1. _____
2. _____
3. _____

General Plan – MDR (Medium Density Residential)



Zoning - C-3 (General Commercial)

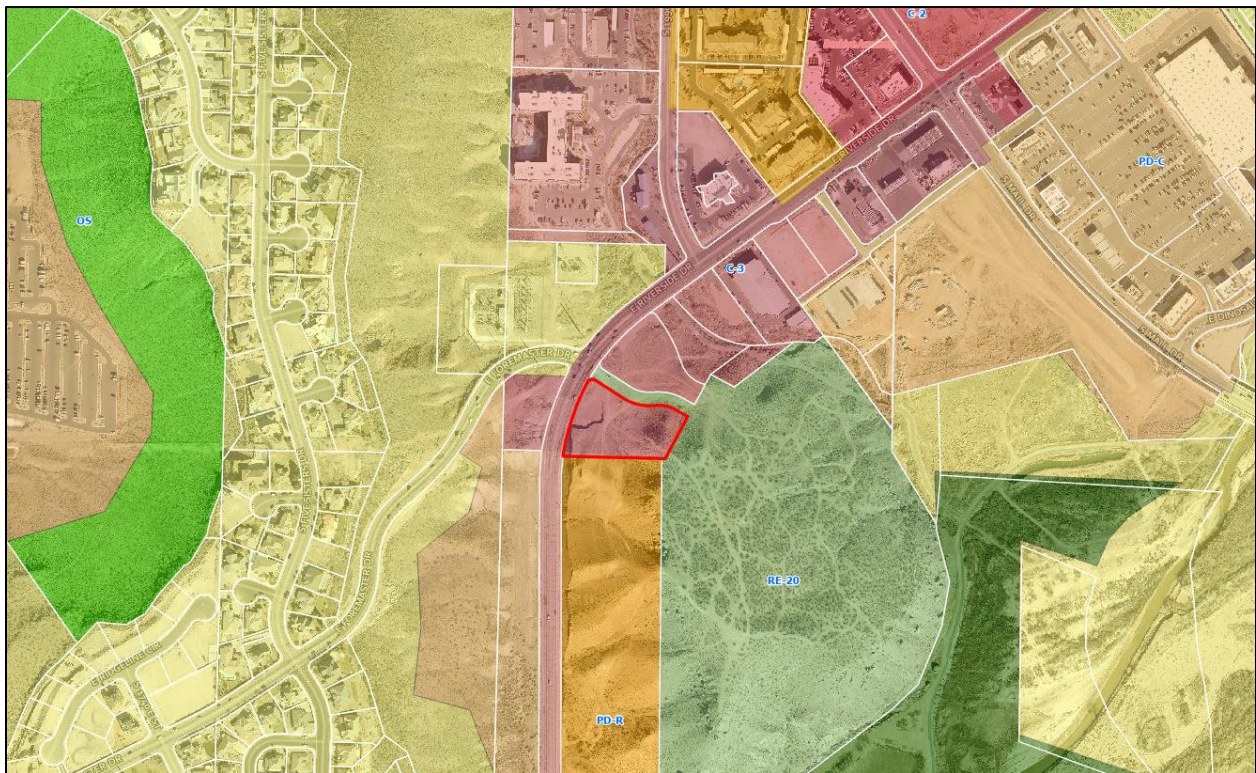
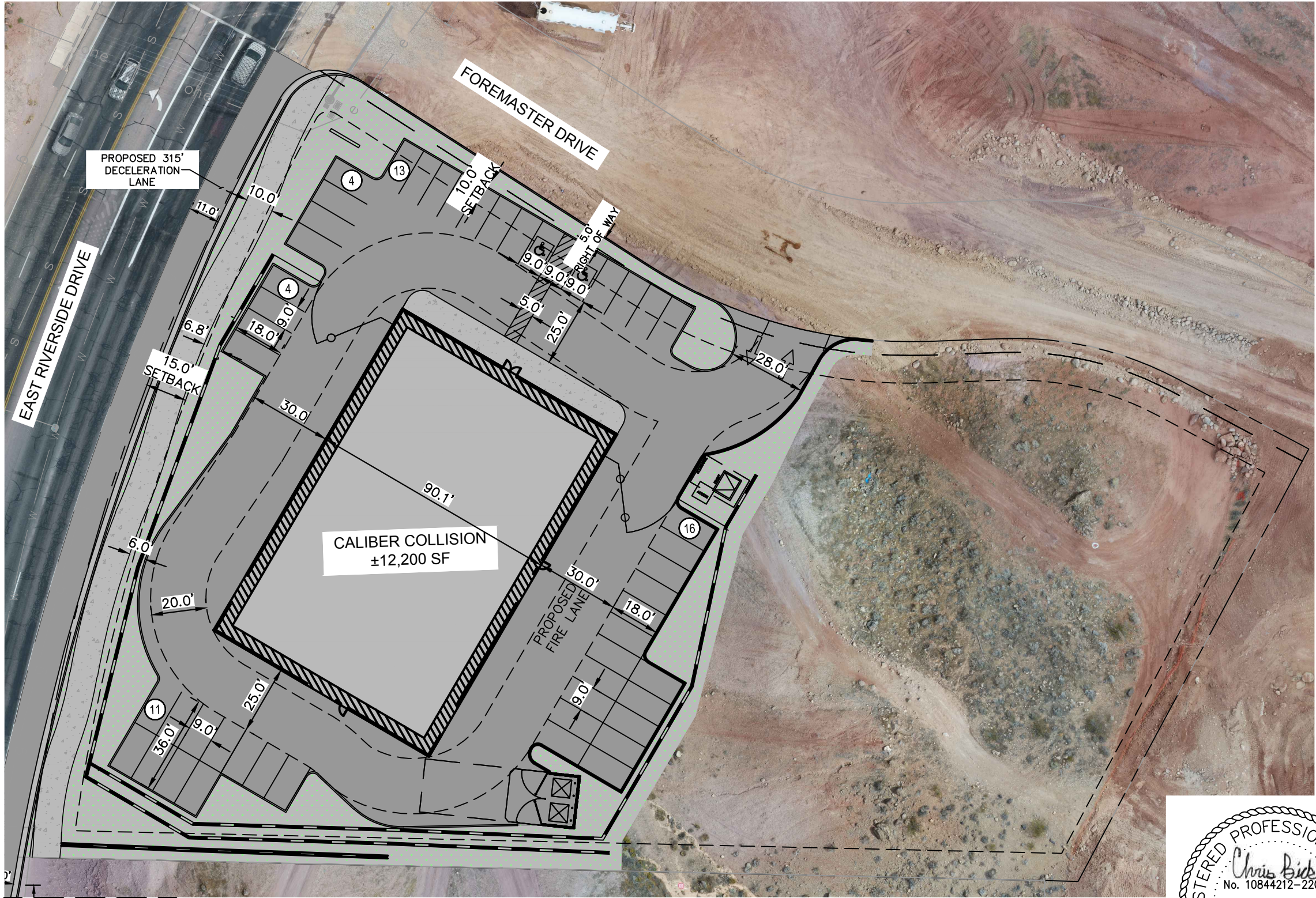


EXHIBIT A

Site Plan

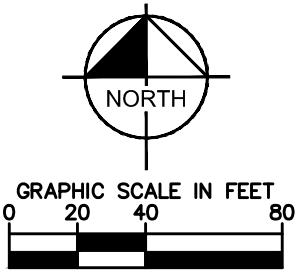
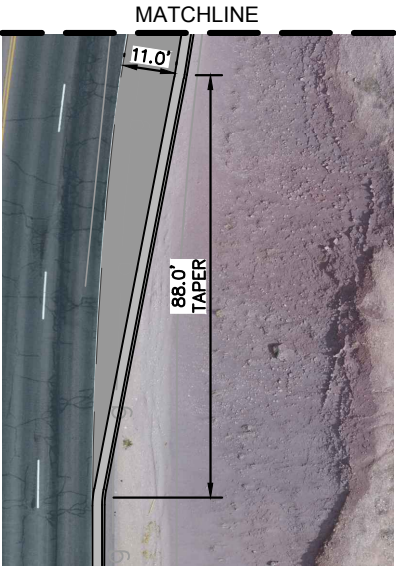
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DEVELOPMENT SUMMARY TABLE	
BUILDING AREA	12,168 S.F.
SITE AREA	2.04 AC
PARKING REQUIRED (1 STALL / 400 S.F.)	35 STALLS
PARKING PROVIDED	48 STALLS
DEVELOPED PERVIOUS AREA	13,745 S.F. (15.5% OF OVERALL SITE)
DEVELOPED IMPERVIOUS AREA	42,936 S.F. (48.3% OF OVERALL SITE)

RIVERSIDE DRIVE LANDSCAPE CALCULATIONS		
CALCULATOINS	PROPOSED AVG. LENGTH	MINIMUM AVG. LENGTH
(S.F. OF LANDSCAPE)/ (LENGTH OF FRONTAGE) (4448.2)/(291.2)	15.28 FT	15 FT

FOREMASTER DRIVE LANDSCAPE CALCULATIONS		
CALCULATOINS	PROPOSED AVG. LENGTH	MINIMUM AVG. LENGTH
(S.F. OF LANDSCAPE)/ (LENGTH OF FRONTAGE) (2031.5)/(184.3)	11.02 FT	10 FT



PRELIMINARY SITE PLAN

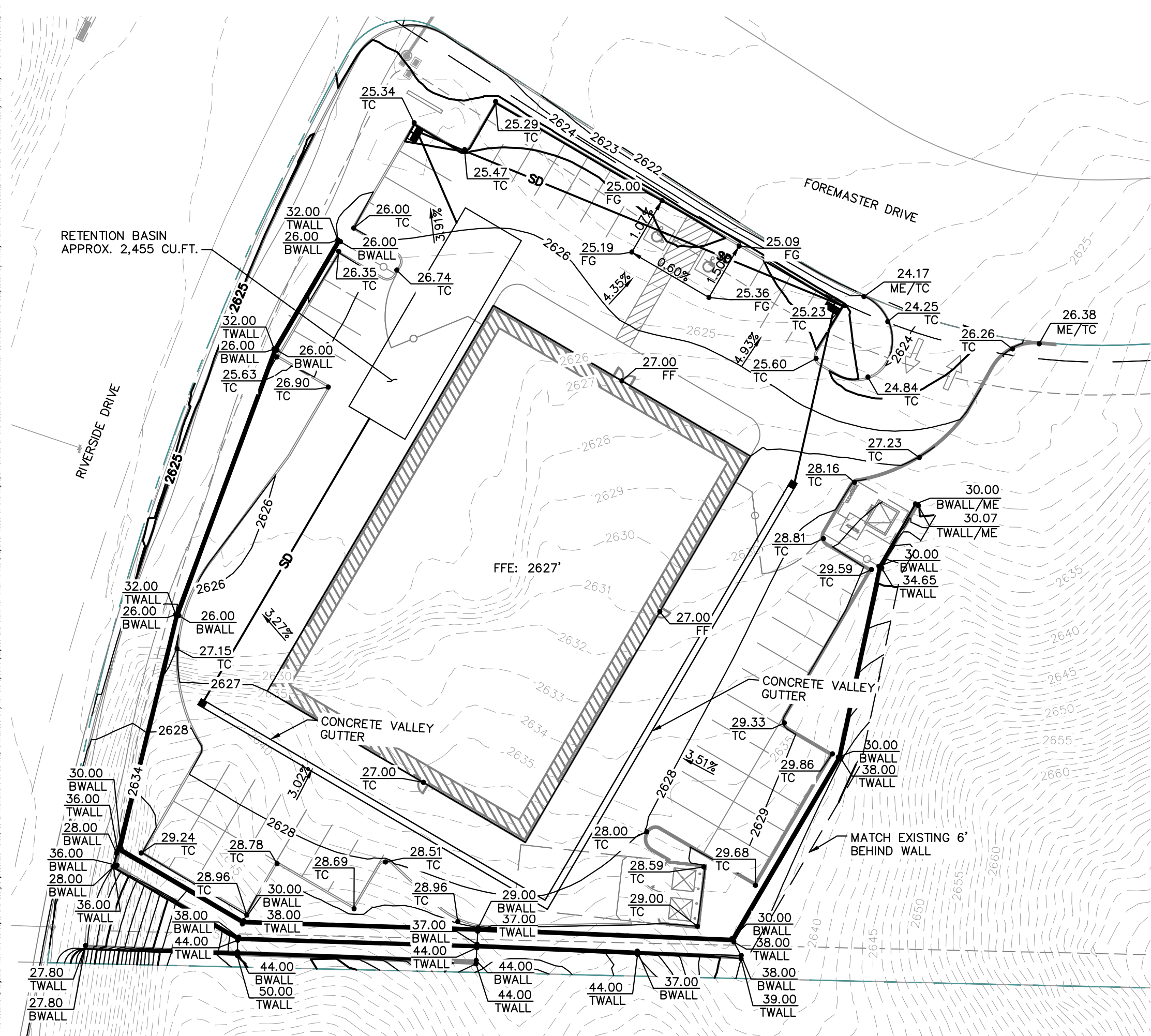
CALIBER COLLISION
1988 EAST RIVERSIDE DRIVE
ST GEORGE, UT

SHEET NUMBER
EX-1

EXHIBIT B

Grading Plan

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PRELIMINARY RETENTION CALCS

Total Project	
i	0.851
Rv	0.754
d	0.037 ft.
A	88800.2 sq. ft.
WQV	2453.9 cu.ft

Step 4: 90th Percentile Volume

Calculate the 90th percentile volume using the following equations for V_{90th} or WQV.

$$V_{90th} = R_v d A \quad \text{or} \quad WQV = R_v d A$$

Where:

V_{90th} and WQV = 90th percentile volume, cf

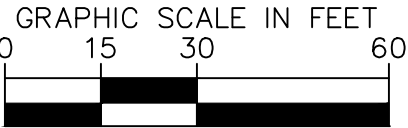
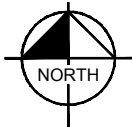
R_v = Runoff coefficient

d = 90th percentile precipitation depth, ft

A = Project area or BMP drainage area, sf

$$R_v = 0.91i - 0.0204$$

A Guide to Low Impact Development within Utah



PRELIMINARY GRADING PLAN

CALIBER COLLISION
1988 EAST RIVERSIDE DRIVE
ST GEORGE, UT

SHEET NUMBER
EX-2

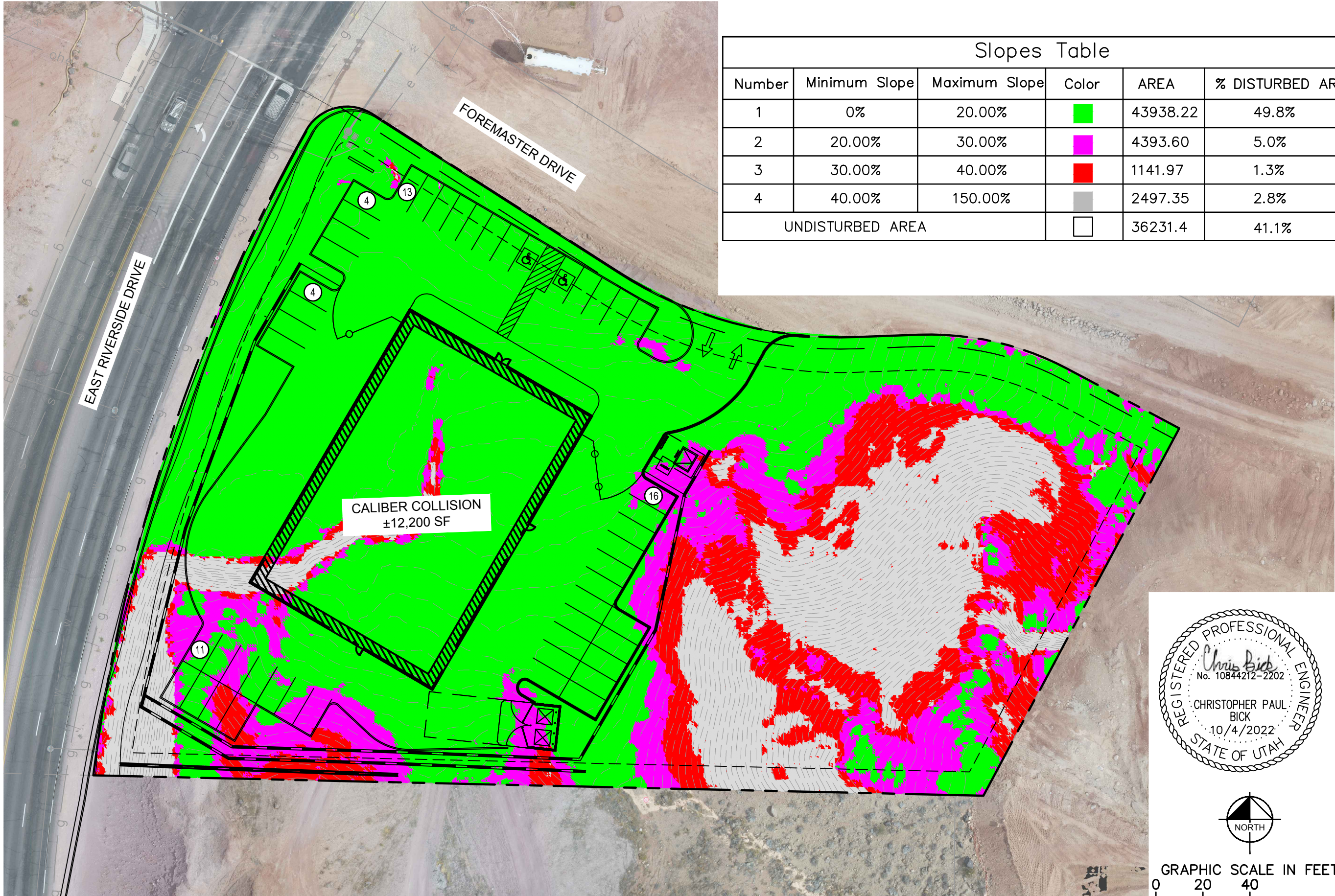
Kimley»Horn
111 East Broadway, Suite 600 | Salt Lake City, UT 84111
Tel. No. (385) 212-3176

DATE: 8/2/2022

EXHIBIT C

Slope Analysis Map

This document, together with the concepts and designs presented herein, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.



Slopes Table					
Number	Minimum Slope	Maximum Slope	Color	AREA	% DISTURBED AREA
1	0%	20.00%		43938.22	49.8%
2	20.00%	30.00%		4393.60	5.0%
3	30.00%	40.00%		1141.97	1.3%
4	40.00%	150.00%		2497.35	2.8%
UNDISTURBED AREA				36231.4	41.1%

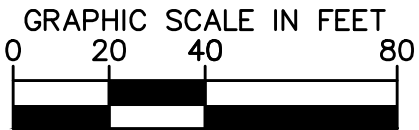
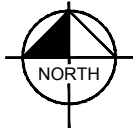


Exhibit D

Geotechnical Report

**PRELIMINARY GEOTECHNICAL
ENGINEERING REPORT**

**Caliber Collision
1988 East Riverside Drive
Saint George, Utah 84790
PSI Project No. 07061856**

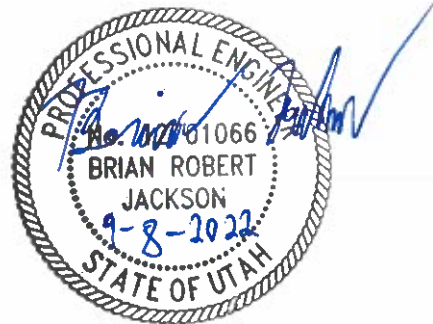
PREPARED FOR:

**Victory Development
2911 Turtle Creek Blvd, Ste. 700
Dallas, Texas 75219
and
Caliber Holdings, LLC
2941 Lake Vista Drive
Lewisville, Texas 75067**

September 8, 2022

BY:

**PROFESSIONAL SERVICE INDUSTRIES, INC.
2779 S 600 W
Salt Lake City, Utah 84115
Phone: (801) 484-8827**



Brian R. Jackson, PE
Project Engineer

A blue ink signature of Britton W. Gentry.

Britton W. Gentry, PE
Chief Engineer



Professional Services Industries, Inc.

2779 S 600 W
Salt Lake City, Utah 84115
Office – (801) 484-8827

September 8, 2022

Victory Development
2911 Turtle Creek Blvd
Dallas, Texas 75219

&

Caliber Holdings, LLC
2941 Lake Vista Drive
Lewisville, Texas 75067

Attn: Mr. Bronson Reed
bronson.reed@vg-re.com

Re: **Preliminary Geotechnical Engineering Report**
CALIBER COLLISION
1988 EAST RIVERSIDE DRIVE
SAINT GEORGE, UTAH 84790
PSI Project No. 07061856

Professional Service Industries, Inc. (PSI), an Intertek company, is pleased to submit this Preliminary Geotechnical Engineering Report for the referenced project. This report includes the results from the field exploration and laboratory testing along with recommendations for use in preparation of the appropriate design and construction documents for this project.

PSI appreciates the opportunity to provide this Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. PSI also has great interest in providing materials testing and inspection services during the construction of this project and will be glad to meet with you to further discuss how we can be of assistance as the project advances.

If there are questions pertaining to this report, or if PSI may be of further service, please contact us at your convenience.

Respectfully submitted,
Professional Services Industries, Inc.

A blue ink signature of Brian R. Jackson, written in a cursive style.

Brian R. Jackson, PE
Project Engineer
brian.jackson@intertek.com

A blue ink signature of Britton W. Gentry, written in a cursive style.

Britton W. Gentry, PE
Chief Engineer
britton.gentry@intertek.com



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1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI), an Intertek company, has completed a field exploration and geotechnical evaluation for the proposed Caliber Collision project in Saint George, Utah. Mr. Bronson Reed, representing Victory Development, authorized PSI's services on June 24, 2022, by signing PSI Proposal No. 0706-376883.

1.2 SITE LOCATION

The subject property is located on the east side of Riverside Drive with a street address of 1988 Riverside Drive in Saint George, Utah (see Figure 1 – Site Location Map). The subject site is an irregularly shaped area within the subject property measuring approximately two acres in plan area.

1.3 PROJECT DESCRIPTION

Information provided by Victory Development includes the following:

- A proposed boring location prepared by Timothy M. Gallup titled, "Soil Boring Plan, Riverside Dr South, ST. George, UT 84790," dated May 5, 2022
- A preliminary grading plan prepared by Perigee Consulting titled, "Caliber Collision Saint George, Preliminary Grading Plan," dated May 2022
- A geotechnical engineering report guidelines document titled, "Guideline for Caliber Collision Center New Structure Geotechnical Reports- Building," (date unavailable)
- An aerial photo of the site showing the approximate extent of the property boundaries (date unavailable)

Based on the provided information, the proposed construction will consist of a 1-story (13,200 sf) structure and associated parking areas and drive lanes. The structure will consist of a pre-engineered metal building with a brick veneer. PSI understands that column loads range from 20 to 50 kips. Column foundations will also be used to resist uplift and horizontal forces. Maximum gravity loads for continuous footings may be in the range of 1 to 2 kips per linear foot. The slab-on-grade will be designed to provide a uniform live load of 125 psf and withstand a maximum concentrated load of 8 kips. Slab subgrade shall provide a reaction modulus of 150 psi/ in minimum with a 4" thick granular sub-base. Column spacing is anticipated to vary between 20 and 40 feet on center. The structure will have an interior concrete pit retaining walls with an estimated maximum retaining height of three feet.

The maximum allowable differential movements for soils supporting masonry walls shall be $L/900$, where L is the horizontal distance between any two points along a wall. The maximum allowable differential movements for soils supporting interior slabs or interior isolated footings shall be $L/500$, where L is the horizontal distance between any two columns. The maximum allowable total settlement shall be 1 inch. In the case of expansive clays, the maximum potential heave shall be 1 inch.

Currently, there is a an approximately 24-foot difference in grade between the west and east side of the proposed structure. Based on the grading plan cuts on the order of 20 feet will be required on the east side of the structure and fill placement on the order four feet on the west side of the structure. A retaining wall is planned on the east and south side of the parking area and will partially extend along the north



and west side of the parking area. Based on the provided grading plan, the retaining wall is anticipated to be on the order of 40 feet tall at its highest point.

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials encountered during the field investigation. Should any of the above information or design basis made by PSI be inconsistent with the planned construction, it is requested that you contact us immediately to allow us to make any necessary modifications to this report. PSI will not be held responsible for changes to the project if not provided the opportunity to review the information and provide modifications to our recommendations.



2.0 REGIONAL AND SITE GEOLOGY

2.1 REGIONAL GEOLOGY

The subject site is located at the transition zone between the Colorado Plateau and the Great Basin physiographic regions. The Colorado Plateau is a large crustal block composed of generally flat sedimentary rocks that display relatively little rock deformation such as faulting and folding. The Great Basin is characterized by basin and range topography that is the result of recent extensional stresses in the earth's crust causing quaternary normal faults.

2.2 SITE GEOLOGY

Based on available geologic mapping of the area, the geology consists of the Dinosaur Canyon Member of the Moenave Formation on the east side of the site, and the Petrified Forest Member of the Chinle Formation on the west side of the site. The Dinosaur Canyon Member is described as interbedded, very fine-grained sandstone and siltstone. The Petrified Forest Member is described as bentonitic shale, mudstone, siltstone and claystone that weathers to a “popcorn” texture with abundant mudcracks due to expansive clays and is susceptible to landslides on slopes greater than 15%. Locally, the Petrified Forest Member is extremely soft.

Special Study 127 prepared by the Utah Geological Survey titled, “Geologic Hazards and Adverse Construction Conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah,” dated 2008 identifies the site as having a high landslide hazard and high shrink/swell susceptibility.

2.3 REGIONAL SEISMICITY

The current tectonic setting of Utah is controlled by its location within the Intermountain Seismic Belt (ISB). The ISB is an intraplate zone of heightened earthquake activity extending from Montana to northern Arizona that is bound by the Colorado Plateau Province to the east and the Basin and Range Province to the west. The ISB is characterized by late Quaternary normal faulting, and shallow seismicity. Extensional stresses in the earth's crust cause normal faulting starting at the Wasatch Range in Utah and extending to the Sierra Nevada Range in California. The faulting results in north to south mountains separated by valleys (basin and range) characteristic of the region.



3.0 SITE AND SUBSURFACE CONDITIONS

3.1 SITE DESCRIPTION

Currently the site consists of an approximately 2-acre lot that is undeveloped with sparse vegetation along the northwest slope of a butte. Riverside Drive is to the west and the land to the north and south of the site is undeveloped. At the time of our site visit, earthwork operations were occurring on the butte above the site to the southeast for a residential development.

3.1.1 TOPOGRAPHY

Based on the provided grading plan and publicly available LIDAR data, the slopes on the east and south side of the site that generally level towards the northwest corner of the site. The highest point on the site is at the southeast corner with an elevation of approximately EL 2686 feet. The lowest point on the site is the northwest corner with an elevation of approximately EL 2625 feet. Most of the grade change occurs on the south and east sides of the site with natural slopes between 3H:1V and 2H:1V.

3.1.2 FAULTING

PSI has reviewed the USGS Quaternary Fault and Fold Database of the United States. Table 3.1 below lists quaternary faults in the database within 25 miles of the site:

TABLE 3.1 – FAULTS WITHIN 25 MILES OF SITE

Fault Name	Type of Fault	Slip Rate (mm/yr)	Direction	Distance		Fault ID Number
				Miles	km	
Washington Fault Zone – Northern Section	Normal	< 0.2	East	2.5	4.1	1004a
Dutchman Draw Fault	Normal	< 0.2	Southeast	11.6	18.7	1003
Washington Fault Zone – Mokaac Section	Normal	< 0.2	South	12.0	19.3	1004b
Volcano Mountain Faults	Normal	< 0.2	East	13.4	21.6	2520
Hurricane Fault Zone – Anderson Junction Section	Normal	0.2 to 1.0	East	13.6	21.9	998c
Gunlock Fault	Normal	< 0.2	Northwest	17.8	28.6	2515
Hurricane Fault Zone – Ash Creek Section	Normal	< 0.2	Northeast	20.1	32.3	998b

Based on a review of the USGS 2014 Deaggregation, the primary contributor to the seismic hazard are the Dutchman Draw Fault, Hurricane Fault zone, and local finite point sources that are modeled from historic seismicity to estimate the hazards on unidentified or uncharacterized faults.

3.1.3 SEISMIC DESIGN PARAMETERS

We understand that the project is governed by the Building Code 2018 of Utah which adopts the International Building Code (IBC), 2018 edition with amendments. As part of this code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event as well as the properties of the soils that underlie the site.



As part of the procedure to evaluate seismic forces, the code requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface. Our borings extended to a maximum depth of 51½ feet bgs, but to define the Site Class for this project, we have interpreted the results of soil test borings drilled within the project site and estimated appropriate soil properties below the base of the borings to a depth of 100 feet as permitted by the code. The estimated soil properties were based upon the soils encountered at the site, data available in published geologic reports, and our experience with subsurface conditions in the general site area.

Based upon our evaluation, the subsurface conditions at the site are consistent with the characteristics of a **Site Class “C”** as defined in Chapter 20.3-1 of the ASCE 7-16. The associated probabilistic ground acceleration values and site coefficients for the general site area were obtained from the ASCE 7 Hazard Tool web page (<https://asce7hazardtool.online/>) using the ASCE 7-16 option and are presented in the table below.

TABLE 3.2: GROUND MOTION VALUES

Period (sec)	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE _R Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
0.2	S_s	0.527	F_a	1.289	S_{Ms}	0.680	S_{Ds}	0.453
1.0	S_1	0.171	F_v	1.5	S_{M1}	0.257	S_{D1}	0.171

2% Probability of Exceedance in 50 years for Latitude, Longitude: 37.0965°, -113.5414°

MCE_R = Maximum Considered Earthquake

The Site Coefficients referring to ASCE 7-16 Section 11.4.7 require the structural engineer to apply appropriate calculations as needed. Design of structures should comply with the requirements of the governing jurisdiction's building codes.

3.2 FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

Prior to initiation of field drilling activities, PSI contacted Blue Stakes of Utah a minimum of 48 hours prior to beginning work to locate any potential buried utilities. The USA inquiry identification number for the utility locate request was #A21961195-00A.

To evaluate soil conditions at the subject site, PSI advanced eight geotechnical borings. The borings were drilled by with a truck-mounted CME 55 drill rig, using solid stem auger, HQ coring, and air rotary drilling methods. Borings B1, B2, B3, B4 and B7 were drilled on July 21, 2022. At the time of drilling, Borings B5 and B6 were not accessible to truck mounted drilling equipment. Access was provided by the drilling subcontractor using earth moving equipment and borings B5, B6 and B8 were drilled on August 12, 2022.

The boring design element, boring labels, approximate depth and total footage are provided in the following table.



TABLE 3.3: FIELD EXPLORATION SUMMARY

Design Element	Boring Number	Latitude	Longitude	Approximate Elevation (ft)	Approximate Finished Grade/Bottom of Retaining wall (ft)	Boring Depth (ft)
Building	SB-1	37.09668	-113.54156	2,629	2,632	16½
	SB-2	37.09656	-113.54110	2,641	2,632	30½
	SB-3	37.09630	-113.54119	2,642	2,632	30
	SB-4	37.09648	-113.54180	2,640	2,632	25
Retaining Wall	SB-5	37.09613	-113.54099	2,655	2,630	30
	SB-6	37.09634	-113.54076	2,681	2,632	50
Parking Area	SB-7	37.09669	-113.54140	2,629	2,629	5
	SB-8	37.09634	-113.54145	2,640	2,630	15

Sampling procedures were performed in general accordance with applicable ASTM methods (ASTM D1586, ASTM D1587, and ASTM D 2113). Complete field exploration methodologies are presented in Appendix A. Samples were identified in the field, placed in sealed containers, and transported to the laboratory for further classification and testing. At the completion of drilling, the soil borings were backfilled with auger cuttings to match the ground surface.

The boring locations were selected by client personnel and located in the field using a recreational-grade GPS system. However, elevations of the ground surface at the boring locations were not provided and should be surveyed by others prior to construction. The references to elevations of various subsurface strata are based on depths below existing grade at the time of drilling. The approximate boring locations are depicted on the Boring Location Plan provided in the Figures.

During field activities, the encountered subsurface conditions were observed, logged, and visually classified (in general accordance with ASTM D2488/D2487). Field notes were maintained to summarize soil types and descriptions, water levels, changes in subsurface conditions, and drilling conditions.

PSI supplemented the field exploration with a laboratory testing program to determine additional engineering characteristics of the subsurface soils encountered. The laboratory testing program was conducted in general accordance with applicable ASTM Test Methods, and is included in Appendix A. Portions of samples not altered or consumed by laboratory testing will be discarded 30 days from the date shown on this report.

3.3 SUBSURFACE CONDITIONS

The results of the field and laboratory testing have been used to generalize a subsurface profile at the project site. The subsurface profile varies due to the previously mentioned slopes on the south and east side of the site. The following subsurface descriptions provide a highlighted generalization of the major subsurface stratification features and material characteristics at the top of the slope, middle of the slope and bottom of the slope. A generalized cross section of the site is included in Appendix A.



TABLE 3.4: GENERALIZED SOIL PROFILE – TOP OF SLOPE

Stratum	Top Elevation (ft)	Bottom Elevation (ft)	Description
1*	2,699	2,689	Gray Conglomerate , cemented cobbles and boulders, hard
2	2,689	2,671	Yellowish Red Siltstone , moist, extremely soft
3	2,671	>2,630	Reddish Brown Claystone , moist, extremely soft

*Observed on properties southeast of site. Not present in soil borings

TABLE 3.5: GENERALIZED SOIL PROFILE – MIDDLE OF SLOPE

Stratum	Top Elevation (ft)	Bottom Elevation (ft)	Description
1	2,681	2,675	Gray Gravel and Cobbles with Boulders, very dense
2	2,675	2,667	Yellowish Red Siltstone , moist, extremely soft
3	2,667	>2,630	Reddish Brown Claystone , moist, extremely soft

TABLE 3.6: GENERALIZED SOIL PROFILE – MIDDLE OF SLOPE

Stratum	Top Elevation (ft)	Bottom Elevation (ft)	Description
1	2,641	2,637	Sandy Fat CLAY , moist, stiff, high plasticity
2	2,637	>2,610	Reddish Brown Claystone , moist, extremely soft

The boring logs included in Appendix A should be reviewed for specific information at individual boring locations. The boring logs include soil descriptions, stratifications, locations of the samples, and field and laboratory test data. The descriptions provided on the logs only represent the conditions at that actual boring location; the stratifications represent the approximate boundaries between subsurface materials. The actual transitions between strata may be more gradual and less distinct. Variations will occur and should be expected across the site.

3.4 GROUNDWATER INFORMATION

Groundwater was not encountered during drilling in any of the soil borings. Based on our review of the State Department of Water Resources Water Data Library, groundwater is estimated to be below an elevation of 2570 feet (NAVD88). As such, groundwater is not expected to impact the proposed construction. It is possible, however, that transient, saturated ground conditions at shallower depths could develop at a later time during periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. Variations in groundwater levels should be expected seasonally, annually, and from location to location.

The groundwater levels presented in this report were measured at the time of PSI field activities. The contractor should determine the actual groundwater levels at the site before construction activities.



4.0 GEOTECHNICAL ENGINEERING ANALYSIS

4.1 EXPANSIVE SOILS

PSI performed ASTM D4546 Swell Testing on selected samples of the recovered on-site material from the soil borings. The following table summarizes the results of the tests:

Boring	Depth (feet)	Soil Type	Moisture Content (%)	Volume Change (%)	Swell Pressure (ksf)
B1	12.5	Claystone	19.1	2.7	4,000
B2	5	Claystone	18.8	12.7	17,300
B3	15	Claystone	21.6	8.9	6,800
B3	30	Claystone	17.3	12.8	7,500
B4	7.5	Claystone	21.5	16.7	9,400
B4	15	Claystone	18.5	4.3	10,300
B4	25	Claystone	11	8.3	7,200

The laboratory swell test results are included in Appendix A. The test results indicated swell percentages of 2.7 to 16.7 percent when tested under a surcharge pressure of 250, 500, 750, and 1000 psf. The surcharge values were selected based on the anticipated approximate overburden pressure after grading, with 100 psf surcharge applied for every 1 foot below the ground surface up to 1,000 psf. Once the samples were hydrated under the surcharge pressure and swelling had stopped, additional pressure was applied until the sample was at or below its initial volume.

Based upon the swell test results, the native soils and bedrock encountered are generally classified as having a “high to very high” potential for swell, therefore; mitigation for swell is required. In addition, if excessive drying and rewetting of these soils is allowed to occur, the risk of swell will increase. Proper drainage and good maintenance must be followed, during and after construction

4.2 SLOPE STABILITY ANALYSIS

Special Study 127 prepared by the Utah Geological Survey identifies sites underlain by the Petrified Forest Member of the Chinle Formation on slopes greater than a critical slope angle of 15 percent as having a high landslide hazard. These criteria fit the previously discussed slopes on the south and east sides of the site. PSI used the software Slide2 (build version 9.007) created by RocScience, Inc to perform a preliminary slope stability analysis using the general cross section in Appendix A. Based on the results of our analysis, the factor of safety (FOS) exceeded 1.0 and the slope is stable under the current conditions. The temporary and long-term stability of the slope will depend on the site conditions and grading during and after construction. Permanent cut or fill slopes should not exceed 2 Horizontal to 1 Vertical (2H:1V), and temporary cut or fill slopes should not exceed 1H:1V.



5.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

5.1 GEOTECHNICAL DISCUSSION

The primary geotechnical consideration at this site is the existence of expansive clay soil and claystone below the proposed finished floor elevation of the structure and required cuts on the order of 40 feet for the retaining wall on the south and east sides of the site. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to our recommendations will be required.

Based on the information gathered from the soil borings and laboratory testing, the clay soil and claystone encountered at this site has a high potential for expansion. PSI recommends the expansive potential of the claystone be mitigated to an acceptable magnitude as agreed upon by the Project Team to reduce the potential for foundation movements and foundation distress. An improved foundation pad must be constructed under soil supported floor slab and foundation elements due to the presence of expansive claystone underlying the foundation. Several methods are available to reduce the expansive potential. PSI recommends excavating unacceptable soils and placing an impermeable geomembrane below the building footprint and pavement areas to mitigate water from entering the expansive soils. Please note that over-excavation will limit, but not eliminate the risk of heave. The owner must be willing to accept some risk of movement by using an over-excavation for swell mitigation. Alternatively, a deep foundation system consisting of drilled piers or micropiles installed and a structural floor slab may be considered.

Proper moisture control will be imperative at this site during and following construction. The risk of swelling soils can be reduced, but not eliminated, by preventing fluctuations in moisture content. Therefore, it is imperative that positive slope away from the building and foundations is maintained, hardscape is constructed around the building perimeter, utilities are prevented from transmitting water via trench bedding or broken lines, and pavements are regularly maintained.

The following geotechnical design recommendations have been developed based on the previously described project characteristics and subsurface conditions encountered. The proposed construction should be performed in accordance with these recommendations and the applicable building code, and local governmental standards which have jurisdiction over this project. If there are changes in the project criteria, PSI should be retained to determine if modifications in the recommendations will be required. The findings of such a review would be presented in a supplemental report. Once final design plans and specifications are available, a general review by PSI is recommended to confirm that the conditions anticipated in preparing this geotechnical report are consistent with the earthwork and foundation recommendations contained within the construction documents.

5.2 SITE PREPARATION

The proposed building pad and parking areas should be stripped and grubbed of any construction debris, trash, vegetation, organic laden materials, and other structures in conflict with the proposed construction a minimum of five feet outside the structural and pavement limits. Depressions or low areas resulting from stripping and grubbing should be backfilled with approved soil and compacted in accordance with the recommendations presented in this report.



5.3 EARTHWORK

5.3.1 OVER-EXCAVATION

Due to the presence of expansive claystone, we recommend that the claystone within the building footprint and pavement areas be over-excavated to a depth of 48 inches the bottom of the slab, foundations, and pavement section. The intent of this recommendation is to provide a suitable foundation subgrade and to reduce expansion to within tolerable limits. The over-excavated material should be replaced with structural fill and should be underlain by an impermeable geomembrane liner to prevent water from infiltrating into the expansive claystone.

The potential impact of the expansive characteristics of the claystone underlying the building footprint and pavement areas can be reduced by protecting the claystone from becoming wet. Placement of an impermeable geomembrane liner and structural fill above the expansive materials can help reduce the possibility for water to infiltrate and wet the underlying soils. If the expansive soil are wetted, surface heave will occur, which could result in damage to the foundation, floor slab and pavement.

5.3.2 FILL MATERIALS

Following site preparation, the newly exposed subgrades in site improvement areas intended for structures and pavements must be approved by the Geotechnical Engineer prior to fill placement. These exposed subgrades should be proof rolled with a loaded tandem axle dump truck or similar piece of rubber-tired equipment (20 tons or greater) in the presence of the Geotechnical Engineer's representative. The purpose of the proof rolling is to detect the existence of marginal or loose near-surface materials or unsuitable soils that may require over-excavation. Areas which deflect, rut or pump excessively during proof rolling, and which cannot be densified in-place, should be over-excavated to suitable soils and backfilled as directed by the geotechnical engineer. Proof rolling should not be performed on saturated, frozen or during wet weather conditions. Proper control of placement and compaction of new fills should be observed by PSI. Structural fill should be placed in lifts not exceeding 8- to-12-inch loose lifts for large compaction equipment such as vibratory rollers or hoe-packs, but thinner lifts (4-inch loose lifts) may be necessary if small compaction equipment such as plate compactors are to be used. Each lift is to be compacted to a minimum of 95 percent of the maximum dry density within 2 percent of the optimum moisture content, as determined in accordance with ASTM D1557 (Modified Proctor). A sufficient number of in-place density tests, as determined by the geotechnical engineer, should be performed on each lift of fill.

Tested structural fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of the area should be performed after the Contractor performs remedial measures.



Imported Structural Fill

Imported structural fill should consist of pit-run or quarry-run rock, crushed rock, or crushed gravel. The material should be well-graded between coarse and fine material, angular, have a plasticity index of 8 or less, and have less than 10 percent by weight passing the U.S. Standard No. 200 Sieve (75-µm).

Drain Rock

Drain rock, or “free-draining” material should have less than 5% passing the No. 200 sieve (washed analysis). Examples of materials that would satisfy this requirement include crushed rock that meets the gradation outlined in Table 3 of ASTM C33 for stone size numbers #7, #67, #56 and #57.

5.3.3 EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or other parties' compliance with local, state, and federal safety or other regulations.

5.3.4 SLOPES

Any permanent cut or fill slopes should not exceed 2 Horizontal to 1 Vertical (2H:1V). Excavations extending below a 1H:1V plane extending down from any adjacent footings should be shored for safety. All excavations should be inspected by a representative of the geotechnical engineer during construction to allow any modifications to be made due to variation in the soil types. All work should be performed in accordance with Department of Labor Occupational Safety and Health Administration (OSHA) guidelines as described in the previous section.

5.3.5 UTILITIES

Utility trenches may be backfilled with suitable onsite native soils or imported soil above the pipe zone. Trench backfill should be moisture conditioned to within 0 to 4 percent above the optimum moisture content, compacted in 6- to 8-inch lifts to a minimum of 90 percent of the maximum dry density as determined by the modified Proctor (ASTM D1557). In pavement areas, the top 12-inches of soil subgrade should reach a minimum of 95 percent of this Proctor. Cutoffs or check dams should be considered using a bentonite cement slurry to limit migration of water onsite and under the building footprint. Pipe zone backfill requirements should be in conformance with the requirements of the local agencies having jurisdiction but should consist of clean granular sand material having a sand equivalent equal to or above 30. Jetting or flooding of utility backfill is not recommended. If smaller compaction equipment such as jumping jacks or plate compactors are used, thinner lifts will be required to achieve compaction.



5.4 FOUNDATIONS

In our opinion, the structural loads of the proposed development can be supported on conventional spread footing foundations bearing on structural fill and constructed in accordance with the following design criteria. PSI recommends that foundation type and bearing strata be consistent throughout the proposed structure.

5.4.1 SHALLOW FOUNDATIONS

Shallow spread and continuous footings founded at a depth of at least 18 inches below lowest adjacent finished grade can be designed for a maximum net allowable soil bearing pressure of 4,000 pounds per square foot (psf). Minimum widths of 48 inches for column footings and 18 inches for continuous footings should be used in foundation design to reduce the possibility of a local bearing capacity failure. The above recommended allowable soil bearing pressure may be increased by one third ($\frac{1}{3}$) for short term wind and/or seismic loads.

If unsuitable soils are encountered below the overexcavation depth, the unsuitable material should be over excavated to suitable subgrade material and replaced with Engineered Fill or granular structural fill. The total width of the over excavation area beneath the design footing elevation should increase by 1 foot for each foot of over-excavation. The over excavated areas should be backfilled with structural fill or clean crushed rock and compacted in accordance with the *FILL MATERIALS* section of this report.

Based on the provided loads and the recommended site preparation, we estimate that post-construction total static settlement will be less than 1 inch. Differential settlement is estimated to be less than $\frac{1}{2}$ inch over a 40-foot span. These magnitudes of estimated settlements are assumed to be within tolerable limits but should be confirmed by the project architect and structural engineer.

We recommend the use of a smooth-edged excavator to make the footing excavations. The foundation excavations should be observed by a representative of PSI prior to steel or concrete placement to assess that the foundation materials can support the design loads and are consistent with the materials and recommendations discussed in this report.

The base frictional resistance and the passive soil resistance will counteract the horizontal loads on shallow foundations. Footings cast against structural fill may be designed using a frictional coefficient between the concrete and soil of 0.40. An ultimate equivalent fluid pressure of 320 pounds per cubic foot (pcf) may be used to compute the ultimate passive resistance. The passive resistance of any uncompacted fill material or loose natural soils should be neglected. It is recommended that the overturning moments on the foundations be resisted by the weight of the foundation system.

After opening, footing excavations should be observed, and concrete should be placed as quickly as possible to avoid exposure of the excavations to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond within 20 feet of the open excavation during or after construction. When possible, the foundation concrete should be placed during the same day the foundation excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce moisture loss or gain.

PSI should be consulted during the design of the foundation pad to verify that the appropriate parameters are utilized. PSI should provide periodic observation during construction of the foundation pad to verify that the design parameters and the soil materials used during construction correspond.



5.5 FLOOR SLABS

5.5.1 SLAB-ON-GRADE

Where slab-on-grade floors are constructed in conjunction with conventional shallow footings, the slab-on-grade should be underlain by at least 4 inches of clean (open-graded) granular material to provide uniform support and limit the risk of the capillary rise of moisture. Granular material, such as ¾-inch to ¼-inch crushed rock having less than 5 percent passing the U.S. Standard No. 200 sieve (75-µm) would be suitable for this purpose. The crushed rock should be compacted until it is “well-keyed”. In addition, it will be appropriate to install a durable vapor-retarding membrane beneath the slab-on-grade to limit the risk of damp floors in areas that will have moisture-sensitive materials placed directly on the floor. The vapor-retarding membrane should be installed in accordance with the manufacturer’s recommendations.

A modulus of subgrade reaction, k value, of 150 pounds per cubic inch (pci, or psi/ inch of deflection) may be used in the grade slab design based on values typically obtained from 1 foot by 1 foot plate load tests. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesionless soil:

Modulus of Subgrade Reaction, $k_s = \frac{k}{B}$ for cohesive soils $k_s = k \left(\frac{B+1}{2B} \right)^2$ for cohesionless soils

where:

k_s = coefficient of vertical subgrade reaction for loaded area;

k = coefficient of vertical subgrade reaction for 1x1 square foot area; and,

B = width of area loaded, in feet

5.6 RETAINING WALLS

Based on the provided grading plan, a retaining wall is planned on the north, east, and south sides of the site with a maximum wall height on the order of 40 feet.

5.6.1 CANTILEVER RETAINING WALLS

Design lateral earth pressures against a retaining wall or other embedded structure depend on the drainage condition provided behind the wall, the geometry of the backfill slope, and the type of construction, i.e., the ability of the wall to yield. The two possible conditions regarding the ability of the wall to yield include the active and at-rest earth pressure cases. The active earth pressure case is applicable to a wall that is capable of yielding slightly away from the backfill by either sliding or rotating about its base. A conventional cantilever retaining wall is an example of a wall that can develop the active earth pressure case by yielding. The at-rest earth pressure case is applicable to a wall that is considered to be relatively rigid and laterally supported at the top and bottom and therefore is unable to yield. The following general recommendations for retaining wall design are based on the wall backfill consisting of granular structural fill within the active wedge compacted to 90 to 95% of ASTM D 1557, and the embedded wall is fully drained, i.e., hydrostatic pressure cannot act on the wall.

Walls that are allowed to yield by tilting about their base should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 30 psf/ft for horizontal backfill. Non-yielding walls should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 48 psf/ft for horizontal backfill. We further recommend that horizontal earth pressures due to surcharge loads be taken as an additional uniform horizontal pressure (rectangular pressure diagram) of 0.5 times the intensity of the surcharge load acting over the entire height of the wall.



Over compaction of the backfill behind walls should be avoided. In this regard, we recommend compacting the backfill to about 93% of the maximum dry density (ASTM D 1557). Heavy compactors and large pieces of construction equipment should not operate within 5 ft of any embedded wall to avoid the buildup of excessive lateral pressures. Compaction close to the walls should be accomplished using hand-operated vibratory plate compactors.

The earth pressure increases and movements of retaining walls due to dynamic loading during a seismic event are relatively complex to model. The soil-structure-interaction depends on the inertial and flexural response of the wall, the response of the soil underlying the wall, the response of the backfill, and the input motions. The dynamic pressures are estimated based on the rigidity of the wall system. To account for dynamic thrust due to seismic loadings we recommend increasing the static earth pressure by a seismic pressure of 8.3 psf/ft for yielding walls. This value is based on a deflection at the top of the wall of at least $0.001H$; where H is the height of the wall. The distribution should be triangular, starting from the base of the wall, and the resultant of the additional seismic force can be placed at $0.5H$ measured up from the base of the wall, where H equals the overall height of the wall in feet measured from the bottom of the footing.

Figure 3 shows the retaining wall pressure configurations for cantilever and gravity retaining walls.

5.6.2 SOIL NAIL WALLS

The soil nail wall system consists of drilling and grouting rows of steel bars or “nails” behind the excavation face as it is excavated and then covering the face with reinforced shotcrete. The placement of soil nails reinforces the soils/weak bedrock located behind the excavation face and increases the soil’s ability to prevent a mass of soil from sliding into the excavation. Soil nail walls are typically constructed using the following sequence:

- Excavate the soil at the wall face to between 1 and 3 feet below the row of soil nails to be installed.
- Drill, install and grout soil nails.
- Excavate berm, if present, located within about 3 feet below the elevation of the soil nail.
- Place drainage strips, steel wire mesh and/or reinforcing bars in front of the excavated soil.
- Install shotcrete and place steel plates and nuts over the soil nails.
- Complete nail pullout capacity testing in accordance with wall designer recommendations typically one out of every 20 nails in an installed row.
- Repeat steps two through seven for each row of nails located below the completed row.

Soil nails typically consist of #6 to #12 threaded steel bars ($\frac{3}{4}$ - to $1\frac{1}{2}$ -inch-diameter). The steel bars are placed in 4- to 8-inch-diameter holes drilled at angles typically ranging from 10 to 25 degrees below horizontal. Centralizers are used to center the steel bars in the holes. Once the steel bars are installed, the holes are grouted using cement grout or concrete. We recommend a preliminary Grout-to-Ground Bond Ultimate Strength (α_{bond}) of 20 psi within the claystone bedrock. Higher adhesion values may be developed, depending on the anchor installation technique. The contractor should be given the opportunity to use higher adhesion values by conducting performance tests prior to the start of installing the production tieback anchors.



5.6.3 SOLDIER PILE AND TIE BACK WALLS

Soldier pile walls consist of steel beams that are concreted into drilled vertical holes located along the wall alignment, typically 8 feet on center. After excavation to specified elevations, tiebacks are installed, if necessary. Once the tiebacks are installed, the pullout capacity of each tieback is tested, and the tieback is locked-off to the soldier pile at or near the design tieback load. Tiebacks typically consist of steel strands that are installed into pre-drilled holes and then either tremie or pressure grouted. Timber lagging is typically installed behind the flanges of the steel beams to retain the soil located between the soldier piles. Geotechnical design recommendations for each of these components of the soldier pile and tieback wall system are presented in the following sections.

PSI recommend that soldier pile walls be designed using the earth pressure diagrams presented in Figures 4 and 5. Due to the expected variance heights of the cut perimeter cuts for the site, PSI anticipates that any soldier pile wall design will include soldier piles with and without tiebacks. Soldier piles without tieback are referred to as cantilevered soldier piles and may be appropriate for use along shorter sections of the site retaining walls. The earth pressures presented in Figures 4 and 5 represent the estimated loads that will be applied to the wall system for various wall heights and are based on fully-drained conditions (no hydrostatic pressure is allowed to build up) above the base of the excavation. We recommend that the embedded portion of the soldier piles be at least 2 feet in diameter and extend a minimum distance of 10 feet into claystone to resist “kick-out.” We recommend using an allowable end bearing value of 30,000 psf for piles embedded a minimum of 10 feet into competent claystone bedrock. The allowable end bearing value should be applied to the base area of the drilled hole into which the soldier pile is concreted.

Tieback anchors will likely be required for some section of the soldier pile walls on this site. Tieback anchors should extend far enough behind the wall to develop anchorage beyond the “no-load” zone and within a stable soil mass. The anchors should be inclined downward at 15 to 25 degrees below the horizontal unless steeper angles are required to avoid buried utility lines or other structures, however steeper inclination of tieback may necessitate the use of walers. Centralizers should be used to keep the tieback in the center of the hole during grouting. Structural grout or concrete should be used to fill the bond zone of the tiebacks. A bond breaker, such as plastic sheathing, should be placed around the portion of the tieback located within the no-load zone if the shoring contractor plans to grout both the bond zone and unbonded zone of the tiebacks in a single stage.

We recommend that spacing between tiebacks be at least three times the diameter of the anchor hole to minimize group interaction. We recommend a preliminary Grout-to-Ground Bond Ultimate Strength (α_{bond}) of 20 psi within the claystone bedrock. Higher adhesion values may be developed, depending on the anchor installation technique. The contractor should be given the opportunity to use higher adhesion values by conducting performance tests prior to the start of installing the production tieback anchors.

5.6.4 RETAINING WALL DRAINAGE

PSI recommends that the retaining wall be provided with drainage. One possible drainage system would include:

- 1) A 4 or 6-inch diameter perforated drain tile at the bottom of the backfill to collect seepage water with the tile connected to a suitable means of disposal.
- 2) Clean ½-inch or 1-inch gravel classified as "GP" and containing less than 5% passing a #200 sieve surrounding the draitile.
- 3) Non-woven 4 ounce per square yard geotextile between the drainage material and the on-site soils to prevent infiltration of fine-grained soils into the draitile, granular drainage blanket, or granular backfill.



Due to the highly expansive claystone bedrock underlaying the site below the retaining wall, it is imperative that water collected by the retaining wall drainage system is not allowed to infiltrate the claystone underlaying the pavement areas or building footprint and should be diverted into stormwater systems.

In specific design cases where water is allowed to build up on the below-grade wall structure, the hydrostatic load correlating to the maximum height of the water build up should be added to the lateral loads acting on the wall.

5.6.5 MOISTURE SENSITIVE SOILS / WEATHER RELATED CONCERNS

The soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundations construction activities during dry weather.

If grading occurs in a period of increased rainfall, unstable subgrade conditions may be present. These conditions may require stabilizing the subgrade with admixtures, such as cement kiln dust or a coarse aggregate. Isolated areas may be stabilized using a geogrid, such as Tensar BX-1200 or equal, with one foot compacted aggregate base over the geogrid. Additional recommendations can be provided, as required, during construction.

5.6.6 DESIGN MEASURES TO REDUCE CHANGES IN SOIL MOISTURE

Site grading should be carefully planned to promote positive drainage away from structures and to divert surface water away into stormwater systems. Water should not be allowed to collect near the structures either during or after construction.

We recommend footing drains be placed around the exterior of the building foundations to reduce the potential for lateral migration of moisture into the building envelope. Pavement surfaces and open space areas should be sloped such that surface water runoff is collected and routed to suitable discharge points. Ground surfaces adjacent to buildings must be sloped to facilitate positive drainage away from the buildings.

Final grading should be designed to provide positive drainage away from the structure. Soil areas within 10-feet of the structure should slope at a minimum of 5 percent away from the building, if possible. Roof leaders and downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system.

Landscaped or planted areas should not be placed within 10 feet of the footings of the proposed structures. Where concrete flat work such as sidewalks are placed next to the structure, concrete should be placed adjacent to the foundation to prevent a planter strip that would trap surface water between the foundation and the sidewalk. For vegetation planted near the buildings, plants that require very little moisture should be used. Irrigation systems (drip and/or sprinkler heads) should not direct water where it could saturate foundation soil.



5.7 PAVEMENT DESIGN

Due to the expansive soils, PSI recommends that the pavement areas be over-excavated to a depth of 48 inches and replaced with structural fill overlaying a geomembrane liner. Pavement design recommendations for several levels of traffic loading were developed based on potential traffic, drive paths or patterns and anticipated soil support characteristics of pavement subgrades. PSI utilized the “AASHTO Guide for Design of Pavement Structures” published by the American Association of State Highway and Transportation Officials to evaluate the pavement thickness recommendations in this report. This method of design considers pavement performance, traffic, roadbed soil, pavement materials, environment, drainage and reliability. Each of these items is incorporated into the design methodology. *PSI is available to provide site specific laboratory testing and engineering evaluation to refine the estimated design parameters and sections, upon request.*

Specific design traffic types and volumes for this project were not available to PSI at the issuance of this report. This traffic information is typically used to determine the number of 18-kip Equivalent Single Axle Loads (ESAL) that is applied to the pavement over its design life. In lieu of project specific design parameters, general traffic and subgrade parameter assumptions were used for this design. Furthermore, the scope of services for this project did not include California Bearing Ratio (CBR) testing. A CBR value of 15 was estimated for design purposes, based on the pavement area being underlain by 4 feet of structural fill. Details regarding the basis for this design are presented in the table below.

TABLE 5.1: PAVEMENT DESIGN PARAMETERS

Pavement Type	Reliability	Initial Serviceability Index	Terminal Serviceability Index	Standard Deviation
Flexible	80	4.2	2.0	0.45
Rigid		4.5		0.35

The below presented estimated pavement sections are based on the field and laboratory test results for the project, local pavement design practice, design basis presented herein and previous experience with similar projects. The project Civil Engineer should verify that the ESAL and other design values are appropriate for the expected traffic and design life of the project. PSI should be notified in writing if the assumptions or design parameters are incorrect or require modification.

TABLE 5.2: ESTIMATED FLEXIBLE PAVEMENT SECTION OPTIONS

Component	Employee	Truck Delivery		
	50,000 ESALs	100,000 ESALs	150,000 ESALs	250,000 ESALs
Hot Mixed Asphalt Concrete (HMAC)	3	3	3	3
Aggregate Base Course	6	7	8	10

TABLE 5.3: ESTIMATED RIGID PAVEMENT SECTION OPTIONS

Component	Truck Delivery	
	< 300,000 ESALs	375,000 ESALs
Portland Cement Reinforced Concrete (PCC)	5	5½
Compacted Subgrade	6	6

These recommended pavement sections are to be constructed over three feet of compacted subgrade or structural fill compacted to 95% of the maximum dry unit weight as determined in accordance with ASTM



D1557 (Modified Proctor), and that the pavements will be constructed during the dry summer months. Proof rolling should be used to evaluate pavement subgrades. Any soft areas disclosed by the proof rolling will likely require over-excavation and replacement with structural fill. Some contingencies should be provided for the repair of soft areas. If pavement construction is scheduled during wet weather, it will be necessary to increase the above-recommended base course sections.

The construction of new pavements over established granular construction haul routes or staging areas can be accomplished by re-grading the existing rock section to remove surficial contamination. Typically, a new 6-in. minimum thickness of $\frac{3}{4}$ -inch-minus UTBC is added to the section to serve as a leveling course beneath the above-recommended thicknesses of AC.

Permanent, properly installed drainage is also an essential aspect of pavement design and construction. All paved areas should have positive drainage to prevent ponding of surface water and saturation of the base course. This is particularly important in cut sections or at low points within the paved areas, such as in sunken loading dock areas or around stormwater catch basins. Effective means to prevent saturation of the base course include installing subdrain systems below sunken loading docks and weep holes in the sidewalls of catch basins.

To provide quality materials and construction practices, we recommend that the pavement work conform to the "UDOT 2022 Road and Bridge Construction Standard Specifications" used by the Utah Department of Transportation. Periodic maintenance should be expected and performed on all pavements during the service life. All pavement materials and construction procedures should conform Utah Department of Transportation (UDOT), or appropriate local requirements.

5.7.1 PAVEMENT MATERIALS

Pavement material requirements for the above pavement sections are presented below:

- **Compacted Subgrade:** Pavement subgrade preparation should be performed in accordance with the **EARTHWORK** section.
- **Aggregate Base Course:** Base materials should meet all requirements specified in the UDOT 2022 Road and Bridge Construction Standard Specifications. Aggregate base should be placed in maximum 6-inch compacted lifts. The base materials should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Flexible base materials should be moisture conditioned to between minus two (-2) and plus three (+3) percentage points of the optimum moisture content. Approximately six inches of base course was observed underlying the asphalt in the test boring locations. The base coarse material may be stockpiled and reused, provided it remains clean of contamination, and meets the specifications for UDOT UTBC.
- **Hot Mix Asphalt Concrete (HMAC) Surface Course:** Should meet all requirements specified in Section 02745 of the UDOT 2022 Road and bridge Construction Standard Specifications.
- **Portland Cement Concrete:** Concrete used for paving should have a minimum compressive strength of 4,000 psi at 28-days. The air content at the point of placement should range from 2 to 4 percent. The concrete pavements should be reinforced and jointed per current ACI recommendations.
- **Concrete Reinforcement:** Should be in accordance with applicable ACI standards. The contraction maximum joint spacing, in general accordance with ACI 330, should be less than 30 times the thickness of the concrete pavement or 15 feet, whichever is smaller.



5.8 PLAN REVIEW AND CONSTRUCTION OBSERVATION

After final plans and specifications are complete, PSI should review the final design and specifications so that the earthwork and foundation recommendations are properly interpreted and implemented. It is considered imperative that the Geotechnical Engineer and/or their representative be present during earthwork operations and foundation installations to observe the field conditions with respect to the design documents and specifications. PSI will not be responsible for changes in the project design or project information it was not provided, or interpretations and field quality control observations made by others. PSI would be pleased to provide these services for this project.



6.0 GEOTECHNICAL RISK AND REPORT LIMITATIONS

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

Services performed by PSI for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. No warranty, expressed or implied, is made.

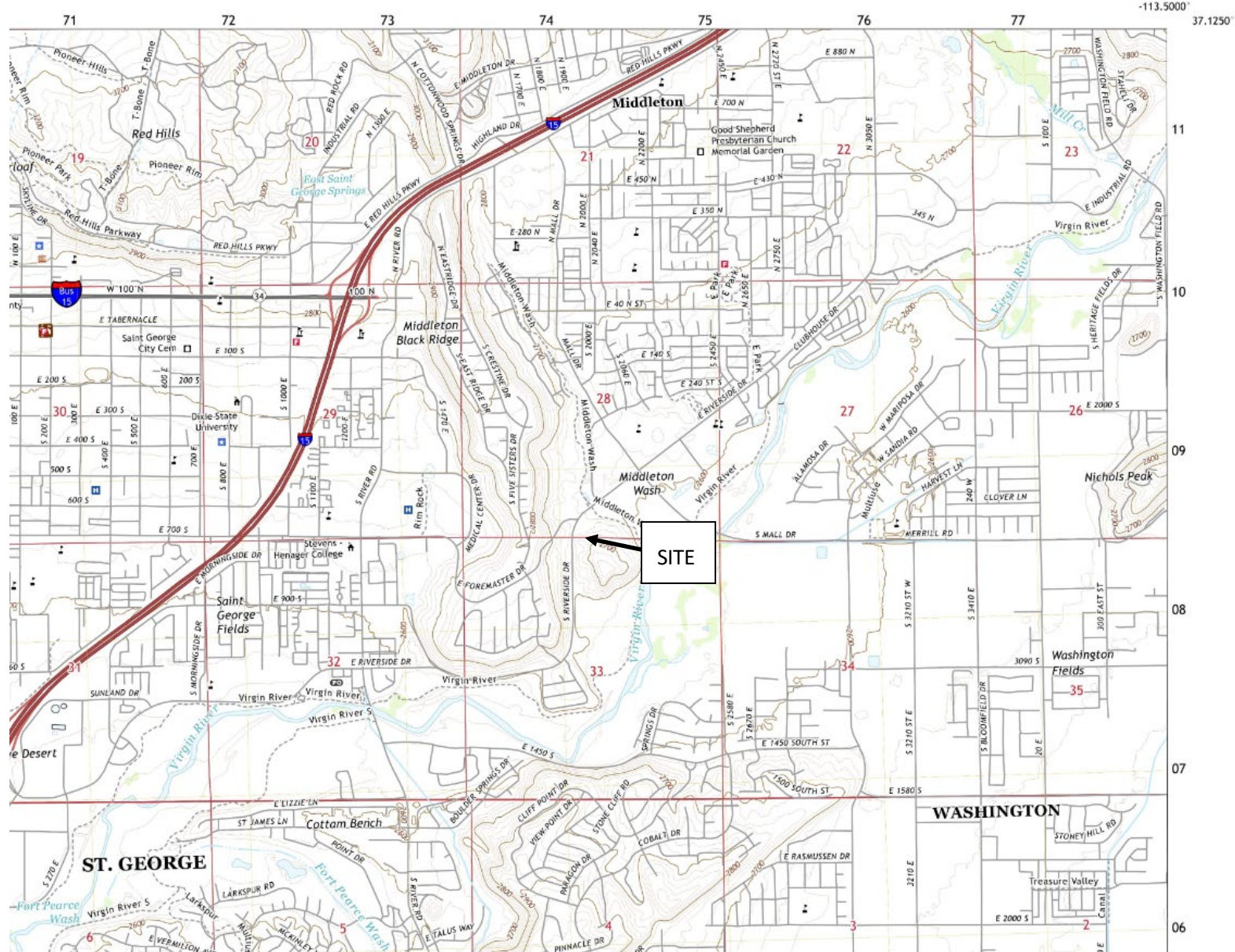
The recommendations submitted are based on the available subsurface information obtained by PSI, and information provided by the client, client's representative and client's design consultants. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation and/or other recommendations are required. If PSI is not retained to perform these functions, PSI cannot be responsible for the impact of those conditions on the performance of the project.

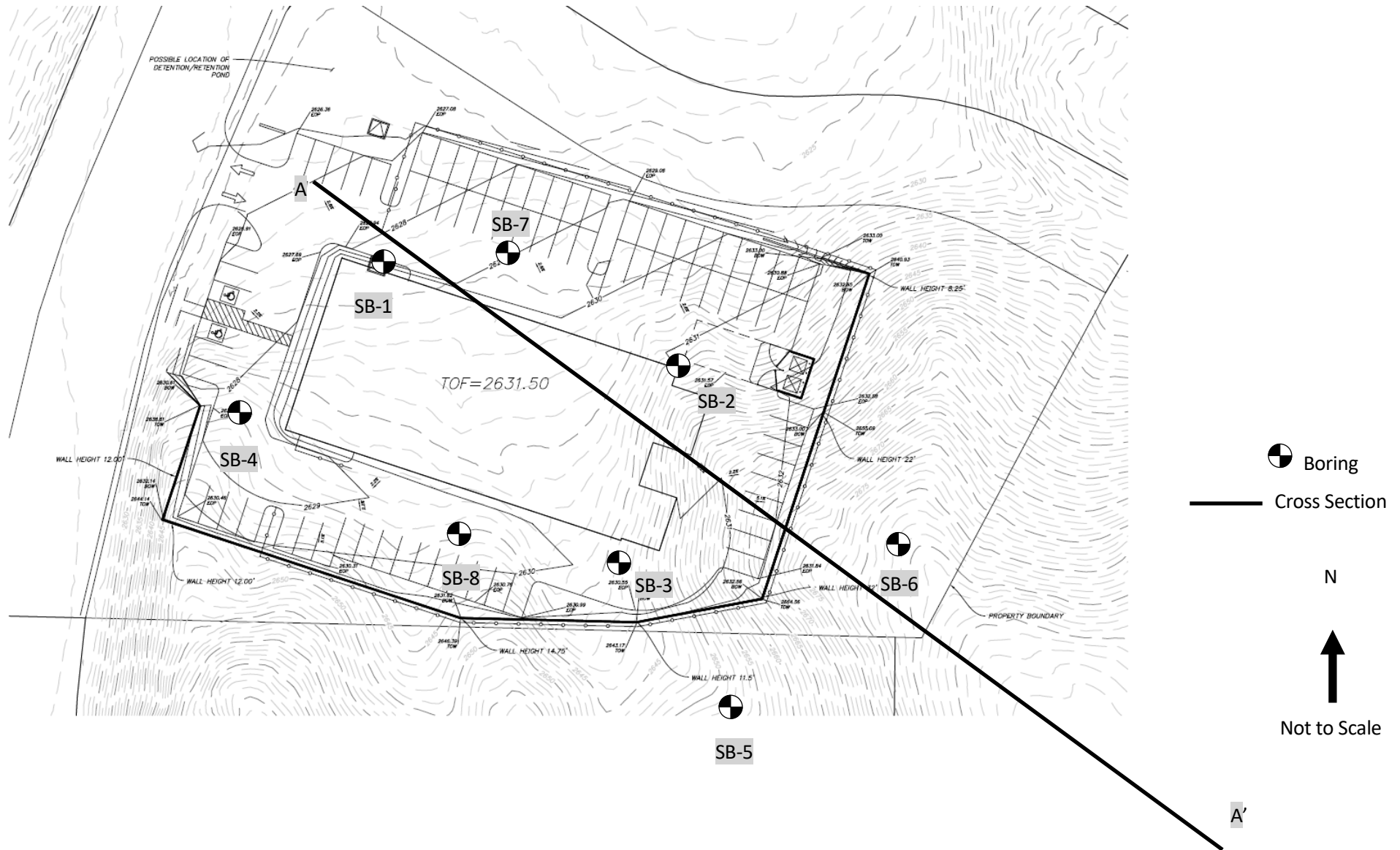
The Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

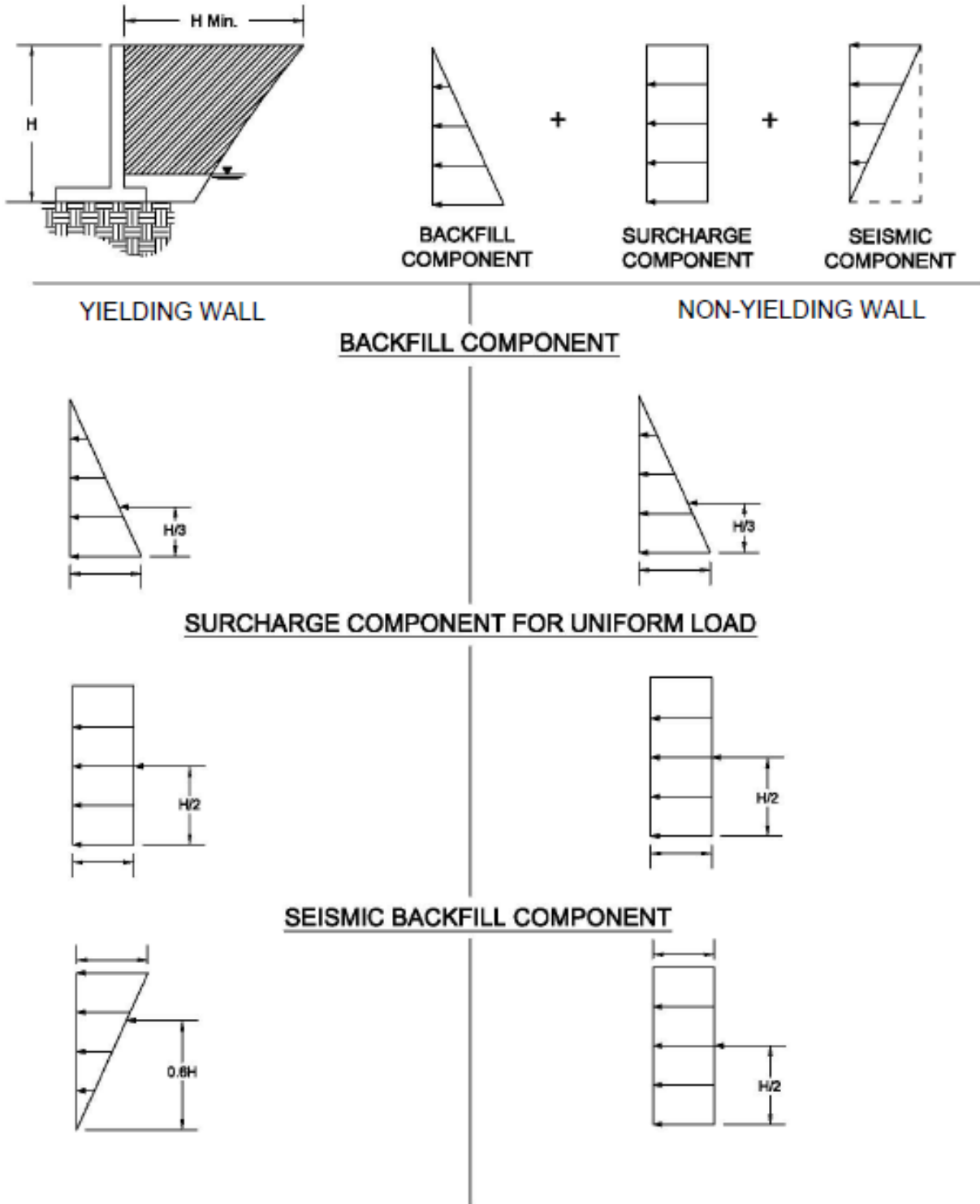
This report has been prepared for the exclusive use of Client and their design consultants, for the aforementioned project parameters.



FIGURES







DATE
September 1,
2022

Caliber Collision – Saint George, Utah

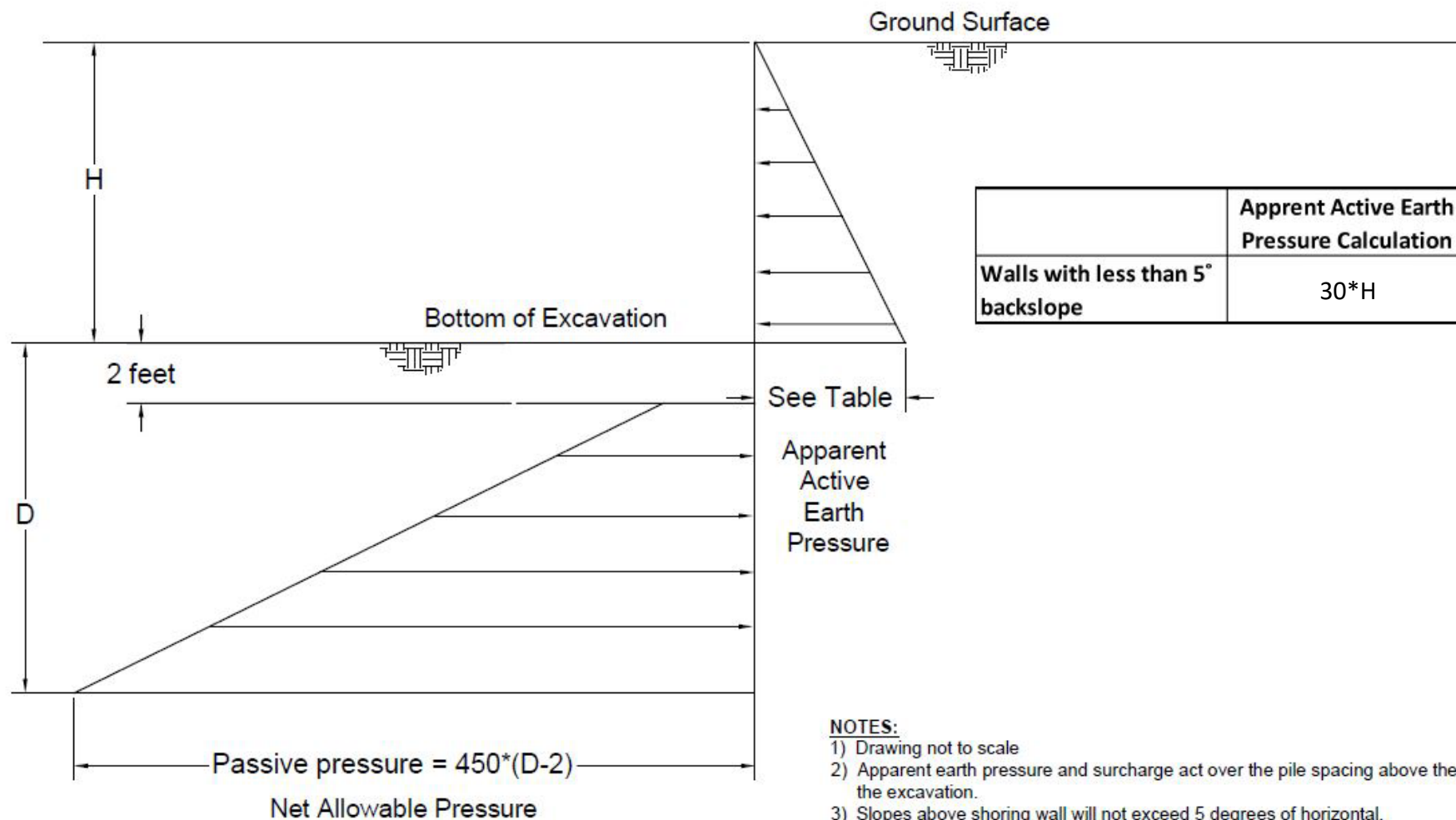
PSI PROJECT
#: 07061856

PSI, INC.
2779 South 600 West
Salt Lake City, Utah 84115
(801) 484-8827

DRAWN BY:
BRJ

**RETAINING WALL
PRESSURES**

FIGURE 3



LEGEND:

D = Total depth below base of excavation
H = Exposed height of wall
T = Horizontal load from tieback

NOTES:

- 1) Drawing not to scale
- 2) Apparent earth pressure and surcharge act over the pile spacing above the base of the excavation.
- 3) Slopes above shoring wall will not exceed 5 degrees of horizontal.
- 4) Additional surcharge from footings of adjacent buildings, retaining walls, or rockeries should be included in accordance with recommendation provided in Figure 6
- 5) The pressure diagram is approximate, if additional surcharge loading is required PSI should be consulted to provide revised surcharge pressures.
- 6) Hydrostatic pressures are accounted for in the areas below the base of the excavation in the diagram



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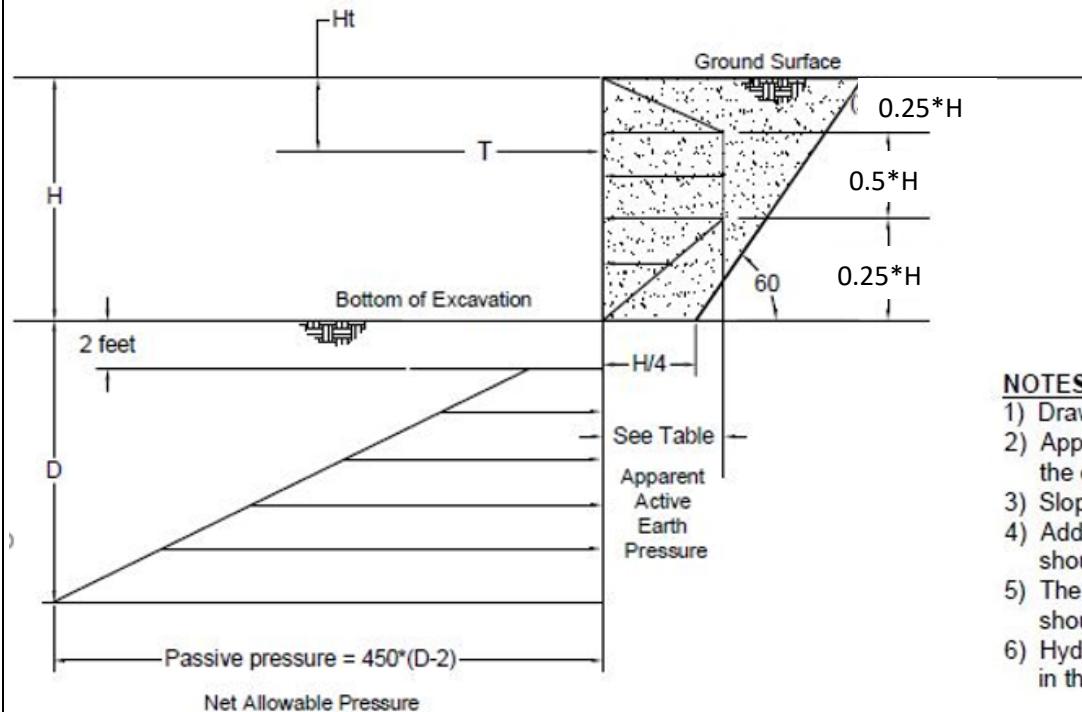
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Caliber Collision – Saint George, Utah

**SOLDIER PILE EARTH PRESSURE DIAGRAM
(CANTILEVERED)**

PSI PROJECT #:
07061856

FIGURE 4



NOTES:

- 1) Drawing not to scale
- 2) Apparent earth pressure and surcharge act over the pile spacing above the base of the excavation.
- 3) Slopes above shoring wall will not exceed 5 degrees of horizontal.
- 4) Additional surcharge from footings of adjacent buildings, retaining walls, or rockeries should be included in accordance with recommendation provided in Figure 6
- 5) The pressure diagram is approximate, if additional surcharge loading is required PSI should be consulted to provide revised surcharge pressures.
- 6) Hydrostatic pressures are accounted for in the areas below the base of the excavation in the diagram

	Walls with less than 5° of Backslope
Apparent Active Earth Pressure Calculation, for Single Tieback walls	$30 \cdot H$
Apparent Active Earth Pressure Calculation, for wall with Multiple Tiebacks	$30 \cdot H$

LEGEND:

- D = Total depth below base of excavation
 H = Exposed height of wall
 T = Horizontal load from tieback
 No load Zone



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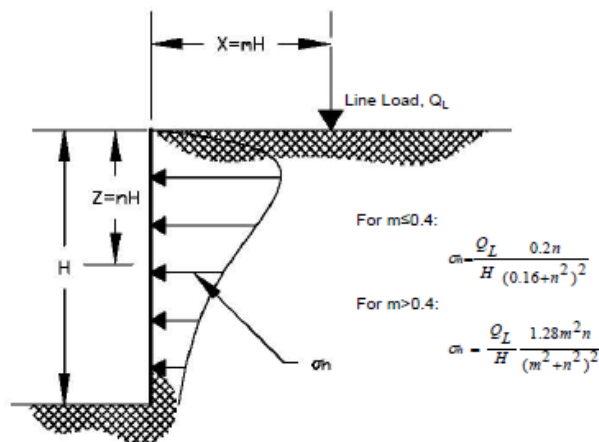
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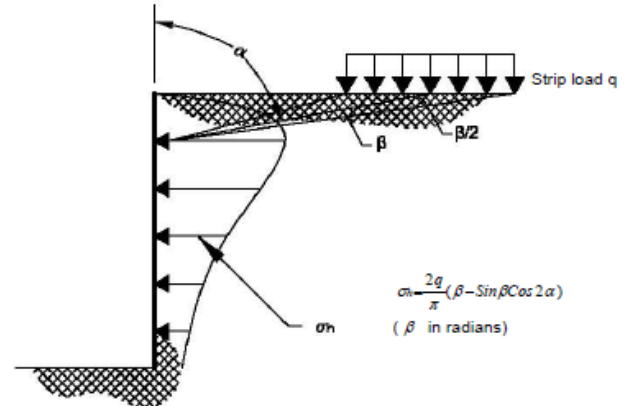
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SOLDIER PILE WITH TIEBACKS EARTH PRESSURE DIAGRAM

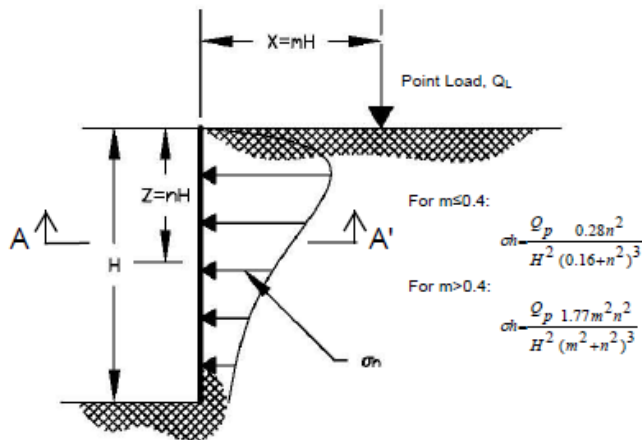
FIGURE 5



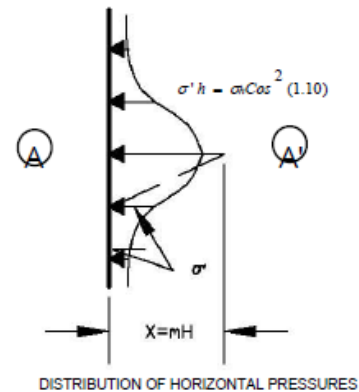
LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL



VERTICAL POINT LOAD



Notes:

1. These guidelines apply to rigid wall with Poisson's Ratio assumed to be 0.5 for backfill materials.
2. Lateral pressures from any combination of above loads may be determined by the principle of superposition.



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**RETAINING WALL
SURCHARGE**

FIGURE 6

APPENDIX A

Field Exploration & Laboratory Testing Program



FIELD EXPLORATION PROGRAM

Approximate exploration locations of our field investigation are shown on Figure 2, Exploration Location Map. PSI notified Blue Stakes of Utah to indicate the approximate location of underground utilities in the vicinity of the proposed exploration locations prior to commencing field activities.

The field exploration consisted of seven solid stem auger borings, and one hollow stem auger borings with HQ coring and air rotary performed. PSI completed borings B1, B2, B3, B4, and B7 on July 21, 2022. At the time of drilling, Borings B5 and B6 were not accessible to track mounted drilling equipment. Access was provided by the drilling subcontractor using earth moving equipment and borings B5, B6 and B8 were drilled on August 12, 2022. Hollow Stem Auger borings. Exploration locations and depths are summarized in the table below:

Table A1: Field Exploration Summary

Design Element	Boring Number	Latitude	Longitude	Approximate Elevation (ft)	Approximate Finished Grade/Bottom of Retaining wall (ft)	Boring Depth (ft)
Building	SB-1	37.09668	-113.54156	2,629	2,632	16½
	SB-2	37.09656	-113.54110	2,641	2,632	30½
	SB-3	37.09630	-113.54119	2,642	2,632	30
	SB-4	37.09648	-113.54180	2,640	2,632	25
Retaining Wall	SB-5	37.09613	-113.54099	2,655	2,630	30
	SB-6	37.09634	-113.54076	2,681	2,632	50
Parking Area	SB-7	37.09669	-113.54140	2,629	2,629	5
	SB-8	37.09634	-113.54145	2,640	2,630	15

Solid Stem and Hollow Stem Auger Borings

The Borings were advanced using a CME-55 track mounted drill rig owned and operated by Applied Geotechnical Engineering Consultants, Inc. out of Saint George, Utah. Soil samples were recovered at selected depths during drilling using a Standard Split Spoon Sampler (outside diameter- 2.0 inches; inside diameter – 1.4 inches) or Modified California Sampler driven by a 140-lb weight free falling 30 inches. The number of blows required to drive the Standard Split Spoon-Sampler 12 inches is designated as the Standard Penetration Resistance (SPT) (N-value, blows per foot) and provides an indication of the consistency of cohesive soils and the relative density of granular materials. The boring logs show the uncorrected N values. They do not reflect the correction for the Modified California Samples, or Hammer Efficiency, which were used in our analysis. Relatively undisturbed Shelby Tube samples (outside diameter – 3.0 inches; inside diameter 2.88 inches) were recovered at selected intervals to measure the in-situ unit weight.

HQ Coring

In test boring B6, an HQ wireline double core barrel was advanced using air rotary drilling methods from a depth of approximately 26½ to 35 feet. The core barrels were advanced using a diamond core bit, and the inner core barrels were recovered using a wireline while the outer core barrel and drill rods remained in place for continuous coring. The HQ core barrel has an outer diameter of 2.5 inches and recovered core samples have a diameter of approximately 2.4 inches. The recovery percentage and Rock Quality Designation (RQD) were recorded by PSI for each core run, and photos of the core samples are shown in Appendix A.

Physical soil samples recovered were sealed in plastic bags and transported to PSI's Salt Lake City laboratory for additional examination and testing. A representative of PSI's geotechnical staff was present during the explorations to record soil and groundwater conditions encountered in the exploration and to obtain soil samples for laboratory testing.

A representative from PSI's office observed the drilling and prepared boring logs of the conditions encountered. It should be noted that the subsurface conditions presented on the boring logs are representative of the conditions at the specific locations drilled. Variations may occur and should be expected across the site. The soil morphology represents the approximate boundary between subsurface materials and the transitions may be gradual and indistinct. Elevations referenced were obtained from publicly available LIDAR data provided by the United States Geological Survey (USGS) and should be considered approximations.

Field Classification

Soil samples were initially classified visually in the field. Consistency, color, relative moisture, degree of plasticity, and other distinguishing characteristics of the soil samples were noted. The terminology used in the soil classifications and other modifiers are depicted in the General Notes and Soil Classification Chart.

LABORATORY TESTING PROGRAM AND PROCEDURES

Soil samples obtained during the field explorations were examined in our laboratory. The physical characteristics of the samples were noted, and the field classifications were modified, where necessary. Representative samples were selected during the course of the examination for further testing.

Moisture Content

Natural moisture content determinations were made on selected soil samples in general accordance with ASTM D2216. The natural moisture content is defined as the ratio of the weight of water to the dry weight of soil, expressed as a percentage.

Visual-Manual Classification

The soil samples were classified in general accordance with guidelines presented in ASTM D2487. Certain terminology incorporating current local engineering practice, as provided in the Soil Classification Chart, included with, or in lieu of, ASTM terminology. The term which best

described the major portion of the sample was used in determining the soil type (i.e., gravel, sand, silt or clay).

Sieve Analysis by Washing

In general, the sample was dried in an oven and then washed with water over the No. 200 sieve. The mass retained on the No. 200 sieve was dried in an oven, and the dry weight recorded. Results from this test procedure assist in determining the fraction, by weight, of coarse-grained and fine-grained soils in the sample.

The determination of the gradation curve of the coarse-grained material was made on selected soil samples in general accordance with ASTM D6913. In general, the oven dried mass retained on the No. 200 sieve is passed over progressively smaller sieve openings, by agitating the sieves by hand or by a mechanical apparatus. The mass retained on each sieve is recorded as a fraction of the total sample, including the percent passing the No. 200 sieve.

Atterberg Limits

The Atterberg Limits are defined by the liquid limit (LL) and plastic limit (PL) states of a given soil. These tests are performed in general accordance with ASTM D4318. These limits are used to determine the moisture content limits where the soil characteristics change from behaving more like a fluid on the liquid limit end to where the soil behaves more like individual soil particles on the plastic limit end. The plasticity index (PI) is the difference between the liquid limit and the plastic limit. The plasticity index is used in conjunction with the liquid limit to assess if the material will behave like a silt or clay.

Unconfined Compressive Strength of Rock Cores

The Uniaxial Compressive Strength (UCS) of rock core specimens was determined in general conformance with Method C of ASTM D7012. Rock core samples were selected and prepared, and the dimensions of the cylinders were recorded. The rock core specimens were loaded under unconfined and uniform axial load until failure. The maximum load was recorded, and the maximum stress applied to the cores were taken as the Unconfined Compressive Strength (q_u).

One Dimensional Swell or Collapse Test

The one-dimensional swell was tested on selected approximately 2-inch diameter intact samples in general accordance with Method C ASTM D4546. The sample is loaded to a desired vertical pressure and then inundated and allowed to swell or collapse. The volume change is recorded over time, and once the volume has stopped changing, the sample is loaded again incrementally. The test is completed once the sample has returned to its original volume, and the pressure at which that occurs is recorded as the swell pressure.

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.	 SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
HSA: Hollow Stem Auger - typically 3 1/4" or 4 1/4" I.D. openings, except where noted.	 ST: Shelby Tube - 3" O.D., except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry	 RC: Rock Core
R.C.: Diamond Bit Core Sampler	 TC: Texas Cone
H.A.: Hand Auger	 BS: Bulk Sample
P.A.: Power Auger - Handheld motorized auger	 PM: Pressuremeter
	CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N ₆₀ : A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q _u : Unconfined compressive strength, TSF
Q _p : Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL), %
DD: Dry unit weight, pcf
 ,  ,  Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (3/4 in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to 3/4 in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

<u>Q_u - TSF</u>	<u>N - Blows/foot</u>	<u>Consistency</u>
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

<u>Description</u>	<u>Criteria</u>
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term</u>	<u>% Dry Weight</u>
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

<u>Description</u>	<u>Criteria</u>	<u>Description</u>	<u>Criteria</u>
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick	Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick	Lensed:	Inclusion of small pockets of different soils
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing	Layer:	Inclusion greater than 3 inches thick (75 mm)
Slickensided:	Fracture planes appear polished or glossy, sometimes striated	Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
		Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

<u>Q_u - TSF</u>	<u>Consistency</u>
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

<u>Description</u>	<u>Criteria</u>
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

<u>Voids</u>	<u>Void Diameter</u>
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

<u>(Typically Sedimentary Rock)</u>	
<u>Component</u>	<u>Size Range</u>
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

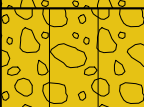
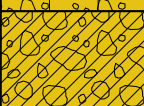
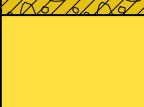
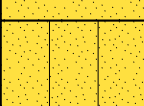
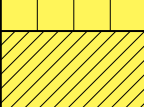
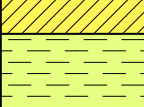
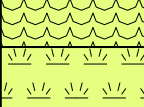
<u>Rock Mass Description</u>	<u>RQD Value</u>
Excellent	90 - 100
Good	75 - 90
Fair	50 - 75
Poor	25 - 50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

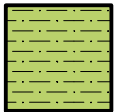
Graphic Symbols for Materials and Rock Deposits



CONCRETE
Portland Cement Concrete



BITUMINOUS CONCRETE



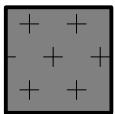
CLAYSTONE



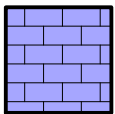
COAL
Coal, Anthracite Coal



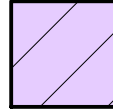
CONGLOMERATE/BRECCIA
Conglomerate, Breccia



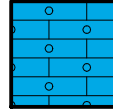
IGNEOUS ROCK
Anorthosite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodiorite, Hornfels, Pegmatite, Rhyolite/Metarhyolite



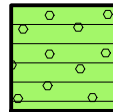
LIMESTONE
Limestone, Dolomite



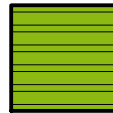
METAMORPHIC ROCK
Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentine, Slate



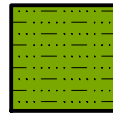
CHERT



SANDSTONE
Sandstone, Orthoquartzite (Sandstone)



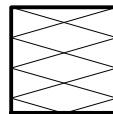
SHALE



SILTSTONE



NO RECOVERY



VOID

DATE STARTED: 7/21/22		DRILL COMPANY: AGECE		BORING B1	
DATE COMPLETED: 7/21/22		DRILLER: BEN LOGGED BY: RDS			
COMPLETION DEPTH: 16.5 ft		DRILL RIG: CME 55		Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A feet N/A feet N/A	
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Augers			
ELEVATION: 2629 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal			
LATITUDE: 37.09668°		HAMMER TYPE: Automatic		BORING LOCATION: Building Footprint	
LONGITUDE: -113.54156°		EFFICIENCY: 70%			
STATION: N/A OFFSET: N/A		REVIEWED BY: BWG			
REMARKS:		NW Corner			

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ⊙			Additional Remarks	
										⊗ Moisture ▣ PL ⬛ LL				
										STRENGTH, tsf ▲ Qu ✱ Qp				
	0			B1-1	14	Reddish Brown Sandy Fat CLAY with gravel moist, very stiff	CH	11 - 9 - 10 N=19	6	⊗			LL = 58 PL = 18 Fines=76.3% Fines=79.4% DD = 97 pcf Sat.=73% Fines=83.7% Fines=83.1%	
2625				B1-2	11			10 - 14 - 17 N=31	6	⊗	▣	⊗		
	5			B1-3	9	Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins	CH	10 - 18 - 20 N=38	11	⊗				
2620				B1-4	10				23 - 41 - 50/5"	9	⊗			>>⊗
	10			B1-5	10				24 - 24 - 30 N=54	13	⊗			>>⊗
				B1-6	11				30 - 50/5"	19		⊗		>>⊗
2615				B1-7	18				25 - 40 - 42 N=82	11	⊗			>>⊗
	15					End of Boring at approximately 16.5 feet bgs								

	Professional Service Industries, Inc.	PROJECT NO.: 07061856
	2779 South 600 West	PROJECT: Caliber Collision
	Salt Lake City, UT 84115	LOCATION: SE Lot of Riverside and Foremaster Dr
	Telephone: (801) 484-8827	Saint George, Utah

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/21/22 DATE COMPLETED: 7/21/22 COMPLETION DEPTH: 31.5 ft BENCHMARK: N/A ELEVATION: 2641 ft LATITUDE: 37.09656° LONGITUDE: -113.5411° STATION: N/A OFFSET: N/A REMARKS:		DRILL COMPANY: AGECE DRILLER: BEN LOGGED BY: RDS DRILL RIG: CME 55 DRILLING METHOD: Solid Stem Augers SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal HAMMER TYPE: Automatic EFFICIENCY: 70% REVIEWED BY: BWG		BORING B2 Water ∇ While Drilling ∇ Upon Completion ∇ Delay N/A feet N/A feet N/A BORING LOCATION: Building Footprint NE Corner	
---	--	---	--	--	--

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	STRENGTH, tsf	Additional Remarks
2640	0					Dark Gray Gravel and Cobbles subrounded, basalt clasts, 10 inch maximum particle size	CH				
				B2-1	1	Reddish Brown Sandy Fat CLAY with gravel					
						moist, stiff					
						Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins					
2635	5			B2-2	18				19		DD = 109 pcf Sat = 97% Fines = 64.8%
				B2-3	18				13		
2630	10			B2-4	18				16		LL = 66 PL = 30
2625	15			B2-5	16		CH		11		Fines = 75.2%
2620	20			B2-6	18				11		Fines = 61.8%
2615	25			B2-7	18				13		LL = 62 PL = 28
2610	30			B2-8	18				13		Fines = 61.1%
						End of Boring at approximately 31.5 feet bgs					



Professional Service Industries, Inc.
 2779 South 600 West
 Salt Lake City, UT 84115
 Telephone: (801) 484-8827

PROJECT NO.: 07061856
PROJECT: Caliber Collision
LOCATION: SE Lot of Riverside and Foremaster Dr
 Saint George, Utah

DATE STARTED: 7/21/22		DRILL COMPANY: AGECE		BORING B3	
DATE COMPLETED: 7/21/22		DRILLER: BEN LOGGED BY: RDS			
COMPLETION DEPTH: 31.5 ft		DRILL RIG: CME 55		Water ▽ While Drilling ▼ Upon Completion ▽ Delay N/A feet N/A feet N/A	
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Augers			
ELEVATION: 2642 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal		BORING LOCATION: Building Footprint	
LATITUDE: 37.0963°		HAMMER TYPE: Automatic			
LONGITUDE: -113.54119°		EFFICIENCY: 70%		SE Corner	
STATION: N/A OFFSET: N/A		REVIEWED BY: BWG			
REMARKS:					

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
									× Moisture ■ PL ⊕ LL ▲ Qu ✱ Qp 02550 02.04.0	
2640	0					Dark Gray Gravel and Cobbles subrounded, basalt clasts, 10 inch maximum particle size	CH			
	5		B3-1	11		Reddish Brown Sandy Fat CLAY with gravel moist, stiff		3 - 5 - 5 N=10	6	
2635			B3-2	13		Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins		6 - 11 - 12 N=23	8	Fines=68.6%
2630	10		B3-3	9				15 - 24 - 24 N=48	10	Fines=72.0%
2625	15		B3-4	11			CH	34 - 41 - 50/5"	22	DD = 97 pcf Sat.=82% Fines=65.4%
2620	20		B3-5	11				13 - 32 - 39 N=71	11	Fines=69.5%
2615	25		B3-6	14				16 - 34 - 30 N=64	12	
	30		B3-7	11				22 - 50/5"	17	DD = 105 pcf Sat.=80%
						End of Boring at approximately 31.5 feet bgs				

	Professional Service Industries, Inc.	PROJECT NO.: 07061856
	2779 South 600 West	PROJECT: Caliber Collision
	Salt Lake City, UT 84115	LOCATION: SE Lot of Riverside and Foremaster Dr
	Telephone: (801) 484-8827	Saint George, Utah

The stratification lines represent approximate boundaries. The transition may be gradual.

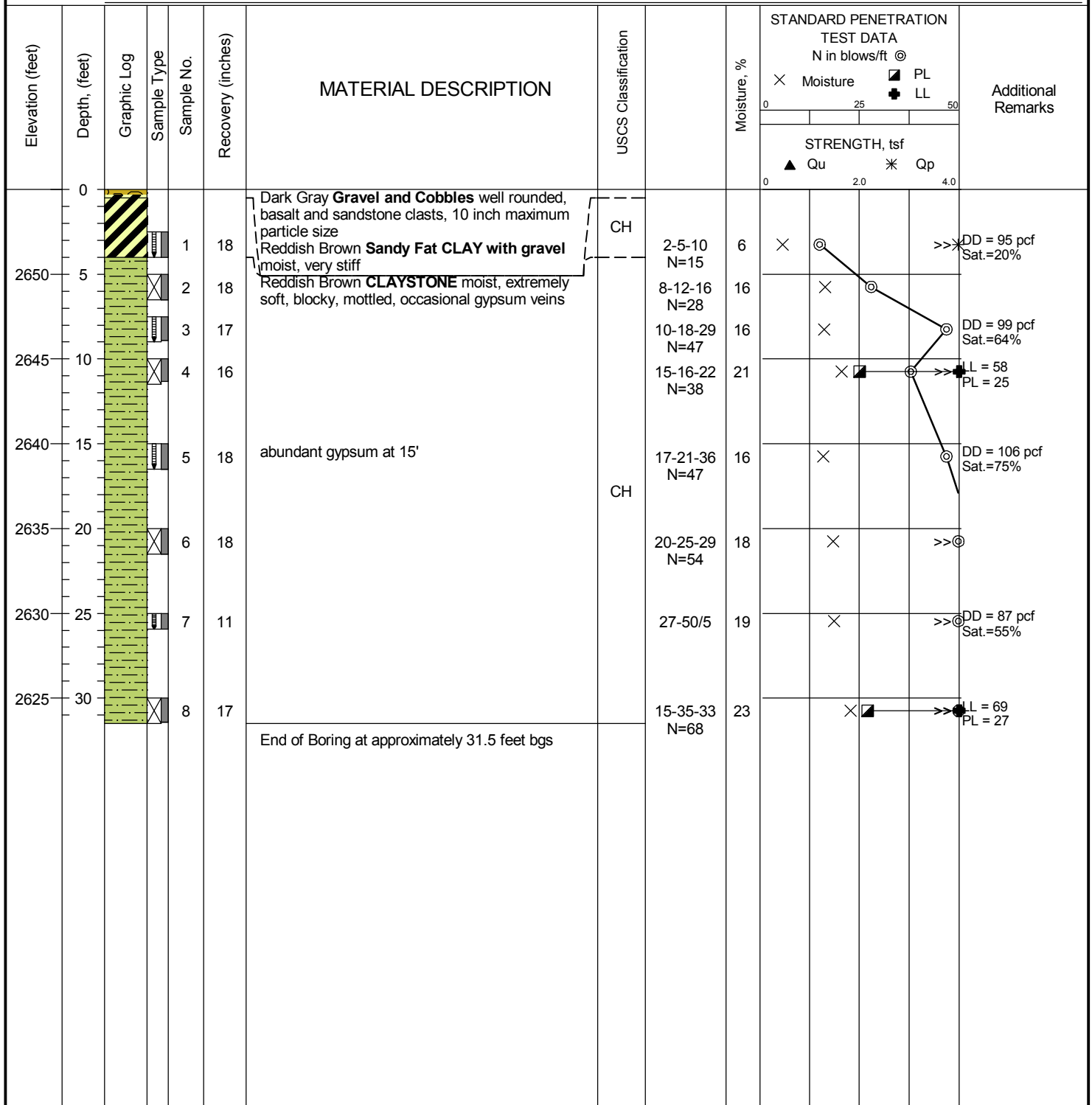
DATE STARTED: 7/21/22		DRILL COMPANY: AGECE		BORING B4	
DATE COMPLETED: 7/21/22		DRILLER: BEN LOGGED BY: RDS			
COMPLETION DEPTH: 25.5 ft		DRILL RIG: CME 55		Water While Drilling N/A feet Upon Completion N/A feet Delay N/A	
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Augers			
ELEVATION: 2640 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal		BORING LOCATION: Building Footprint	
LATITUDE: 37.09648°		HAMMER TYPE: Automatic			
LONGITUDE: -113.5418°		EFFICIENCY: 70%		SW Corner	
STATION: N/A OFFSET: N/A		REVIEWED BY: BWG			
REMARKS:					

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎			Additional Remarks
									×	Moisture	■ PL + LL	
									STRENGTH, tsf			
									▲ Qu		* Qp	
									0	25	50	
									0	2.0	4.0	
	0			B4-1	11	Reddish Brown Sandy Fat CLAY with gravel moist, very stiff	CH	2 - 6 - 13 N=19	6	×	◎	Fines=87.0%
				B4-2	9	Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins		13 - 16 - 20 N=36	9	×	◎	
2635	5			B4-3	11			17 - 19 - 25 N=44	13	×	◎	
				B4-4	11			13 - 50/5"	22		×	>>◎ DD = 97 pcf Sat.=81% Fines=80.0%
2630	10			B4-5	10			20 - 32 - 47 N=79	13	×	◎	>>◎ Fines=82.0%
2625	15			B4-6	11		CH	35 - 50/5"	19		×	>>◎ DD = 107 pcf Sat.=89%
2620	20			B4-7	11			24 - 21 - 24 N=45	13	×	◎	Fines=67.7%
2615	25			B4-8	18			11 - 23 - 30 N=53	22		×	>>◎ DD = 104 pcf Sat.=97% Fines=69.8%
						End of Boring at approximately 26.5 feet bgs						

	Professional Service Industries, Inc.	PROJECT NO.: 07061856
	2779 South 600 West	PROJECT: Caliber Collision
	Salt Lake City, UT 84115	LOCATION: SE Lot of Riverside and Foremaster Dr
	Telephone: (801) 484-8827	Saint George, Utah

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 8/11/22		DRILL COMPANY: AGECE		BORING B5											
DATE COMPLETED: 8/11/22		DRILLER: BEN LOGGED BY: BRJ													
COMPLETION DEPTH: 31.5 ft		DRILL RIG: CME 55		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 30px; text-align: center; vertical-align: middle;">Water</td> <td style="text-align: center;">▽</td> <td>While Drilling</td> <td style="text-align: right;">N/A feet</td> </tr> <tr> <td style="text-align: center;">▼</td> <td>Upon Completion</td> <td style="text-align: right;">N/A feet</td> </tr> <tr> <td style="text-align: center;">▽</td> <td>Delay</td> <td style="text-align: right;">N/A</td> </tr> </table>		Water	▽	While Drilling	N/A feet	▼	Upon Completion	N/A feet	▽	Delay	N/A
Water	▽	While Drilling	N/A feet												
	▼	Upon Completion	N/A feet												
	▽	Delay	N/A												
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Auger		BORING LOCATION: Retaining Wall SE Corner											
ELEVATION: 2655 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal													
LATITUDE: 37.09613°		HAMMER TYPE: Automatic													
LONGITUDE: -113.54099°		EFFICIENCY: 70%													
STATION: N/A		OFFSET: N/A		REVIEWED BY: BWG											
REMARKS:															



Professional Service Industries, Inc.
2779 South 600 West
Salt Lake City, UT 84115
Telephone: (801) 484-8827

PROJECT NO.: 07061856
PROJECT: Caliber Collision
LOCATION: SE Lot of Riverside and Foremaster Dr
Saint George, Utah

DATE STARTED: 8/11/22		DRILL COMPANY: AGECE		BORING B6	
DATE COMPLETED: 8/12/22		DRILLER: BEN LOGGED BY: BRJ			
COMPLETION DEPTH: 51.5 ft		DRILL RIG: CME 55		Water ☐ While Drilling N/A feet ☒ Upon Completion N/A feet ☐ Delay N/A	
BENCHMARK: N/A		DRILLING METHOD: HSA, Core, Air Rotary			
ELEVATION: 2681 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal, HQ Core			
LATITUDE: 37.09634°		HAMMER TYPE: Automatic		BORING LOCATION: Retaining Wall	
LONGITUDE: -113.54076°		EFFICIENCY: 70%			
STATION: N/A OFFSET: N/A		REVIEWED BY: BWG			
REMARKS:					

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
									X Moisture ☒ PL ☒ LL STRENGTH, tsf ▲ Qu * Qp	
2680	0					Dark Gray Gravel and Cobbles well rounded, basalt and sandstone clasts, occasional boulders, 36 inch maximum size observed at surface				
2675	5			1	18	Yellowish Red SILTSTONE moist, extremely soft, with claystone laminations	14-20-20 N=40	11	X	DD = 101 pcf Sat.=45%
				2	18		17-23-24 N=47	7	X	
2670	10			3	17		15-19-28 N=47	5	X	DD = 111 pcf Sat.=29%
2665	15			4	18	Reddish Brown CLAYSTONE moist, extremely soft, blocky, mottled, occasional gypsum veins	13-18-26 N=44	12	X	
2660	20			5	11		36-50/5	12	X	DD = 108 pcf Sat.=59%
2655	25			6	15		22-47-50/5			>>①
2650	30			7	33	Rock Coring performed from 26 1/2 feet to 35 feet	RQD=0 Rec=79%	12	X	▲ Qu = 3.4 tsf 40 min.
2645	35			8	54		RQD=18.3 Rec=90%	13	X▲	Qu = 1.4 tsf 45 min.
				9	18	Air Rotary performed from 35 feet to the termination depth	27-40-47 N=86	12	X	>>①
2640	40			10	18	Silt laminations, with CaCO3 veins at 40 feet	31-42-48 N=90	15	X	LL = 55 PL = 25
2635	45			11	8		36-50/3	12	X	DD = 101 pcf Sat.=51%
2630	50			12	18	blocky, mottled	32-42-49 N=91	10	X	DD = 110 pcf Sat.=51%
						End of Boring at approximately 51.5 feet bgs				

	Professional Service Industries, Inc.	PROJECT NO.: 07061856
	2779 South 600 West	PROJECT: Caliber Collision
	Salt Lake City, UT 84115	LOCATION: SE Lot of Riverside and Foremaster Dr
	Telephone: (801) 484-8827	Saint George, Utah

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/21/22		DRILL COMPANY: AGECE		BORING B7											
DATE COMPLETED: 7/21/22		DRILLER: BEN LOGGED BY: RDS													
COMPLETION DEPTH: 31.5 ft		DRILL RIG: CME 55		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 30px; text-align: center; vertical-align: middle;">Water</td> <td style="text-align: center;">▽</td> <td>While Drilling</td> <td style="text-align: right;">N/A feet</td> </tr> <tr> <td style="text-align: center;">▼</td> <td>Upon Completion</td> <td style="text-align: right;">N/A feet</td> </tr> <tr> <td style="text-align: center;">▽</td> <td>Delay</td> <td style="text-align: right;">N/A</td> </tr> </table>		Water	▽	While Drilling	N/A feet	▼	Upon Completion	N/A feet	▽	Delay	N/A
Water	▽	While Drilling	N/A feet												
	▼	Upon Completion	N/A feet												
	▽	Delay	N/A												
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Augers		BORING LOCATION: Parking Area North Side of Building											
ELEVATION: 2629 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal													
LATITUDE: 37.09669°		HAMMER TYPE: Automatic													
LONGITUDE: -113.5414°		EFFICIENCY: 70%													
STATION: N/A OFFSET: N/A		REVIEWED BY: BWG													
REMARKS:															

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification		Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
										X Moisture PL LL 0 25 50	
										STRENGTH, tsf ▲ Qu * Qp 0 2.0 4.0	
0	0					Reddish Brown Sandy Fat CLAY with gravel moist, very stiff	CH				
2625	5		B7-1	18	18	Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins	CH	8 - 11 - 14 N=25	9	X ⊙	Fines=86.9%
			B7-2	18	18			5 - 11 - 11 N=22	9	X ⊙	
2620	10					End of Boring at approximately 6.5 feet bgs					
2615	15										
2610	20										
2605	25										
2600	30										

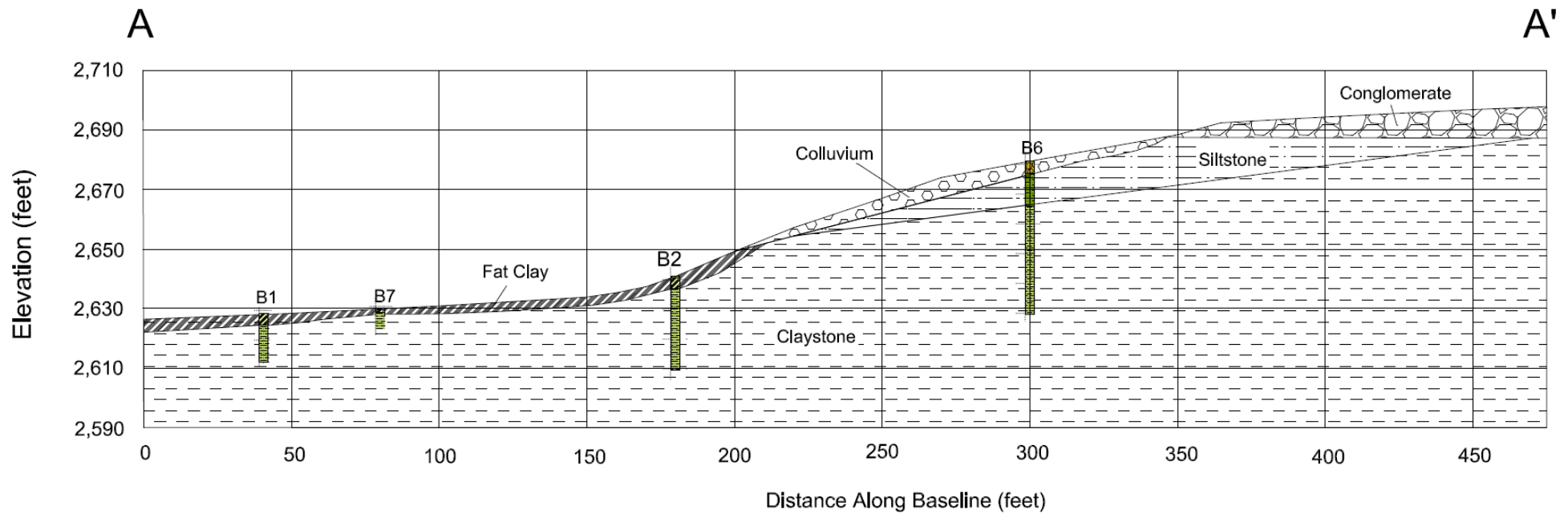
	Professional Service Industries, Inc. 2779 South 600 West Salt Lake City, UT 84115 Telephone: (801) 484-8827		PROJECT NO.: 07061856 PROJECT: Caliber Collision LOCATION: SE Lot of Riverside and Foremaster Dr Saint George, Utah

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 8/12/22		DRILL COMPANY: AGECE		BORING B8	
DATE COMPLETED: 8/12/22		DRILLER: BEN LOGGED BY: BRJ			
COMPLETION DEPTH: 16.5 ft		DRILL RIG: CME 55		Water While Drilling Upon Completion Delay N/A feet N/A feet N/A	
BENCHMARK: N/A		DRILLING METHOD: Solid Stem Augers		BORING LOCATION:	
ELEVATION: 2640 ft		SAMPLING METHOD: 2in-SPT, 2.5in-Mod Cal			
LATITUDE: 37.09634°		HAMMER TYPE: Automatic		Parking Area	
LONGITUDE: -113.54145°		EFFICIENCY: 70%		South Side of Building	
STATION: N/A		OFFSET: N/A		REVIEWED BY: BWG	
REMARKS:					

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
									× Moisture ■ PL + LL ▲ Qu ✱ Qp	
0						Reddish Brown CLAYSTONE moist, extremely soft, blocky, occasional gypsum veins				
2635	5			1	18		CH	17-19-20 N=39	20	DD = 91 pcf Sat.=64%
2630	10			2	18			17-22-21 N=43	17	
2625	15			3	18	End of Boring at approximately 6.5 feet bgs		18-20-22 N=42	21	DD = 95 pcf Sat.=74%

	Professional Service Industries, Inc.	PROJECT NO.:	07061856
	2779 South 600 West	PROJECT:	Caliber Collision
	Salt Lake City, UT 84115	LOCATION:	SE Lot of Riverside and Foremaster Dr
	Telephone: (801) 484-8827		Saint George, Utah



DATE
August, 2022

Caliber Collision – Saint George, Utah

PSI PROJECT #:
07061856

PSI, INC.
2779 South 600 West
Salt Lake City, Utah 84115
(801) 484-8827

DRAWN BY:
BRJ

Generalized Profile Along A-A'

Laboratory Summary Sheet

Sheet 1 of 1

Borehole	Approx. Depth	Liquid Limit	Plastic Limit	Plasticity Index	Qu (tsf)	%<#200 Sieve	Est. Specific Gravity	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
B1	Grade							6			
B1	2.5	58	18	40				6			
B1	5.0					76.3%		11			
B1	7.5							9			
B1	10.0					79.4%		13			
B1	12.5					83.7%	2.65	19	97	73%	0.70
B1	15.0					83.1%		11			
B2	2.5							0			
B2	5.0					64.8%	2.65	19	109	97%	0.51
B2	7.5							13			
B2	10.0	66	30	36				16			
B2	15.0					75.2%		11			
B2	20.0					61.8%		11			
B2	25.0	62	28	34				13			
B2	30.0					61.1%		13			
B3	2.5							6			
B3	5.0					68.6%		8			
B3	10.0					72.0%		10			
B3	15.0					65.4%	2.65	22	97	82%	0.70
B3	20.0					69.5%		11			
B3	25.0							12			
B3	30.0						2.65	17	105	80%	0.58
B4	Grade					87.0%		6			
B4	2.5							9			
B4	5.0							13			
B4	7.5					80.0%	2.65	22	97	81%	0.70
B4	10.0					82.0%		13			
B4	15.0						2.65	19	107	89%	0.55
B4	20.0					67.7%		13			
B4	25.0					69.8%	2.65	22	104	97%	0.60
B5	2.5						2.65	6	95	20%	0.74
B5	5.0							16			
B5	7.5						2.65	16	99	64%	0.67
B5	10.0	58	25	33				21			
B5	15.0						2.65	16	106	75%	0.56
B5	20.0							18			
B5	25.0						2.65	19	87	55%	0.89
B5	30.0	69	27	42				23			



Professional Service Industries
2779 South 600 West
Salt Lake City, UT 84115
Telephone: (801) 484-8827
Fax: (801) 487-3312

Summary of Laboratory Results

PSI Job No.: 07061856
Project: Caliber Collision
Location: SE Lot of Riverside and Foremaster Dr
Saint George, Utah

Laboratory Summary Sheet

Sheet 1 of 1

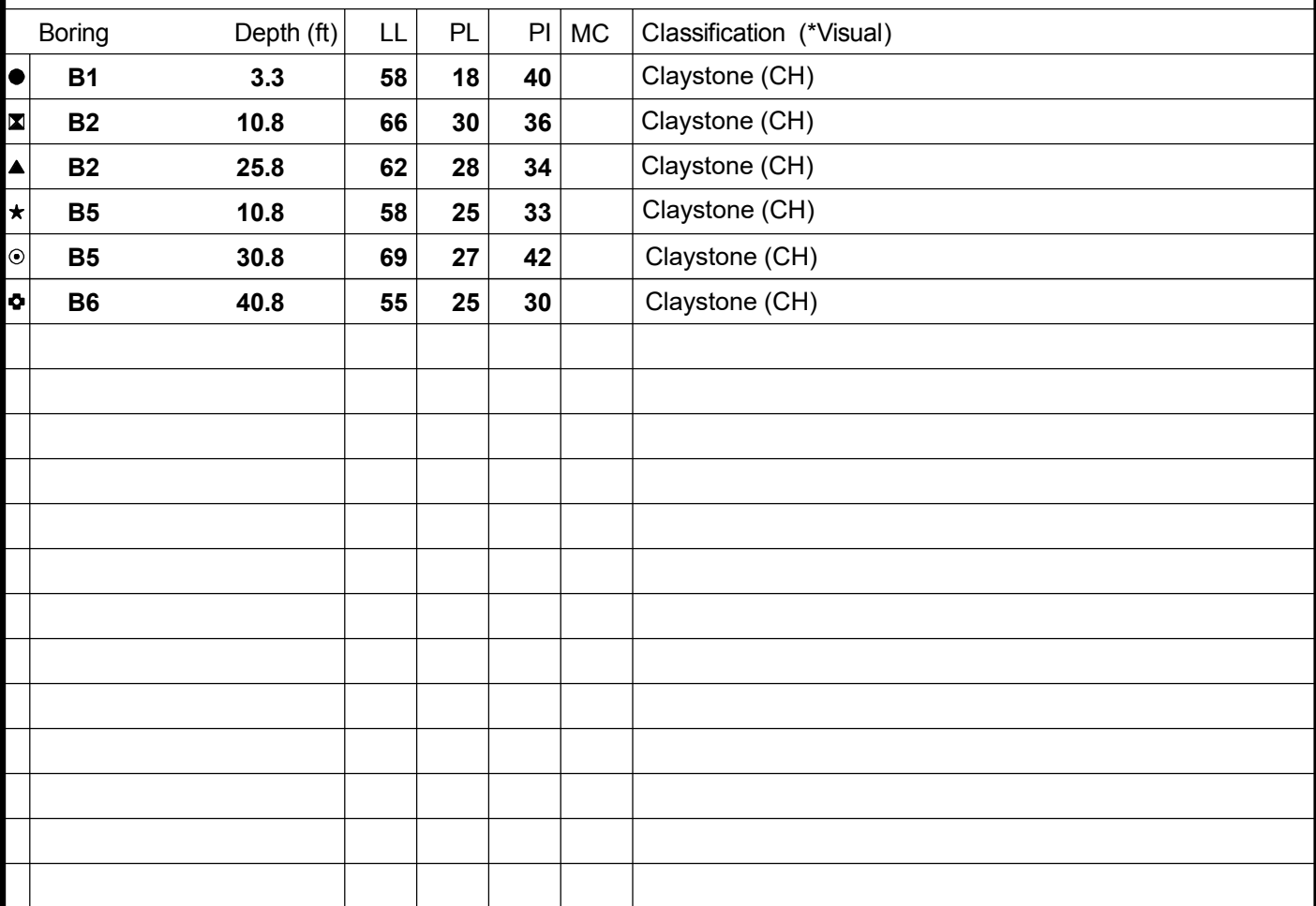
Borehole	Approx. Depth	Liquid Limit	Plastic Limit	Plasticity Index	Qu (tsf)	%<#200 Sieve	Est. Specific Gravity	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
B6	4.0						2.65	11	101	45%	0.64
B6	7.5							7			
B6	10.0						2.65	5	111	29%	0.49
B6	15.0							12			
B6	20.0						2.65	12	108	59%	0.53
B6	25.0										
B6	28.0				3.36			12			
B6	32.5				1.37			13			
B6	35.0							12			
B6	40.0	55	25	30				15			
B6	45.0						2.65	12	101	51%	0.64
B6	50.0						2.65	10	110	51%	0.51
B7	2.5					86.9%		9			
B7	5.0							9			
B8	5.0						2.65	20	91	64%	0.81
B8	10.0							17			
B8	15.0						2.65	21	95	74%	0.74



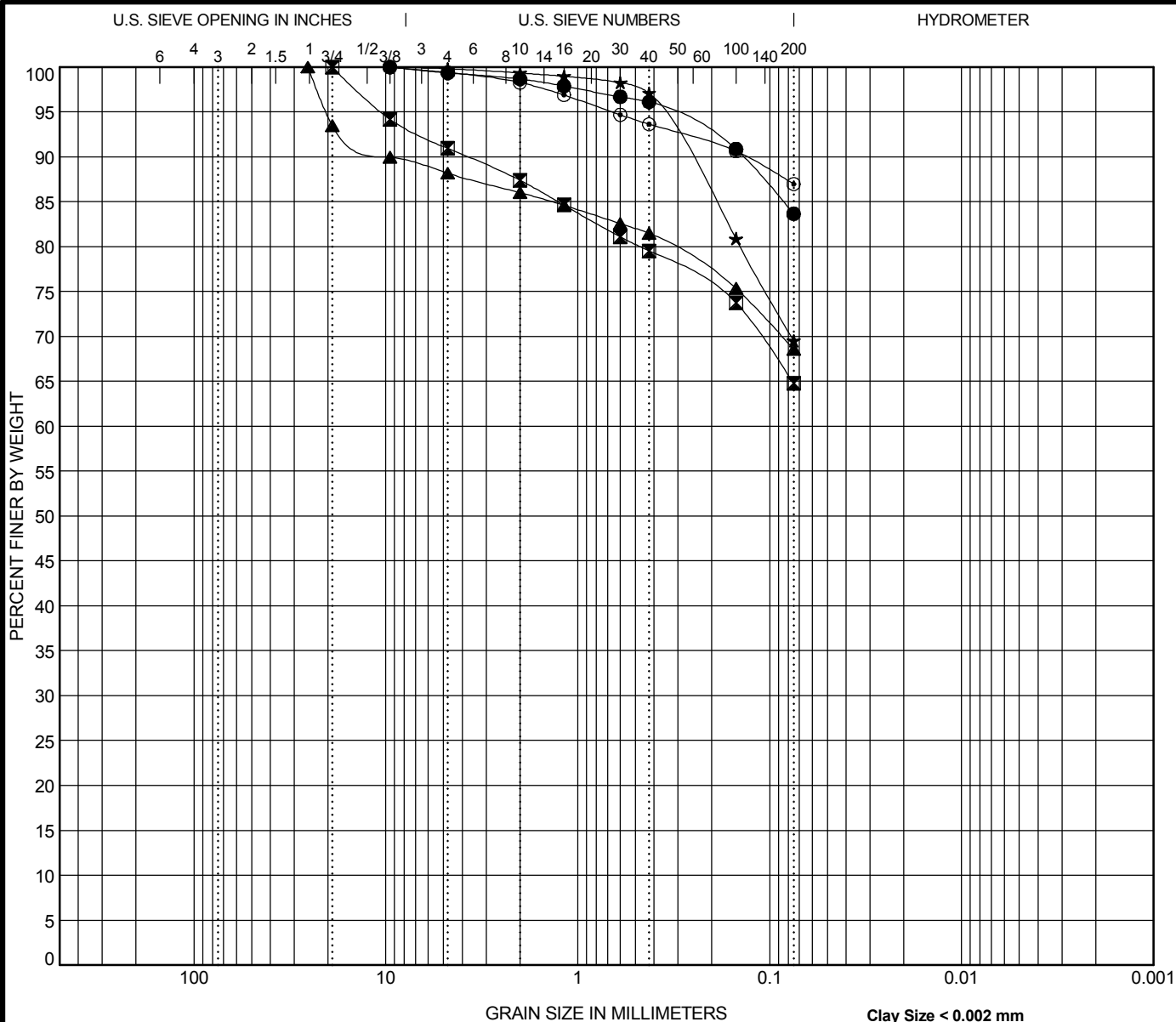
Professional Service Industries
2779 South 600 West
Salt Lake City, UT 84115
Telephone: (801) 484-8827
Fax: (801) 487-3312

Summary of Laboratory Results

PSI Job No.: 07061856
Project: Caliber Collision
Location: SE Lot of Riverside and Foremaster Dr
Saint George, Utah



PSI Job No.: 07061856
Project: Caliber Collision
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Saint George, Utah



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	B1	13.0	Claystone (Fat CLAY with Sand)							
⊗	B2	5.8	Claystone (Sandy Fat CLAY)							
▲	B3	5.8	Claystone (Sandy Fat CLAY)							
★	B3	20.8	Claystone (Sandy Fat CLAY)							
⊙	B4	0.8	Claystone (Fat CLAY with Sand)							
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B1	13.0	9.525				0.7	15.7	83.7	
⊗	B2	5.8	19.05				9.1	26.2	64.8	
▲	B3	5.8	25.4				11.8	19.6	68.6	
★	B3	20.8	9.525				0.2	30.3	69.5	
⊙	B4	0.8	9.525				0.6	12.4	87.0	

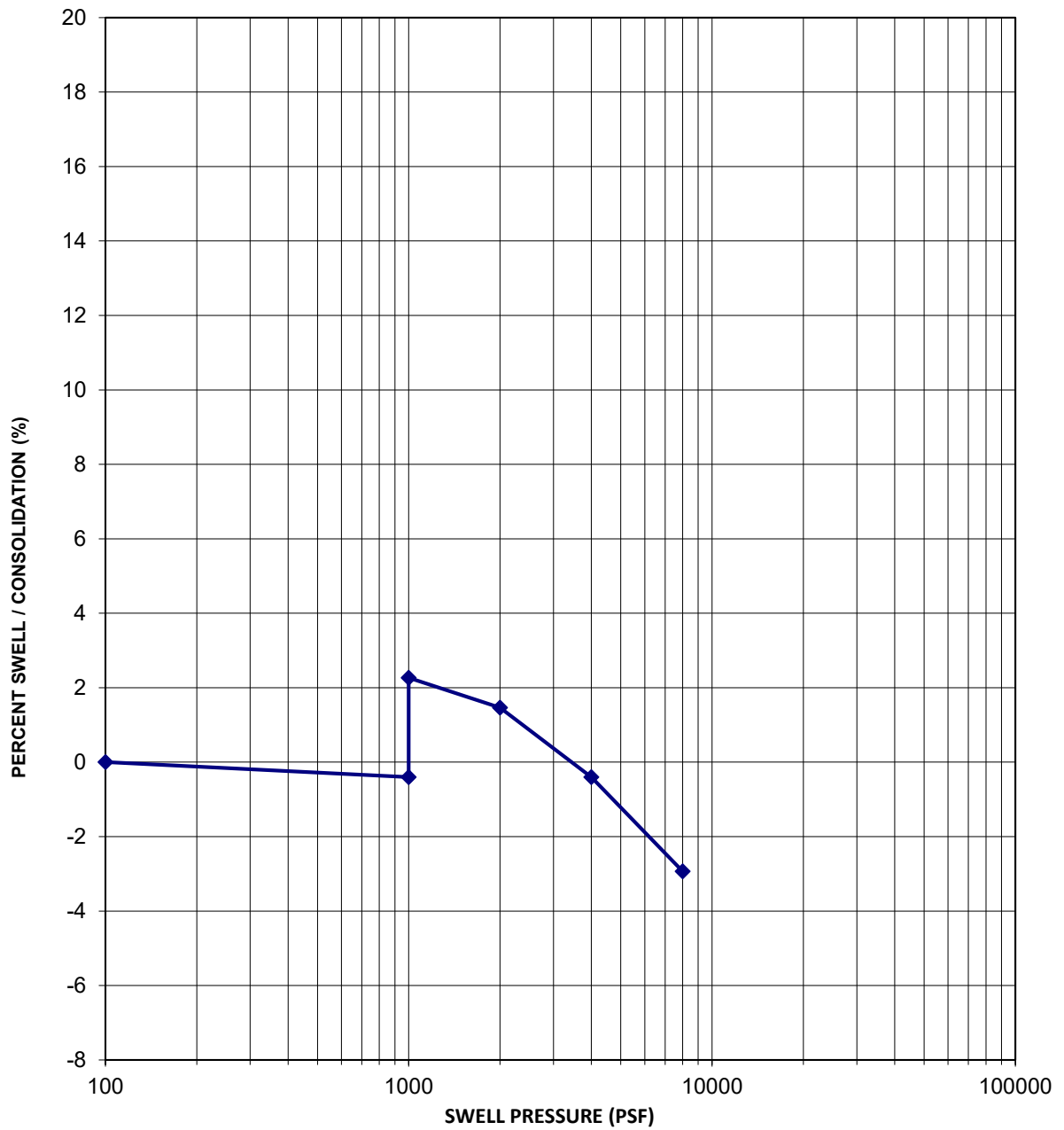


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GRAIN SIZE DISTRIBUTION

Project: Caliber Collision
 PSI Job No.: 07061856
 Location: SE Lot of Riverside and Foremaster Dr
 Saint George, Utah

SWELL-CONSOLIDATION TEST



Sample Location	B1
Sample Depth	12.5 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	97 pcf
In-Situ Moisture Content	19.1 %
Volume Change	2.7 %
Swell Pressure	4,000 psf

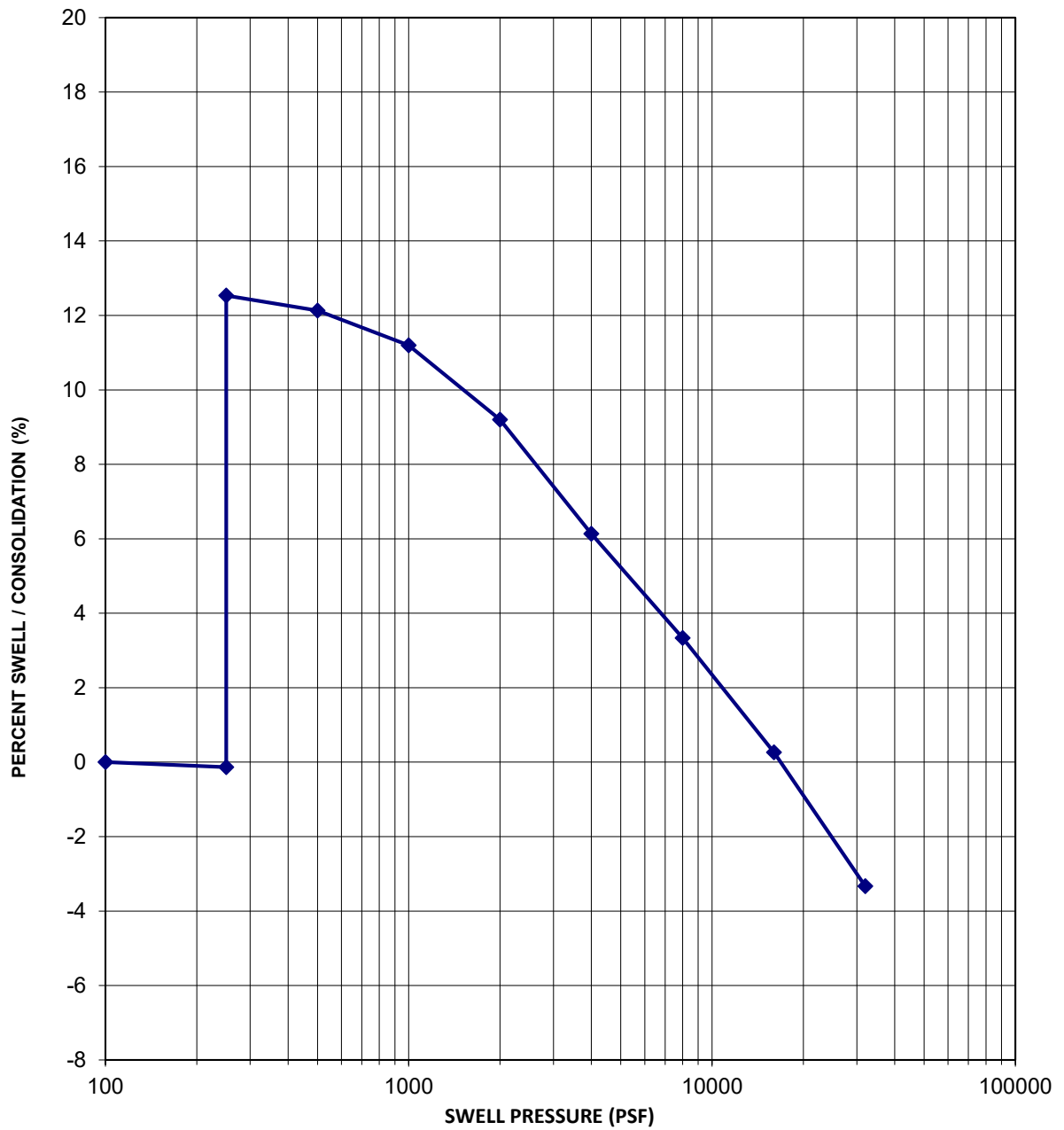


Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B2
Sample Depth	5 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	109 pcf
In-Situ Moisture Content	18.8 %
Volume Change	12.7 %
Swell Pressure	17,300 psf



Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B3
Sample Depth	15 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	97 pcf
In-Situ Moisture Content	21.6 %
Volume Change	8.9 %
Swell Pressure	6,800 psf

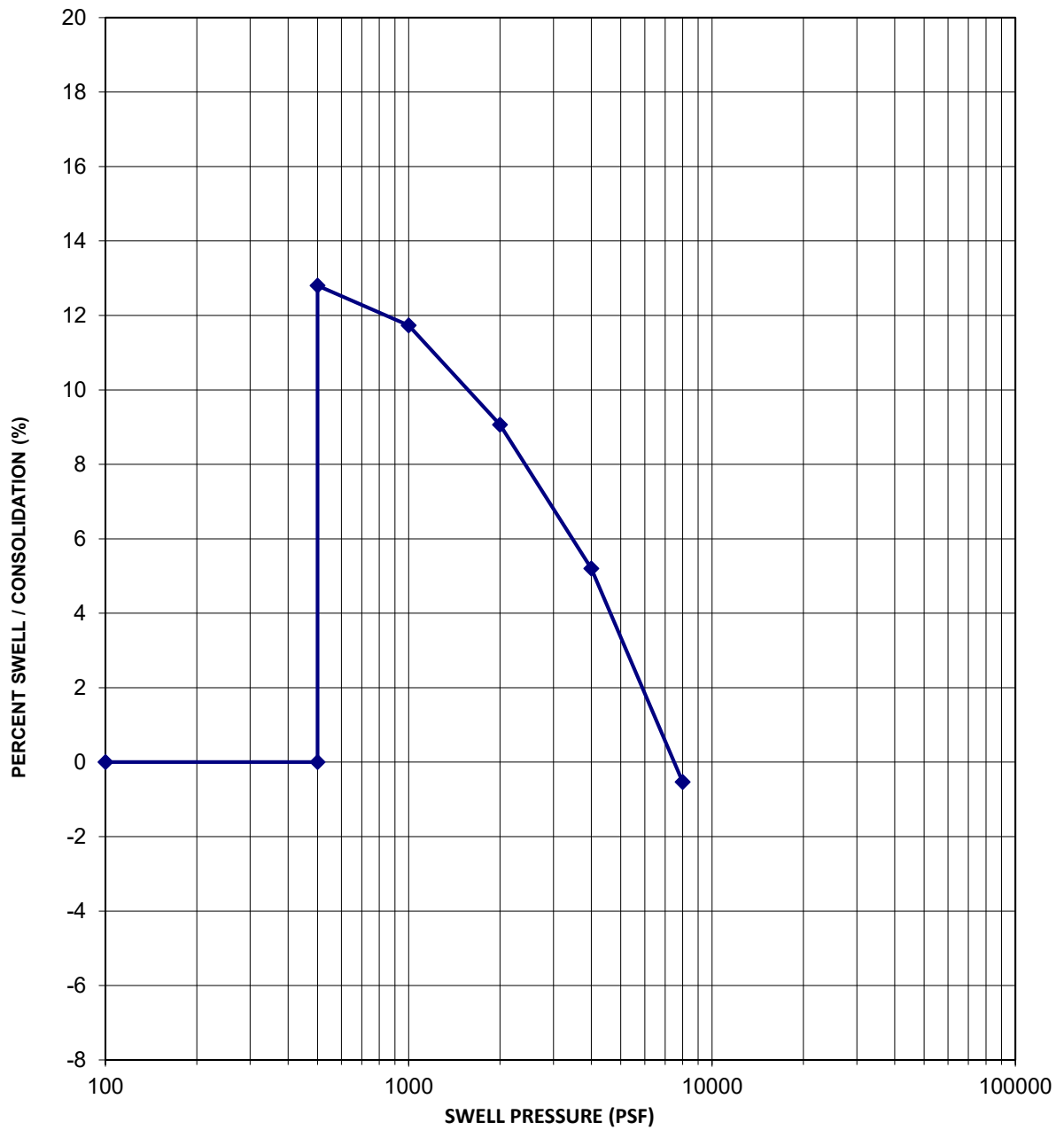


Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B3
Sample Depth	30 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	105 pcf
In-Situ Moisture Content	17.3 %
Volume Change	12.8 %
Swell Pressure	7,500 psf

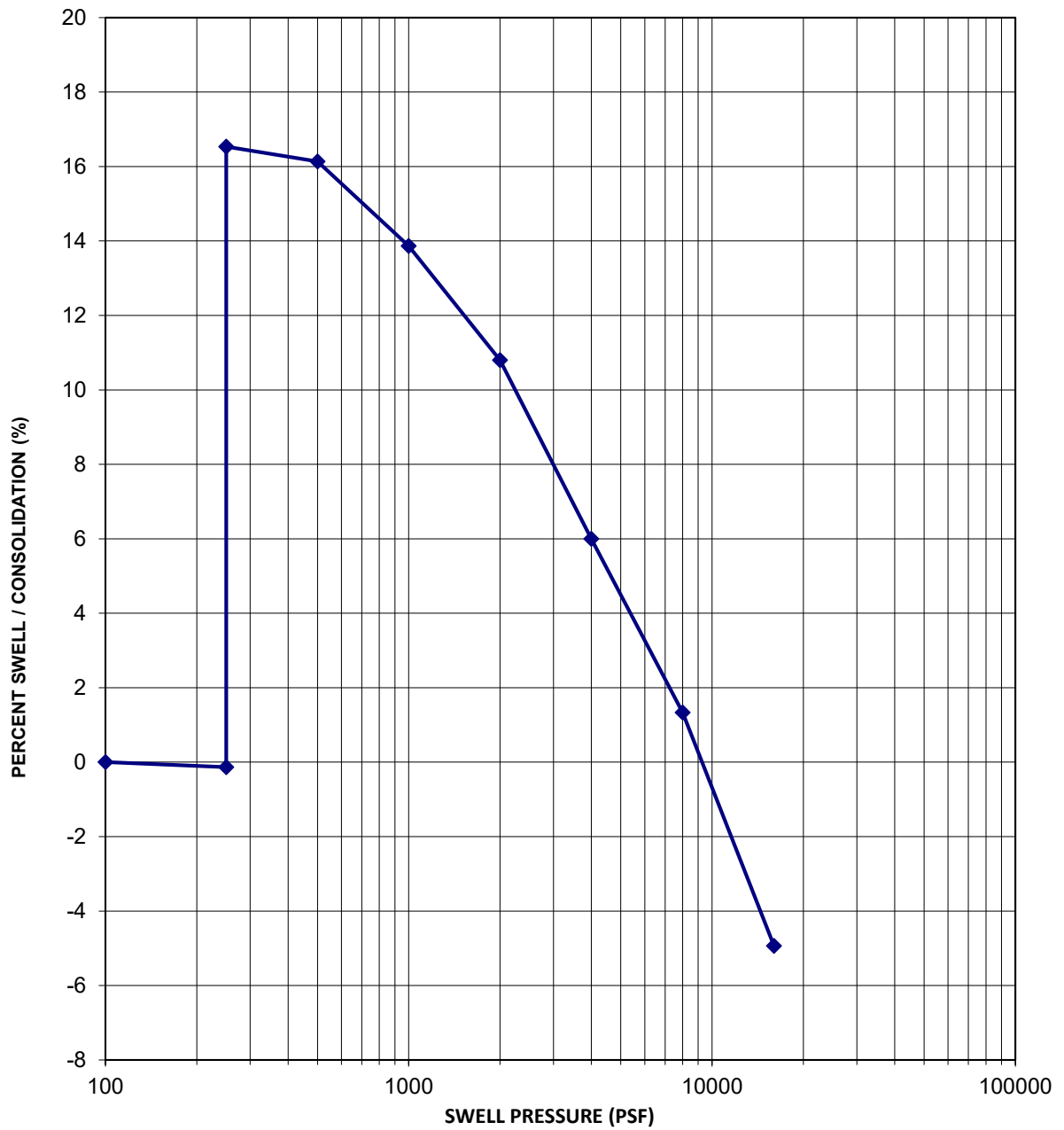


Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B4
Sample Depth	7.5 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	97 pcf
In-Situ Moisture Content	21.5 %
Volume Change	16.7 %
Swell Pressure	9,400 psf



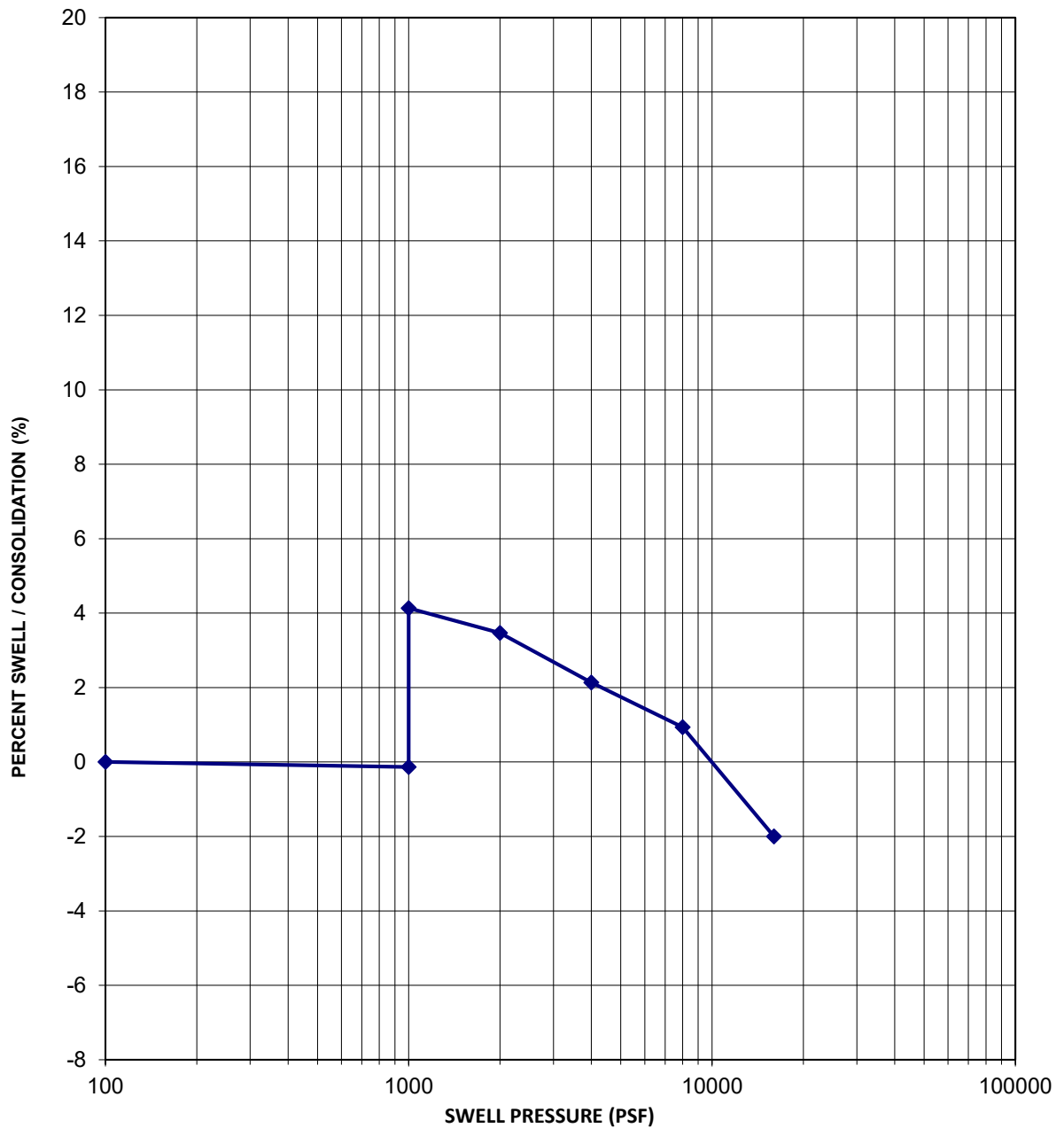
Caliber Collision - Saint George

JOB NO.

07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B4
Sample Depth	15 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	107 pcf
In-Situ Moisture Content	18.5 %
Volume Change	4.3 %
Swell Pressure	10,300 psf

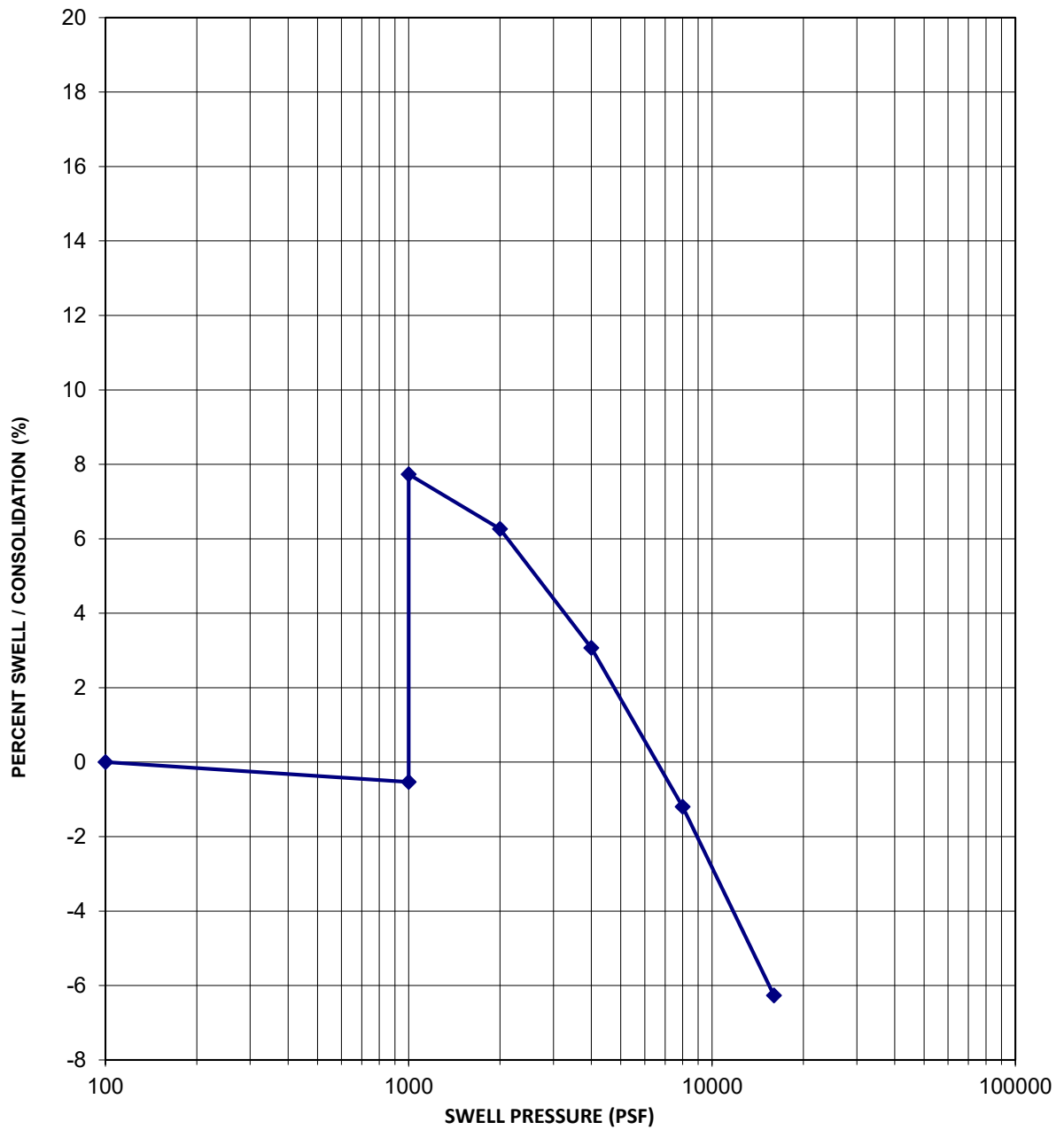


Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

SWELL-CONSOLIDATION TEST



Sample Location	B4
Sample Depth	25 feet
Sample Description	Claystone
USCS Classification	CH

Dry Density	104 pcf
In-Situ Moisture Content	21.9 %
Volume Change	8.3 %
Swell Pressure	7,200 psf



Caliber Collision - Saint George

JOB NO. 07061856

SWELL - CONSOLIDATION TEST

NOTICE OF MEETING
HILLSIDE REVIEW BOARD
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH

Public Notice

Notice is hereby given that the Hillside Review Board of the City of St. George, Washington County, Utah, will hold meetings at the referenced site on **Wednesday, August 24, 2022**, commencing on-site at approximately 8:30 a.m.

PRESENT:

Chair Sullivan
James Dotson
Russ Owens
Jeff Mathis

EXCUSED:

Dave Black

CITY STAFF:

Assistant Public Works Director, Wes Jenkins
Planner III, Dan Boles
Planner III, Carol Davidson
Development Office Supervisor, Brenda Hatch

Chair Sullivan called the meeting to order.

1. Consider a request for a hillside development permit at the Divario Development. The applicant is requesting that the Hillside Review Board consider the unimprovable open space designated on the Divario land use map to be improvable on PA-1 (Planning Area 1). The property is currently zoned PD-R (Planned Development Residential). The property is generally located south-east of the Gap Canyon Pkwy and 1790 West intersection (*See 'Meeting Place' exhibit below*). The applicant is St. George 730, LLC. Case No. 2022-HS-014.

Rick Rosenberg – This sewer easement goes across the site and serves Las Palmas. The site has been disturbed from the sewer easement down. It's shown as open space on the general plan, they would like to do some improvements on it. It has been previously disturbed like I said. It extends this way down to the next property line and into the next planning area. The slope analysis is in your packet.

James Dotson – What plan improvements were you thinking?

Rick Rosenberg – I don't think there are a lot of improvements, they just want improvable open space.

Dan Boles – The applicant has an approved zoning on this property for a PD. This is open space and we told them they need to keep out of the open space. The one thing that they did show is a trail that will come through here and maybe a corner of a building. Improvable open space can have amenities like trails and things like that. I anticipate seeing an application for an amendment to the approval. They are wanting to do some different architecture, layout their site a little different, more inline as opposed to staggered and that kind of thing. They are still proposing that trail that would come through here.

Rick Rosenberg – Their plan shows a trail on the slope to the east of us then it comes up and across the top and ties back down to Gap Canyon Pkwy. It's on the plan inside the packet.

Russ Owens – So the slope will still remain the same?

Rick Rosenberg – Yeah, I think they've got a building down into here and there are some buildings that come into the edge of it, so you will have buildings here in front of us but as far as the slope goes, there is a sewer easement that goes right up in there that they can't do anything with and the trail kind of loops around the whole thing.

Jeff Mathis – So the trail doesn't fall within the easement?

Rick Rosenberg – No.

Dan Boles – The other thing with the unimprovable vs improvable status is, and Wes correct me if I'm wrong, unimprovable they cannot count as part of density. They can with improvable. That said, they were approved for 500 units in here. Their new plan shows 463 I believe. They haven't made that application yet, but I think they're going to at any time now. Just know that is another aspect of unimprovable vs improvable open space.

Wes Jenkins – Most of these unimprovable were the washes that we looked at in PA-4, there's the one over here on PA-6, the big one Gap Canyon. They were listed as unimprovable for obvious reasons because they had a beautiful and aesthetic value. The applicant wasn't sure how this became unimprovable and not improvable to be allowed to be disturbed with certain things. That is the argument.

Dan Boles – Still to remain open space, but there may be some minor improvements like a trail.

Rod Packer – The actual line of the open size is not going to change, just the designation.

Jeff Mathis – So will there be some landscaping, or will it be this natural with a trail and get rid of the garbage?

Rick Rosenberg – All of the above.

MOTION: Jeff Mathis made a motion to recommend approval of the change from unimprovable open space to improvable open space as listed in the request.

SECOND: Russ Owens
AYES (4)
Chair Sullivan
Jeff Mathis
James Dotson
Russ Owens
NAYS (0)
Motion carries.

2. Consider a request for a hillside development permit at the Divario Development. The applicant is requesting that the Hillside Review Board consider the unimprovable open space designated on the Divario land use map to be improvable on PA-2 (Planning Area 2). The property is currently zoned R-1-10 (Single Family Residential, 10,000 sq ft minimum lot size). PA-2 is generally located south-west of the Gap Canyon Pkwy and 1790 West intersection (*See 'Meeting Place' exhibit below*). The applicant is St. George 730, LLC. Case No. 2022-HS-013.

Rick Rosenberg – It is basically everything from the toe of this slope over to Gap Canyon Pkwy where we were just at. A lot of it has been previously disturbed, there was a gravel pit out here and you can see the remnants of the CATs and some of the earth moving that happened back when Green Valley, when the resort was being developed. That's when this pit was active, it hasn't been active since the 80's except for people dumping out here. Their request is similar to the one on PA-1, it doesn't involve the slope that is right in front of us, this is going to be preserved. Everything at the bottom that is included in the site plan they put together for PA-2 so they would like to go in and do some improvements on that, there is some really steep stuff between PA-3 and there will be some preserved on this top slope and then it will be into PA-2. It's not real well defined. They are proposing to channelize the wash and better define it with some open space around it, so it takes that flood plain and narrows it from about 600 ft down to 150 ft or so, it lets it be reduced. The flood plain was shown as open space FEMA has updated their map since the original development agreement and master plan was done. They would like to continue the channelization that was started down at Tonaquint Center approved up through the property between us and Tonaquint Center by FEMA and the State. They want to extend that up through this canyon the same way.

Wes Jenkins – So if it was left unimprovable you couldn't go in there and do all those improvements and channelize it. If it's changed to improvable then it allows you to go in and channel and so forth and still leave it open space but do some improvements.

Rick Rosenberg – It's really important for the bridge. Gap Canyon Parkway crosses it, where that power pole is, there is a well right there. Gap Canyon Parkway is just beyond that, and it crosses the Gap Wash. It takes the bridge from a 600 ft span down to 4- or 5-barrel box culverts like you see on Dixie Drive coming out here. But we have to be able to do the improvements to be able to do that.

Chair Sullivan – Once again we are not changing the boundaries of the open space, we're just changing the designation of it.

MOTION: James Dotson made a motion to change the open space from unimprovable to improvable on Item 2.

SECOND: Jeff Mathis

AYES (4)

Chair Sullivan

Jeff Mathis

James Dotson

Russ Owens

NAYS (0)

Motion carries.

3. Consider a request for a hillside development permit to adjust the location of the ridgeline and ridgeline setback on lot 89 of the South Rim at Foremaster Ridge Phase 4 subdivision in anticipation of the construction of a residential home. The property is generally located at 1751 Ridgeline Circle and is currently zoned Single Family Residential, minimum lot size 10,000 sf (R-1-10). The applicant is MG Homes, LLC, Carl Ford. Case No. 2022-HS-015.

Mike Gubler – Our thoughts are that this point represents the ridgeline more than this point here. It keeps us more inline with these two corner property lines. In all of these back in here which really pinches our house to get our entrance way, our living room and a back deck that is going to look over here. We have really tried to squeeze it as skinny as we can, but I think this represents more what the ridgeline is. We are proposing that we draw a straight line from that property corner to that property corner.

Discussion on where the property corners are located.

Scott Woolsey – The way this was originally done, we just kind of surveyed the top of it and we determined the boundary and that is how we divided that out. We didn't do really precise, this little part of it could have easily been moved out. That is why the boundary was done the way it was.

Jeff Mathis – So we are talking the setback line, a 30-foot setback from this line?

Mike Gubler – Correct.

Wes Jenkins – Within that 30-feet you can't have a structure which would be a retaining wall, a privacy wall or a house.

Jeff Mathis – So they could slope it out, but they can't do a retaining wall?

Mike Gubler – We actually need a deck so we can see that beautiful view. We would have some pillars for a deck, if we can't have that then the house isn't worth building.

Chair Sullivan – Looking up from the bottom I was looking at the big rocks. It seems a lot more obvious from down there then it does up here.

Russ Owens – Are you going to have a rock wall up here?

Mike Gubler – No, I understand that I can't have a rock wall. We're just going to have landscape up through here and up to the house.

Discussion continued on walls.

James Dotson – How close to grade is this here to what the walkout is?

Mike Gubler – This would be my yard right here.

James Dotson – So if it was fill, it's not going to be 10 ft up from here? Which is great.

Russ Owens – So basically, you really won't past here other than the landscape with the grade, it's just your setback for the building.

Mike Gubler – And it's just this pinch corner too. I'm curved on the front, so my house has to come back because of the curve on the front.

Jeff Mathis – On this one Scott you are showing going to the very next property corner with a straight line, but you're anticipating it was going to the actual property corner of this lot. So, are we talking the next angle point over on the next lot or are we talking your lot corner?

Mike Gubler – My lot corner.

Chair Sullivan – So basically we are taking this angle point out and there is still going to be an angle point in the ridgeline setback right there.

Discussion on the lines shown on the presentation and the property corners.

Jeff Mathis – I'm inclined to believe it does meet the ridgeline setback, but again I want to see the straight line from lot 89 property corner to property corner and not extend that line out to the next one over.

Mike Gubler – Yes, I don't think that was the intention.

Discussion on the fact that the property line isn't moving just the ridgeline where the setback is measured from.

Jeff Mathis – I guess we are moving it 10 ft.

Wes Jenkins – What sticks out further the deck or the house?

Mike Gubler – It's the same.

Wes Jenkins – You could cantilever the deck 4 ft into that setback, but your columns couldn't be in the setback.

Discussion on whether the deck can cantilever into the setback.

Dan Boles – So no cantilever.

MOTION: Jeff Mathis made a motion to approve moving the setback line, the ridgeline, the 30 ft setback line on the back property line which would be like the northwest line of lot 89 to continue between the two north westerly corners of lot 89. So a straight line between the two corners on the edge and allow them to do a 30 ft setback from that line.
SECOND: James Dotson
AYES (4)
Chair Sullivan
Jeff Mathis
James Dotson
Russ Owens
NAYS (0)
Motion carries.

4. Consider approval of the meeting minutes from August 3, 2022.

MOTION: Russ Owens made a motion to approve the minutes.
SECOND: James Dotson
AYES (4)
Chair Sullivan
Jeff Mathis
James Dotson
Russ Owens
NAYS (0)
Motion carries.

5. Jeff Mathis made a motion to adjourn.