ENT 64897:2023 PG 1 of 48
ANDREA ALLEN
UTAH COUNTY RECORDER
2023 Oct 2 01:19 PM FEE 40.00 BY AR
RECORDED FOR AMERICAN FORK CITY

When Recorded Mail To:
American Fork City
51 East Main
American Fork UT 84003

NOTICE OF INTEREST, BUILDING REQUIREMENTS, AND ESTABLISHMENT OF RESTRICTIVE COVENANTS

This Notice is recorded to bind the attached Geotechnical Study dated OCT. 26. 2018 along with the site grading plan to the property generally located at 6820 W. 7533 N (address), American Fork, UT 84003 and therefore mandating that all construction be in compliance with said Geotechnical Study and site grading plan per the requirements of American Fork City ordinances and standards and specification including specifically Ordinance 07-10-47, Section 6-5, Restrictive Covenant Required and 6-2-4, Liquefiable Soils. Said Sections require establishment of a restrictive covenant and notice to property owners of liquefiable soils or other unique soil conditions and construction methods associated with the property.

Exhibit A – Legal Description of Property
Exhibit B – Geotechnical Study
Exhibit C – Site Grading Plan

Dated this 18TH day of SEPTEMBER, 2023.

OWNER(S):

(Signature)	(Signature)
Jacob M Horan (Printed Name)	(Printed Name)
Manager (Title)	(Title)

STATE OF UTAH)
§
COUNTY OF Utah)

On the 18th day of September, 2023, personally appeared before me Jacob M Horan and —, Owner(s) of said Property, as (individuals and/or authorized representatives of a company), and acknowledged to me that such individuals or company executed the within instrument freely of their own volition and pursuant to the articles of organization where applicable.

TIFFANIE S MACE
NOTARY PUBLIC·STATE OF UTAH
My Commission Expires January 25, 2027
COMMISSION NUMBER 728987

Notary Public
My Commission Expires: January 25, 2027

EXHIBIT A – LEGAL DESCRIPTION

AF PD

BEGINNING AT A POINT LOCATED SOUTH 98.97 FEET AND WEST 620.35 FEET FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST, SALT LAKE BASE AND MERIDIAN; THENCE NORTH 65°08'00" WEST 73.40 FEET; THENCE ALONG THE ARC OF A 15.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 18.90 FEET (CURVE HAVING A CENTRAL ANGLE OF 72°12'34" AND LONG CHORD BEARS N29°04'05"W 17.68 FEET); THENCE NORTH 89°37'30" WEST 80.63 FEET; THENCE ALONG THE ARC OF A 564.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 151.36 FEET (CURVE HAVING A CENTRAL ANGLE OF 15°22'34" AND LONG CHORD BEARS S15°43'14"W 150.91 FEET); THENCE NORTH 65°08'03" WEST 124.96 FEET; THENCE NORTH 01°02'00" EAST 53.18 FEET; THENCE NORTH 89°57'21" WEST 3.43 FEET; THENCE NORTH 01°03'29" EAST 709.52 FEET; THENCE SOUTH 89°01'53" EAST 368.90 FEET; THENCE SOUTH 01°00'26" WEST 401.56 FEET; THENCE NORTH 89°59'55" EAST 28.02 FEET; THENCE SOUTH 209.99 FEET; THENCE SOUTH 89°59'26" EAST 60.00 FEET; THENCE NORTH 210.00 FEET; THENCE NORTH 89°59'55" EAST 14.18 FEET; THENCE SOUTH 00°57'46" WEST 191.44 FEET; THENCE ALONG THE ARC OF 243.00 FOOT RADIUS CURVE TO THE RIGHT A DISTANCE OF 28.63 FEET (CURVE HAVING A CENTRAL ANGLE OF 06°45'04" AND LONG CHORD BEARS S04°20'19"W 28.62 FEET); THENCE NORTH 84°19'13" WEST 111.29 FEET; THENCE SOUTH 25°49'32" WEST 111.15 FEET;TO THE POINT OF BEGINNING. AREA = 274,166 SF OR 6.29 ACRES BASIS OF BEARING IS NORTH 89°52'20" EAST ALONG SECTION LINE FROM THE SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST, SALT LAKE AND MERIDIAN, TO THE SOUTHEAST CORNER OF SAID SECTION 22. (NAD 83) NUMBER OF LOTS 22 NUMBER OF PARCELS 3

COMMENCING WEST 8.03 CHAINS ALONG SECTION LINE FROM SOUTH QUARTER CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST, SALT LAKE MERIDIAN; THENCE EAST 60 FEET; THENCE NORTH 210 FEET; THENCE WEST 60 FEET; THENCE SOUTH 210 FEET TO THE POINT OF BEGINNING.

1497 West 40 South
Lindon, Utah - 84042
Phone (801) 225-5711

840 West 1700 South #10
Salt Lake City, Utah - 84104
Phone (801) 787-9138

1596 W. 2650 S. #108
Ogden, Utah - 84401
Phone (801) 399-9516

Geotechnical Study
AF PD
Penrod Properties
6820 West 7333 North
American Fork, Utah

Project No. 189047

October 26, 2018

Prepared For:

AFPD, LLC
Attention: Ms. Ginger Romriell
555 South State Street, #300
Orem, UT 84057

Prepared By:

EARTHTEC ENGINEERING
Lindon Office

CERTIFICATE

I hereby certify that I am a licensed professional engineer, as defined in the "Sensitive Lands Ordinance" Section of American Fork City Ordinances. I have examined this report to which this certificate is attached and the information and conclusions contained therein are, without any reasonable reservation not stated therein, accurate and complete. Procedures and tests used in this report meet minimum applicable professional standards.

PROFESSIONAL ENGINEER
#10183430-2202
CALEB RICHARD
ALLRED
Electronically generated on
10/26/2018
STATE OF UTAH

Caleb R. Allred, P.E.
Project Engineer

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No. 1 VICINITY MAP
No. 2 AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS
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Timpview Analytical Labs
USGS Seismic Printouts

1.0 EXECUTIVE SUMMARY

This entire report presents the results of Earthtec Engineering's completed geotechnical study for the Penrod Properties in American Fork, Utah. This executive summary provides a general synopsis of our recommendations and findings. Details of our findings, conclusions, and recommendations are provided within the body of this report.

- The subject property is approximately 10½ acres and is proposed to be developed with the construction of apartment buildings and townhomes. The proposed structures will consist of conventionally framed and two- to three-story, slab-on-grade buildings. We anticipate foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing walls, 40,000 pounds for column loads, and 100 pounds per square foot for floor slabs. (see Section 3)
- Our field exploration included the boring of one (1) boring and test pits to a depth of 31½ feet below the existing ground surface and the excavation of three (3) test pits to depths of 6 feet below the existing ground surface. Groundwater was encountered at depths of approximately 2 to 3½ feet below the existing ground surface. (see Section 5)
- The native clay and silt soils have a slight to moderate potential for collapse (settlement) and a slight to moderate potential for compressibility under increased moisture contents and anticipated load conditions. (see Section 6)
- The subsurface soils encountered generally consisted of topsoil overlying near-surface very soft to very stiff clay and silt. All topsoil should be removed beneath the entire building footprints, exterior flatwork, and pavements prior to construction. (see Section 7)
- The silt layers between depths of 25 to 25 feet have a "High" potential for liquefaction during a moderate to large earthquake event; should this layer liquefy, we estimate that up to one inch of liquefaction-induced settlement and up to one-half feet of liquefaction-induced lateral movements could occur. (see Section 9)
- Conventional strip and spread footings may be used to support the structure, with foundations placed entirely on a minimum of 24 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. (see Section 10)
- Minimum pavement section consists of 3 inches of asphalt over 12 inches of road-base. Areas that are soft or deflect under construction traffic should be removed and replaced with granular material or structural fill. (see Section 13)

Based on the results of our field exploration, laboratory testing, and engineering analyses, it is our opinion that the subject site may be suitable for the proposed development, provided the recommendations presented in this report are followed and implemented during design and construction.

Failure to consult with Earthtec Engineering (Earthtec) regarding any changes made during design and/or construction of the project from those discussed herein relieves Earthtec from any liability arising from changed conditions at the site. We also strongly recommend that Earthtec observes the building excavations to verify the adequacy of our recommendations presented herein, and that Earthtec performs materials testing and special inspections for this project to provide continuity during construction.

2.0 INTRODUCTION

The project is located at approximately 6820 West 7333 North in American Fork, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map* and Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*, at the end of this report. The purposes of this study are to:

- Evaluate the subsurface soil conditions at the site,
- Assess the engineering characteristics of the subsurface soils, and
- Provide geotechnical recommendations for general site grading and the design and construction of foundations, concrete floor slabs, miscellaneous concrete flatwork, and asphalt paved residential streets.

The scope of work completed for this study included field reconnaissance, subsurface exploration, field and laboratory soil testing, geotechnical engineering analysis, and the preparation of this report.

3.0 PROPOSED CONSTRUCTION

We understand that the proposed project, as described to us by Ms. Ginger Romriell with AF PD LLC, consists of developing the approximately 10½ acre existing parcel with apartment buildings and townhomes. The proposed structures will consist of conventionally framed and two- to three-story, slab-on-grade buildings. We have based our recommendations in this report that the anticipated foundation loads for the proposed structures will not exceed 5,000 pounds per linear foot for bearing walls, 40,000 pounds for column loads, and 100 pounds per square foot for floor slabs. If structural loads will be greater Earthtec should be notified so that we may review our recommendations and make modifications, if necessary.

In addition to the construction described above, we anticipate that

- Utilities will be installed to service the proposed buildings,
- Exterior concrete flatwork will be placed in the form of curb, gutter, and sidewalks, and
- Asphalt paved residential streets will be constructed.

4.0 GENERAL SITE DESCRIPTION

4.1 Site Description

At the time of our subsurface exploration the site was a partially developed lot with a single house located near the center of the site and several outbuildings near the north end of the site with empty fields to the north, south, and west. The ground surface appears to be relatively flat, we anticipate less than 3 feet of cut and fill may be required for site grading. The lot was bounded on all sides by agricultural fields and residential houses.

4.2 Geologic Setting

The subject property is located in the central portion of Utah Valley near the eastern shore of Utah Lake. Utah Valley is a deep, sediment-filled basin that is part of the Basin and Range Physiographic Province. The valley was formed by extensional tectonic processes during the Tertiary and Quaternary geologic time periods. The valley is bordered by the Wasatch Mountain Range on the east and the Lake Mountains on the west. Much of northwestern Utah, including Utah Valley, was previously covered by the Pleistocene age Lake Bonneville. Utah Lake, which currently covers much of the western portion of the valley, is a remnant of this ancient fresh water lake. The surficial geology of much of the eastern margin of the valley has been mapped by Constenius, 20111. The surficial geology at the location of the subject site and adjacent properties is mapped as Fine-grained lacustrine deposits (Map Unit Qlf) dated to upper Pleistocene. These soil or deposits are generally described in the referenced mapping as Silt and clay with some fine-grained sand.

5.0 SUBSURFACE EXPLORATION

5.1 Soil Exploration

Under the direction of a qualified member of our geotechnical staff, subsurface explorations were conducted at the site on October 5, 2018 and October 8, 2018 by the boring of one (1) boring to a depth of 31½ feet below the existing ground surface and the excavation of three (3) test pits to depths of 6 feet below the existing ground surface using an all-terrain hydraulic drill rig and a mini-excavator, respectively. The approximate locations of the boring and test pits are shown on Figure No. 2, *Aerial Photograph Showing Location of Boring and Test Pits*. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 6, *Boring and Test Pit Log* at the end of this report. The stratification lines shown on the logs represent the approximate boundary between soil units; the actual transition may be gradual. Due to potential natural variations inherent in soil deposits, care should be taken in interpolating between and extrapolating beyond exploration points. A key to the symbols and terms on the logs is presented on Figure No. 7, *Legend*.

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[1] Constenius, K.N., Clark, D.L., King, J.K., Ehler, J.B., 2011, Interim Geologic Map of the Provo Quadrangle, Utah, Wasatch and Salt Lake Counties, Utah; U.S. Geological Survey, Open-File 586DM, Scale 1: 62,500.

Samples of the subsurface soils were collected in the borings at depth intervals of approximately 2½ to 5 feet. Relatively undisturbed samples were collected by pushing thin-walled "Shelby" tubes into undisturbed soils below the augers. Disturbed samples were collected with a 1⅜ inch inside diameter split spoon sampler. The split spoon sampler was driven 18 inches into undisturbed soil with a 140-pound hammer free-falling through a distance of 30 inches. The blows required to drive the sampler through the final 12 inches of penetration is called the "N-value" or "blow count," and is recorded as "blows per foot" on the attached boring logs at the respective sample depths. The blow count provides a reasonable indication of the in-place relative density of sandy soils but provides only a limited indication of the relative stiffness of cohesive (clayey) materials, since the penetration resistance for these soils is a function of the moisture content.

Disturbed bag samples and relatively undisturbed block samples were collected at various depths in each test pit.

The soil samples collected were classified by visual examination in the field following the guidelines of the Unified Soil Classification System (USCS). The samples were transported to our Lindon, Utah laboratory where they will be retained for 30 days following the date of this report and then discarded, unless a written request for additional holding time is received prior to the 30-day limit.

6.0 LABORATORY TESTING

Representative soil samples collected during our field exploration were tested in the laboratory to assess pertinent engineering properties and to aid in refining field classifications, if needed. Tests performed included natural moisture content, dry density tests, liquid and plastic limits determinations, mechanical (partial) gradation analyses, and one-dimensional consolidation tests. The table below summarizes the laboratory test results, which are also included on the attached *Boring and Test Pit Logs* at the respective sample depths, on Figure Nos. 8 through 11, *Consolidation-Swell Test*.

Table 1: Laboratory Test Results

Boring and Test Pit No.	Depth (ft.)	Natural Moisture (%)	Natural Dry Density (pcf)	Atterberg Limits		Grain Size Distribution (%)			Soil Type
				Liquid Limit	Plasticity Index	Gravel (+ #4)	Sand	Silt/Clay (- #200)	
B-1	2½	26	99	33	11	16	10	74	CL
B-1	20	21	—	21	1	0	16	84	ML
B-1	25	44	—	44	20	1	3	96	CL
TP-1	3	32	—	—	—	3	7	90	CL
TP-1	5	30	92	35	11	8	7	85	CL
TP-2	2	52	69	52	20	3	20	77	MH
TP-3	5	33	91	35	13	4	8	88	CL

As part of the consolidation test procedure, water was added to the samples to assess moisture sensitivity when the samples were loaded to an equivalent pressure of approximately 1,000 psf. The native clay and silt soils have a slight to moderate potential for collapse (settlement) and a slight to moderate potential for compressibility under increased moisture contents and anticipated load conditions.

A water-soluble sulfate test was performed on a representative sample obtained during our field exploration. The water-soluble sulfate testing indicated a value of 277 parts per million. Based on this result, the risk of sulfate attack to concrete appears to be "moderate" according to American Concrete Institute standards. Therefore, we recommend that Type II Portland cement be used for concrete in contact with on-site soils. The results can be found in Appendix A.

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered topsoil which is estimated to extend about one foot in depth at the boring and test pit locations. Below the fill we encountered layers of clay and silt extending to a depth of 31½ feet below the existing ground surface. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 6, *Boring and Test Pit Log* at the end of this report. Based on the blow counts obtained and our experience and observations during field exploration, the clay and silt soils ranged from very soft to very stiff in consistency. Variation in topsoil and even fill depths may occur at the site.

7.2 Groundwater Conditions

Groundwater was encountered at depths of approximately 2 to 3½ feet below the existing ground surface. Note that groundwater levels will fluctuate in response to the season, precipitation, snow melt, irrigation, and other on and off-site influences. Quantifying these fluctuations would require long term monitoring, which is beyond the scope of this study. The contractor should be prepared to dewater excavations as needed.

8.0 SITE GRADING

8.1 General Site Grading

All surface vegetation and unsuitable soils (such as topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, collapsible, and any other inapt materials) should be removed from below foundations, floor slabs, exterior concrete flatwork, and pavement areas. We encountered topsoil on the surface of the site. The topsoil (including soil with roots larger than about ¼ inch in diameter) should be completely removed, even if found to extend deeper, along with any other unsuitable soils that may be encountered. Over-excavations below footings and slabs also may be needed, as discussed in Section 10.0.

Fill placed over large areas, even if only a few feet in depth, can cause consolidation in the underlying native soils resulting in settlement of the fill. Because the site is relatively flat, we anticipate that less than 3 feet of grading fill will be placed. If more than 3 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may provide additional recommendations, if required. Such recommendations will likely include placing the fill several weeks (or possibly more) prior to construction to allow settlement to occur.

8.2 Temporary Excavations

Temporary excavations that are less than 4 feet in depth and above groundwater should have side slopes no steeper than ½H:1V (Horizontal:Vertical). Temporary excavations where water is encountered in the upper 4 feet or that extend deeper than 4 feet below site grades should be sloped or braced in accordance with OSHA[2] requirements for Type C soils.

8.3 Fill Material Composition

The native soils do not appear to be suitable for use as placed and compacted structural fill. Excavated soils, including clay and silt, may be stockpiled for use as fill in landscape areas.

Structural fill is defined as fill material that will ultimately be subjected to any kind of structural loading, such as those imposed by footings, floor slabs, pavements, etc. We recommend that a professional engineer or geologist verify that the structural fill to be used on this project meets the requirements, stated below. We recommend that structural fill consist of imported sandy/gravelly soils meeting the following requirements in the table below:

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[2] OSHA Health and Safety Standards, Final Rule, CFR 29, part 1926.

Table 2: Structural Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
4 inches	100
3/4 inches	70 – 100
No. 4	40 – 80
No. 40	15 – 50
No. 200	0 – 20
Liquid Limit	35 maximum
Plasticity Index	15 maximum

In some situations, particles larger than 4 inches and/or more than 30 percent coarse gravel may be acceptable but would likely make compaction more difficult and/or significantly reduce the possibility of successful compaction testing. Consequently, stricter quality control measures than normally used may be required, such as using thinner lifts and increased or full-time observation of fill placement.

We recommend that utility trenches below any structural load be backfilled using structural fill. Note that most local governments and utility companies require Type A-1-a or A-1-b (AASHTO classification) soils (which overall is stricter than our recommendations for structural fill) be used as backfill above utilities in certain areas. Gradation requirements stated above shall be verified in intervals not exceeding 1,000 tons. In other areas or situations, utility trenches may be backfilled with the native soil, but the contractor should be aware that native clay and silt soils *(as observed in the explorations)* may be time consuming to compact due to potential difficulties in controlling the moisture content needed to obtain optimum compaction. All backfill soil should have a maximum particle size of 4 inches, a maximum Liquid Limit of 35 and a maximum Plasticity Index of 15.

If required (i.e. fill in submerged areas), we recommend that free draining granular material (clean sand and/or gravel) meet the following requirements in the table below:

Table 3: Free-Draining Fill Recommendations

Sieve Size/Other	Percent Passing (by weight)
3 inches	100
No. 10	0 – 25
No. 40	0 – 15
No. 200	0 – 5
Plasticity Index	Non-plastic

Three-inch minus washed rock (sometimes called river rock or drain rock) and pea gravel materials usually meet these requirements and may be used as free draining fill. If free draining fill will be placed adjacent to soil containing a significant amount of sand or silt/clay, precautions should be taken to prevent the migration of fine soil into the free draining fill. Such precautions should include either placing a filter fabric between the free draining fill and the adjacent soil material, or using a well-graded, clean filtering material approved by the geotechnical engineer.

8.4 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness prior to compaction of 4 inches for hand operated equipment, 6 inches for most "trench compactors" and 8 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the following percentages of the maximum dry density, as determined by ASTM D-1557:

- In landscape and other areas not below structurally loaded areas: 90%
- Less than 5 feet of fill below structurally loaded areas: 95%
- 5 feet or greater of fill below structurally loaded areas: 98%

Generally, placing and compacting fill at moisture contents within ±2 percent of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. Typically, the further the moisture content deviates from optimum the more difficult it will be to achieve the required compaction.

Fill should be tested frequently during placement and we recommend early testing to demonstrate that placement and compaction methods are achieving the required compaction. The contractor is responsible to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

8.5 Stabilization Recommendations

Near surface layers of clay and silt soils may rut and pump during grading and construction. The likelihood of rutting and/or pumping, and the depth of disturbance, is proportional to the moisture content in the soil, the load applied to the ground surface, and the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the ground surface by using lighter equipment, partially loaded equipment, tracked equipment, by working in dry times of the year, and/or by providing a working surface for equipment. However, because of the relatively shallow depth of groundwater, it is likely that rutting and pumping may not be avoidable.

During grading the soil in any obvious soft spots should be removed and replaced with granular material. If rutting or pumping occurs traffic should be stopped in the area of concern. The soil in rutted areas should be removed and replaced with granular material. In areas where pumping occurs the soil should either be allowed to sit until pore pressures dissipate (several hours to several days) and the soil firms up or be removed and replaced with granular material. Typically, we recommend removal to a minimum depth of 24 inches.

For granular material, we recommend using angular well-graded gravel, such as pit run, or crushed rock with a maximum particle size of four inches. We suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor. A finer granular material such as sand, gravelly sand, sandy gravel or road base may also be used. Materials which are more angular and coarse may require thinner lifts in order to achieve compaction. We recommend that the fines content (percent passing the No. 200 sieve) be less than 15%, the liquid limit be less than 35, and the plasticity index be less than 15.

Using a geosynthetic fabric, such as Mirafi 600X or equivalent, may also reduce the amount of material required and avoid mixing of the granular material and the subgrade. If a fabric is used, following removal of disturbed soils and water, the fabric should be placed over the bottom and up the sides of the excavation a minimum of 24 inches. The fabric should be placed in accordance with the manufacturer's recommendations, including proper overlaps. The granular material should then be placed over the fabric in compacted lifts. Again, we suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor.

9.0 SEISMIC AND GEOLOGIC CONSIDERATIONS

9.1 Seismic Design

The State of Utah has adopted the 2015 International Building Code (IBC) for seismic design and the structure should be designed in accordance with Chapter 16 of the IBC. The Site Class definitions in the IBC are based upon the soil properties in the upper 100 feet of the soil profile, according to Chapter 20 in ASCE 7. These properties are determined from sampler blow counts, undrained shear strength values, and/or shear velocity measurements. The code states, "When the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines that Site Class E or F soil is likely to be present at the site." Considering our experience in the vicinity of the site and based on the results of our field exploration, we recommend using Site Class D. We encountered some potentially liquefiable soil layers, but given the small amount of possible liquefaction-induced movements, we recommend using Site Class D.

The site is located at approximately 40.364 degrees latitude and -111.823 degrees longitude. Using Site Class D, the design spectral response acceleration parameters are given below.

Table 4: Design Accelerations

S_S	F_a	S_{MS}	S_{DS}
1.138 g	1.045	1.1898 g	0.793 g
S_1	F_v	S_{M1}	S_{D1}
0.3847 g	1 631	0.627 g	0.418 g

S_S = Mapped spectral acceleration for short periods
S_1 = Mapped spectral acceleration for 1-second period
$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} (F_a \cdot S_s)$ = 5% damped design spectral response acceleration for short periods
$S_{D1} = \frac{2}{3} S_{MS} = \frac{2}{3} (F_v \cdot S_1)$ = 5% damped design spectral response acceleration for 1-second period

9.2 Faulting

The subject property is located within the Intermountain Seismic Belt where the potential for active faulting and related earthquakes is present. Based upon published geologic maps[3], no active faults traverse through or immediately adjacent to the site and the site is not located within local fault study zones. The nearest mapped fault trace is part of a group of fault beneath Utah Lake located about 2 miles southwest of the site.

9.3 Liquefaction Potential

According to current liquefaction maps[4] for Utah County, the site is located within an area designated as "High" in liquefaction potential. Liquefaction can occur when saturated subsurface soils below groundwater lose their inter-granular strength due to an increase in soil pore water pressures during a dynamic event such as an earthquake. As part of this study, the potential for liquefaction to occur in the soils we encountered was assessed using Youd *et al*[5] and Boulanger & Idriss[6]. Potential liquefaction-induced movements were evaluated using Tokimatsu & Seed[7] and Youd, Hansen & Bartlett[8].

Loose, saturated sands are most susceptible to liquefaction, but some loose, saturated gravels and relatively sensitive silt to low-plasticity silty clay soils can also liquefy during a seismic event. Subsurface soils were composed of clay and sand soils. Our analysis indicates that approximately up to one inch of liquefaction-induced settlement and possibly up to one-half feet of lateral spreading could occur in the vicinity of B-1 during a moderate to large earthquake event. Given the small amount of movement, it is our opinion that liquefaction mitigation is not needed at the site.

10.0 FOUNDATIONS

10.1 General

The foundation recommendations presented in this report are based on the soil conditions encountered during our field exploration, the results of laboratory testing of samples of the

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[3] U.S. Geological Survey, Quaternary Fault and Fold Database of the United States, November 3, 2010.

[4] Utah Geological Survey, Liquefaction-Potential Map for a Part of Utah County, Utah, Public Information Series 28, August 1994.

[5] Youd, T.L. (Chair), Idriss, I.M. (Co-Chair), and 20 other authors, 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, October 2001, p. 817-833.

[6] Boulanger, R.W. and Idriss, I.M., 2006, Liquefaction Susceptibility Criteria for Silts and Clays, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, November 2006, p. 1413-1426.

[7] Tokimatsu, K. and Seed, H.B., 1987, Evaluation of Settlements in Sands due to Earthquake Shaking, Journal of Geotechnical Engineering, ASCE, p. 861-878.

[8] Youd, T.L., Hansen, C.M. and Bartlett, S.F., 2002, Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, December 2002, p. 1007-1017.

native soils, the site grading recommendations presented in this report, and the foundation loading conditions presented in Section 3.0, *Proposed Construction*, of this report. If loading conditions and assumptions related to foundations are significantly different, Earthtec should be notified so that we can re-evaluate our design parameters and estimates (higher loads may cause more settlement), and to provide additional recommendations if necessary.

Conventional strip and spread footings may be used to support the proposed structures after appropriate removals as outlined in Section 8.1. Foundations should not be installed on topsoil, undocumented fill, debris, combination soils, organic soils, frozen soil, or in ponded water. If foundation soils become disturbed during construction, they should be removed or compacted.

10.2 Strip/Spread Footings

We recommend that conventional strip and spread foundations be constructed entirely on a minimum of 24 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils. For foundation design we recommend the following:

- Footings founded on a minimum of 24 inches of structural fill may be designed using a maximum allowable bearing capacity of 2,000 pounds per square foot. The values for vertical foundation pressure can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2015 International Building Code.
- Continuous and spot footings should be uniformly loaded and should have a minimum width of 20 and 30 inches, respectively.
- Exterior footings should be placed below frost depth which is determined by local building codes. In general, 30 inches of cover is adequate for most sites; however local code should be verified by the end design professional. Interior footings, not subject to frost (heated structures), should extend at least 18 inches below the lowest adjacent grade.
- Foundation walls and footings should be properly reinforced to resist all vertical and lateral loads and differential settlement.
- The bottom of footing excavations should be compacted with at least 4 passes of an approved non-vibratory roller prior to erection of forms or placement of structural fill to densify soils that may have been loosened during excavation and to identify soft spots. If soft areas are encountered, they should be stabilized as recommended in Section 8.5.
- Footing excavations should be observed by the geotechnical engineer prior to beginning footing construction to evaluate whether suitable bearing soils have been exposed and whether excavation bottoms are free of loose or disturbed soils.
- Because of shallow groundwater conditions encountered at the site, we anticipate that 24 inches of structural fill will be required below the proposed structure to provide a firm surface upon which to construct the proposed structure. In lieu of traditional structural fill, clean 1- to 2-inch clean gravel may be used in conjunction with a stabilization fabric, such as Mirafi

600X or equivalent, which should be placed between the native soils and the clean gravel (additional recommendations for placing clean gravel and stabilization fabric are given in Section 8.5 of this report).

- Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to existing site grades. This is intended to provide a minimum of 2 feet of separation between the observed groundwater condition and the bottom of the floor slab.
- Structural fill used below foundations should extend laterally a minimum of 6 inches for every 12 vertical inches of structural fill placed. For example, if 18 inches of structural fill is required to bring the excavation to footing grade, the structural fill should extend laterally a minimum of 9 inches beyond the edge of the footings on both sides.

10.3 Estimated Settlements

If the proposed foundations are properly designed and constructed using the parameters provided above, we estimate that total settlements should not exceed one inch and differential settlements should be one-half of the total settlement over a 25-foot length of continuous foundation, for non-earthquake conditions. Additional settlement could occur during a seismic event due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, if loading conditions are greater than anticipated in Section 3, and/or if foundation soils are allowed to become wetted.

10.4 Lateral Load Resistance

Lateral loads are typically resisted by friction between the underlying soil and footing bottoms. Resistance to sliding may incorporate the friction acting along the base of foundations, which may be computed using a coefficient of friction of soils against concrete of 0.55 for clean gravel or structural fill meeting the recommendations presented herein. The values for lateral resistance can be increased by one-third for wind and seismic conditions per Section 1806.1 when used with the Alternative Basic Load Combinations found in Section 1605.3.2 of the 2015 International Building Code.

11.0 FLOOR SLABS AND FLATWORK

Due to shallow groundwater encountered at the site, lowest floor slab depths should be limited to existing site grades or 3 feet above the observed ground water level. This is intended to provide separation between the observed groundwater condition and the bottom of the floor slab to prevent flooding.

Concrete floor slabs and exterior flatwork may be supported on a minimum of 12 inches of properly placed, compacted, and tested structural fill extending to undisturbed native soils after appropriate removals and grading as outlined in Section 8.1 are completed. We recommend placing a minimum of 4 inches of free-draining fill material (see Section 8.3) beneath floor slabs to facilitate construction, act as a capillary break, and aid in distributing floor loads. For exterior flatwork, we recommend placing a minimum of 4 inches of road-base material. Prior to placing the free-draining fill or road-base materials, the native sub-grade should be proof-rolled to identify soft spots, which should be stabilized as discussed above in Section 8.5.

For slab design, we recommend using a modulus of sub-grade reaction of 130 pounds per cubic inch. The thickness of slabs supported directly on the ground shall not be less than 3½ inches. A 6-mil polyethylene vapor retarder with joints lapped not less than 6 inches shall be placed between the ground surface and the concrete, as per Section 1907.1 of the 2015 International Building Code.

To help control normal shrinkage and stress cracking, we recommend that floor slabs have adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints, frequent crack control joints, and non-rigid attachment of the slabs to foundation and bearing walls. Special precautions should be taken during placement and curing of all concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and practices.

12.0 DRAINAGE

12.1 Surface Drainage

As part of good construction practice, precautions should be taken during and after construction to reduce the potential for water to collect near foundation walls. Accordingly, we recommend the following:

- The contractor should take precautions to prevent significant wetting of the soil at the base of the excavation. Such precautions may include: grading to prevent runoff from entering the excavation, excavating during normally dry times of the year, covering the base of the excavation if significant rain or snow is forecast, backfill at the earliest possible date, frame floors and/or the roof at the earliest possible date, other precautions that might become evident during construction.
- Adequate compaction of foundation wall backfill must be provided i.e. a minimum of 90% of ASTM D-1557. Water consolidation methods should not be used.
- The ground surface should be graded to drain away from the building in all directions. We recommend a minimum fall of 6 inches in the first 10 feet.
- Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.

- Sprinkler nozzles should be aimed away, and all sprinkler components kept at least 2 feet, from foundation walls. A drip irrigation system may be utilized in landscaping areas within 10 feet of foundation walls to minimize water intrusion at foundation backfill. Also, sprinklers should not be placed at the top or on the face of slopes. Sprinkler systems should be designed with proper drainage and well maintained. Over-watering should be avoided.
- Any additional precautions which may become evident during construction.

12.2 Subsurface Drainage

Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall conform to Section 1805 of the 2015 International Building Code for damp proofing and water proofing.

13.0 PAVEMENT RECOMMENDATIONS

We understand that asphalt paved residential streets will be constructed as part of the project. The native soils encountered beneath the fill and topsoil during our field exploration were predominantly composed of clays. We estimate that a California Bearing Ratio (CBR) value of 3 is appropriate for these soils. If the topsoil is left beneath concrete flatwork and pavement areas, increased maintenance costs over time should be anticipated.

We anticipate that the traffic volume will be about 1,000 vehicles a day (3 ESAL/day) or less for the residential streets, consisting of mostly cars and pickup trucks, with a daily delivery truck and a weekly garbage truck. Based on these traffic parameters, the estimated CBR given above, and the procedures and typical design inputs outlined in the UDOT Pavement Design Manual (2008), we recommend the minimum asphalt pavement section presented below.

Table 5: Pavement Section Recommendations

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)	Compacted Subbase Thickness (in)
3	6	6*
3	12*	0

* Stabilization may be required

If the pavement will be required to support construction traffic, more than an occasional semi-tractor or fire truck, or more traffic than listed above, our office should be notified so that we can re-evaluate the pavement section recommendations. The following also apply:

- The subgrade should be prepared by proof rolling to a firm, non-yielding surface, with any identified soft areas stabilized as discussed above in Section 8.5.
- Site grading fills below the pavements should meet structural fill composition and placement recommendations per Sections 8.3 and 8.4 herein.

- Asphaltic concrete, aggregate base and sub-base material composition should meet local, APWA, or UDOT requirements. Gradation requirements and frequency shall be followed as required by local, APWA, or UDOT requirements, but not to exceed 500 tons.
- Aggregate base and sub-base is compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D 1557).
- Asphaltic concrete is compacted to local or UDOT requirements, or to at least 96 percent of the laboratory Marshall density (ASTM D 6927).

Due to high static loads imposed by at dumpster locations, we recommend that a rigid pavement section for this area of a minimum of six (6) inches of Portland Cement Concrete (PCC) over a minimum of twelve (12) inches of aggregate base material. The aggregate base material should meet local, APWA or UDOT requirements and should be compacted to local, APWA, or UDOT requirements, or to at least 95 percent of maximum dry density (ASTM D1557).

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The explorations may not be indicative of subsurface conditions outside the study area or between points explored and thus have a limited value in depicting subsurface conditions for contractor bidding. Variations from the conditions portrayed in the explorations may occur and which may be sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, Earthtec should be advised immediately so that the appropriate modifications can be made.

The findings and recommendations presented in this geotechnical report were prepared in accordance with generally accepted geotechnical engineering principles and practice in this area of Utah at this time. No warranty or representation is intended in our proposals, contracts, letters, or reports.

This geotechnical report is based on relatively limited subsurface explorations and laboratory testing. Subsurface conditions may differ in some locations of the site from those described herein, which may require additional analyses and possibly modified recommendations. Thus, we strongly recommend consulting with Earthtec regarding any changes made during design and construction of the project from those discussed herein. Failure to consult with Earthtec regarding any such changes relieves Earthtec from any liability arising from changed conditions at the site.

To maintain continuity, Earthtec should also perform materials testing and special inspections for this project. The recommendations presented herein are based on the assumption that an adequate program of tests and observations will be followed during construction to verify compliance with our recommendations. We also assume that we will review the project plans and specifications to verify that our conclusions and recommendations are incorporated and remain appropriate (based on the actual design). Earthtec should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Earthtec also should be retained to provide observation and testing services during grading, excavation, foundation construction, and other earth-related construction phases of the project.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please contact Earthtec at your convenience.

Respectfully;

EARTHTEC ENGINEERING

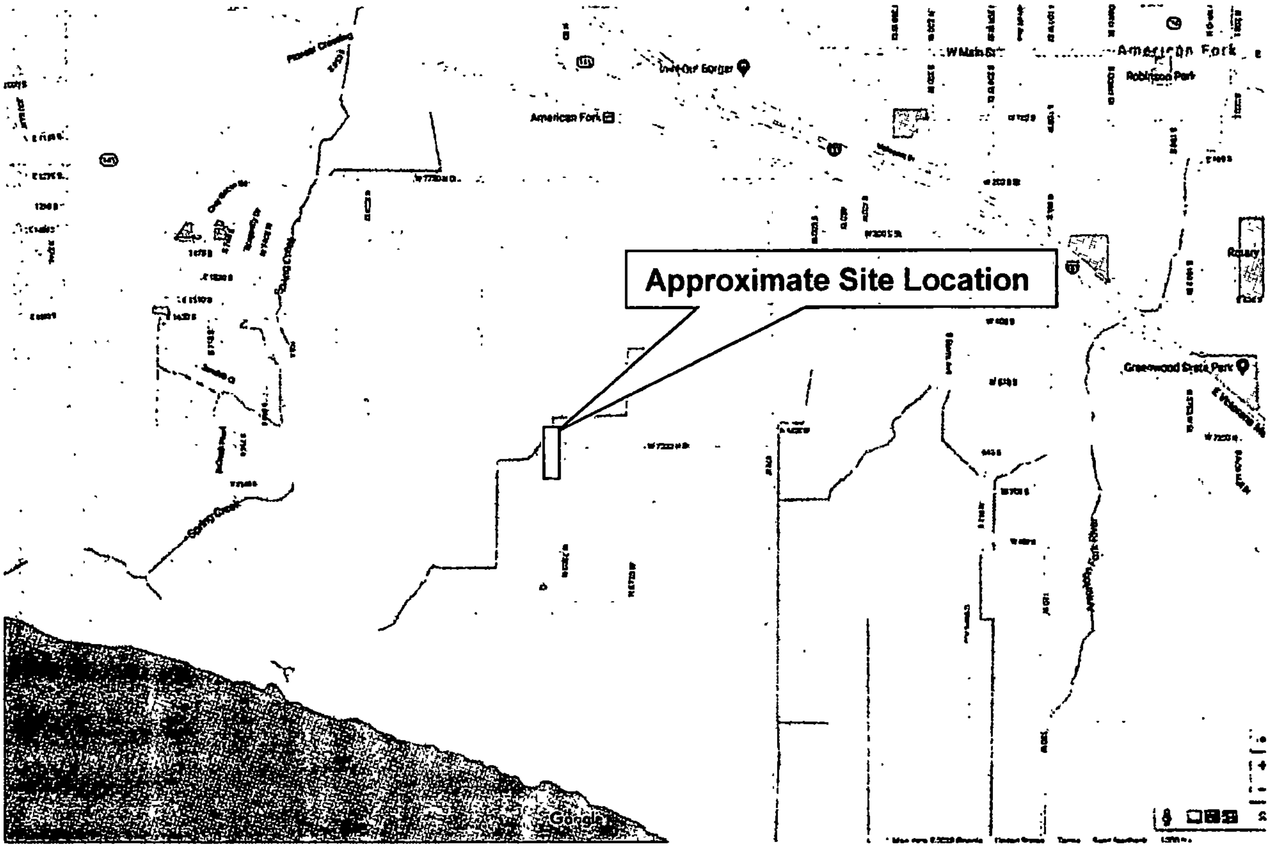
Timothy A. Mitchell

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

#10183430-2202
CALEB RICHARD ALLRED
Electronically generated on 10/26/2018

Caleb R. Allred, P.E.
Project Engineer

VICINITY MAP
AF PD
PENROD PROPERTIES
6820 WEST 7333 NORTH
AMERICAN FORK, UTAH



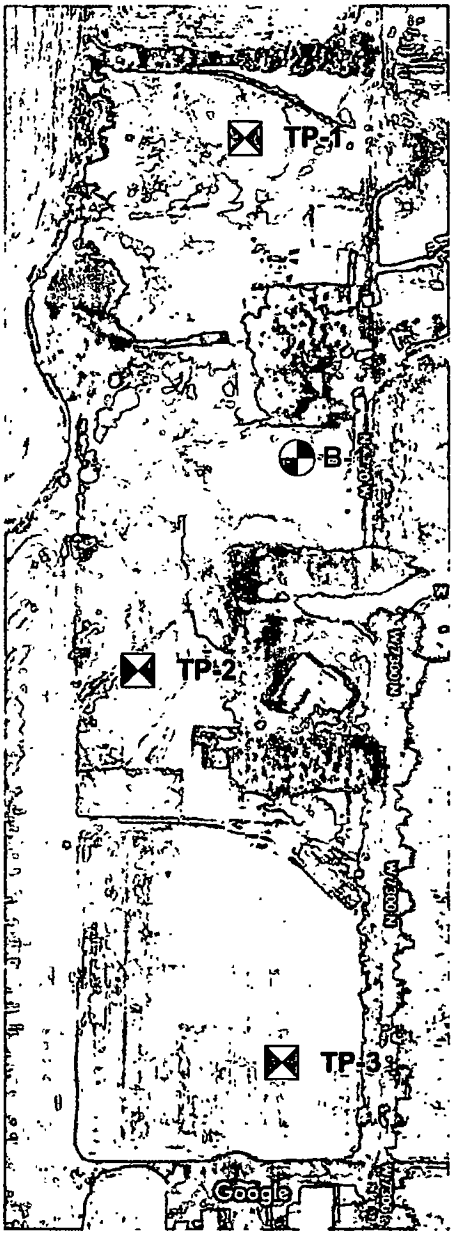
N

Not to Scale

PROJECT NO.: 189047	EARTHTEC ENGINEERING	**FIGURE NO.:** 1

AERIAL PHOTOGRAPH SHOWING LOCATION OF BORING AND TEST PITS

AF PD
PENROD PROPERTIES
6820 WEST 7333 NORTH
AMERICAN FORK, UTAH



⊠ **Approximate Test Pit Locations**
◐ **Approximate Boring Location**

PROJECT NO.: 189047	EARTHTEC ENGINEERING	**FIGURE NO.:** 2

BORING LOG

NO.: B-1

PROJECT:	Penrod Properties	**PROJECT NO.:**	189047
CLIENT:	AFPD	**DATE:**	10/08/18
LOCATION:	See Figure 2	**ELEVATION:**	Not Measured
OPERATOR:	Great Basin Drilling	**LOGGED BY:**	J. Balleck
EQUIPMENT:	All Terain Drill Rig		
DEPTH TO WATER; INITIAL ▽ :		**AT COMPLETION ▼ :**	2.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Blows per foot	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy clay, brown, wet, organics										
	▨		Lean CLAY with sand, soft (estimated), wet, brown ▼										
3	▨	CL		▥		26	99	33	11	16	10	74	C
6	▨		Lean CLAY, very soft to stiff, wet, brown, calcified nodules, 1/4 silt layers throughout	◤	1								
9	▨		...mottled, some roots	◤	12								
12	▨	CL	...some gravel	◤	12								
15	▨			◤	9								
18	▨		...3 inch silty sand layer										
21	▥		SILT, stiff, wet, gray	◤	11	21		21	1	0	16	84	
24	▥	ML											
27	▨		Lean CLAY, very soft to stiff, wet, gray	◤	1	44		44	20	1	3	96	
30	▨	CL		◤	15								
33			Maximum depth explored approximately 31½ feet.										

Notes: Groundwater encountered at approximately 2½ feet.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity/Nitrates/PH
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 189047

EARTHTEC ENGINEERING

FIGURE NO.: 3

LOG OF TESTHOLE 189047 LOGS.GPJ EARTHTEC.GDT 10/26/18

TEST PIT LOG
NO.: TP-1

PROJECT:	Penrod Properties	**PROJECT NO.:**	189047
CLIENT:	AFPD	**DATE:**	10/05/18
LOCATION:	See Figure 2	**ELEVATION:**	Not Measured
OPERATOR:	JSI	**LOGGED BY:**	J. Balleck
EQUIPMENT:	Mini Excavator		
DEPTH TO WATER; INITIAL ▽ :		**AT COMPLETION ▼ :**	2 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0	▒		TOPSOIL, sandy clay, brown, wet, organics									
1	▨	CL	Lean CLAY, stiff to very stiff (estimated), moist to wet, brown to redish gray brown									
2	▨	▼										
	▨			■								SS
3	▨											
	▨			■	32				3	7	90	
4	▨											
5	▨											
	▨			■	30	92	35	11	8	7	85	C
6			Maximum depth explored approximately 6 feet.									
7												
8												
9												
10												

Notes: Groundwater encountered at approximately 2 feet.

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 189047

EARTHTEC ENGINEERING

FIGURE NO.: 4

TEST PIT LOG
NO.: TP-2

PROJECT: Penrod Properties
PROJECT NO.: 189047
CLIENT: AFPD
DATE: 10/05/18
LOCATION: See Figure 2
ELEVATION: Not Measured
OPERATOR: JSI
LOGGED BY: J. Balleck
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽ :
AT COMPLETION ▼ : 2 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy clay, brown, wet, organics									
1		MH	Elastic SILT, medium stiff (estimated), moist to wet, brown, roots									
2		▼		■	52	69	52	20	3	20	77	C
3												
4												
5				■								
6			Maximum depth explored approximately 6 feet.									
7												
8												
9												
10												

Notes: Groundwater encountered at approximately 2 feet.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 189047

FIGURE NO.: 5

TEST PIT LOG

NO.: TP-3

PROJECT: Penrod Properties
CLIENT: AFPD
LOCATION: See Figure 2
OPERATOR: JSI
EQUIPMENT: Mini Excavator
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 189047
DATE: 10/05/18
ELEVATION: Not Measured
LOGGED BY: J. Balleck
AT COMPLETION ▼ : 3.5 ft.

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL, sandy clay, brown, wet, organics									
1	▨		Lean CLAY, medium stiff (estimated), moist to wet, brown, roots, calcified nodules									
2				■								
3		CL	▼ ...no rootholes									
4												
5				■	33	91	35	13	4	8	88	C
6			Maximum depth explored approximately 6 feet.									
7												
8												
9												
10												

Notes: Groundwater encountered at approximately 3½ feet.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
B = Burnoff

PROJECT NO.: 189047

EARTHTEC ENGINEERING

FIGURE NO.: 6

LEGEND

PROJECT: Penrod Properties
CLIENT: AFPD
DATE: 10/05/18
LOGGED BY: J. Balleck

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR SOIL DIVISIONS			USCS SYMBOL	TYPICAL SOIL DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% retaining on No. 200 Sieve)	GRAVELS (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVELS (Less than 5% fines)	GW	Well Graded Gravel, May Contain Sand, Very Little Fines
			GP	Poorly Graded Gravel, May Contain Sand, Very Little Fines
		GRAVELS WITH FINES (More than 12% fines)	GM	Silty Gravel, May Contain Sand
			GC	Clayey Gravel, May Contain Sand
	SANDS (50% or more of coarse fraction passes No. 4 Sieve)	CLEAN SANDS (Less than 5% fines)	SW	Well Graded Sand, May Contain Gravel, Very Little Fines
			SP	Poorly Graded Sand, May Contain Gravel, Very Little Fines
		SANDS WITH FINES (More than 12% fines)	SM	Silty Sand, May Contain Gravel
			SC	Clayey Sand, May Contain Gravel
FINE GRAINED SOILS (More than 50% passing No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		CL	Lean Clay, Inorganic, May Contain Gravel and/or Sand
			ML	Silt, Inorganic, May Contain Gravel and/or Sand
			OL	Organic Silt or Clay, May Contain Gravel and/or Sand
	SILTS AND CLAYS (Liquid Limit Greater than 50)		CH	Fat Clay, Inorganic, May Contain Gravel and/or Sand
			MH	Elastic Silt, Inorganic, May Contain Gravel and/or Sand
			OH	Organic Clay or Silt, May Contain Gravel and/or Sand
HIGHLY ORGANIC SOILS			PT	Peat, Primarily Organic Matter

SAMPLER DESCRIPTIONS

◩ SPLIT SPOON SAMPLER
(1 3/8 inch inside diameter)

⧗ MODIFIED CALIFORNIA SAMPLER
(2 inch outside diameter)

▥ SHELBY TUBE
(3 inch outside diameter)

▮ BLOCK SAMPLE

☒ BAG/BULK SAMPLE

WATER SYMBOLS

∇ Water level encountered during field exploration

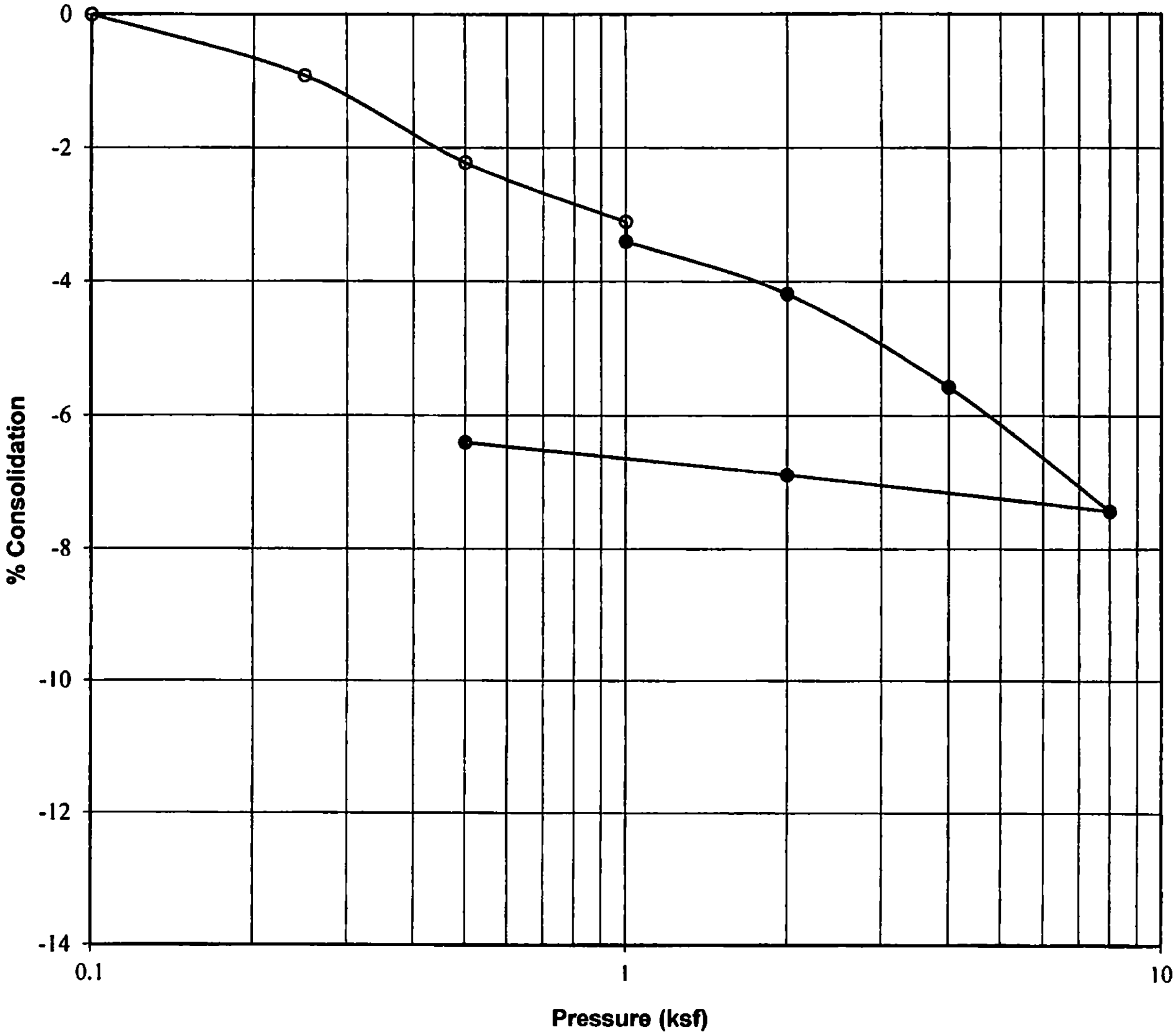
▼ Water level encountered at completion of field exploration

NOTES:
1. The logs are subject to the limitations, conclusions, and recommendations in this report.
2. Results of tests conducted on samples recovered are reported on the logs and any applicable graphs.
3. Strata lines on the logs represent approximate boundaries only. Actual transitions may be gradual.
4. In general, USCS symbols shown on the logs are based on visual methods only: actual designations (based on laboratory tests) may vary.
5. In "Blows per foot" column, values in parentheses are corrected (N1)60 values.

PROJECT NO.: 189047

FIGURE NO.: 7

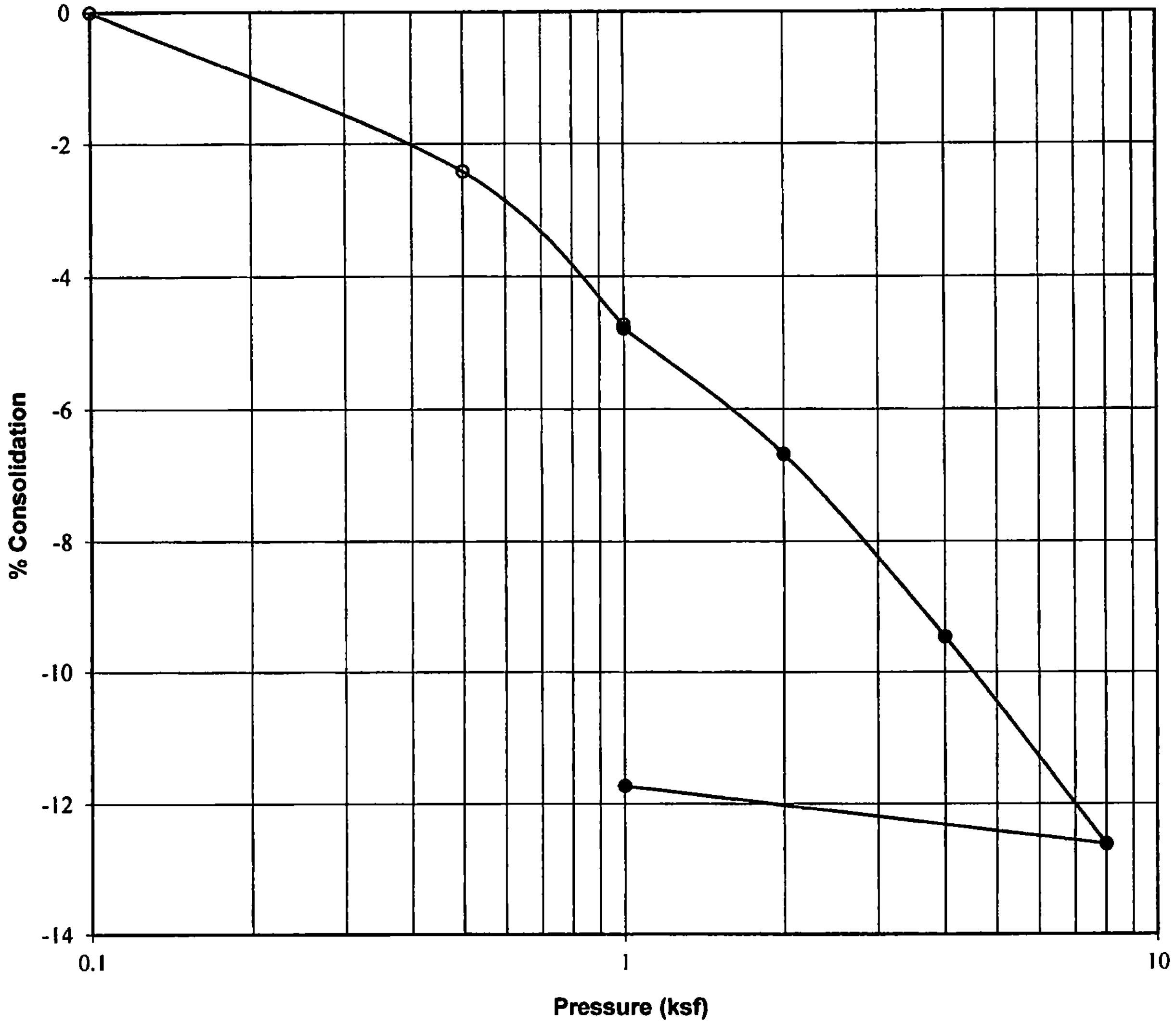
CONSOLIDATION - SWELL TEST



Project:	Penrod Properties
Location:	B-1
Sample Depth, ft:	2½
Description:	Block
Soil Type:	Lean CLAY with gravel (CL)
Natural Moisture, %:	26
Dry Density, pcf:	99
Liquid Limit:	33
Plasticity Index:	11
Water Added at:	1 ksf
Percent Collapse:	0.3

PROJECT NO.: 189047	EARTHTEC ENGINEERING	**FIGURE NO.:** 8

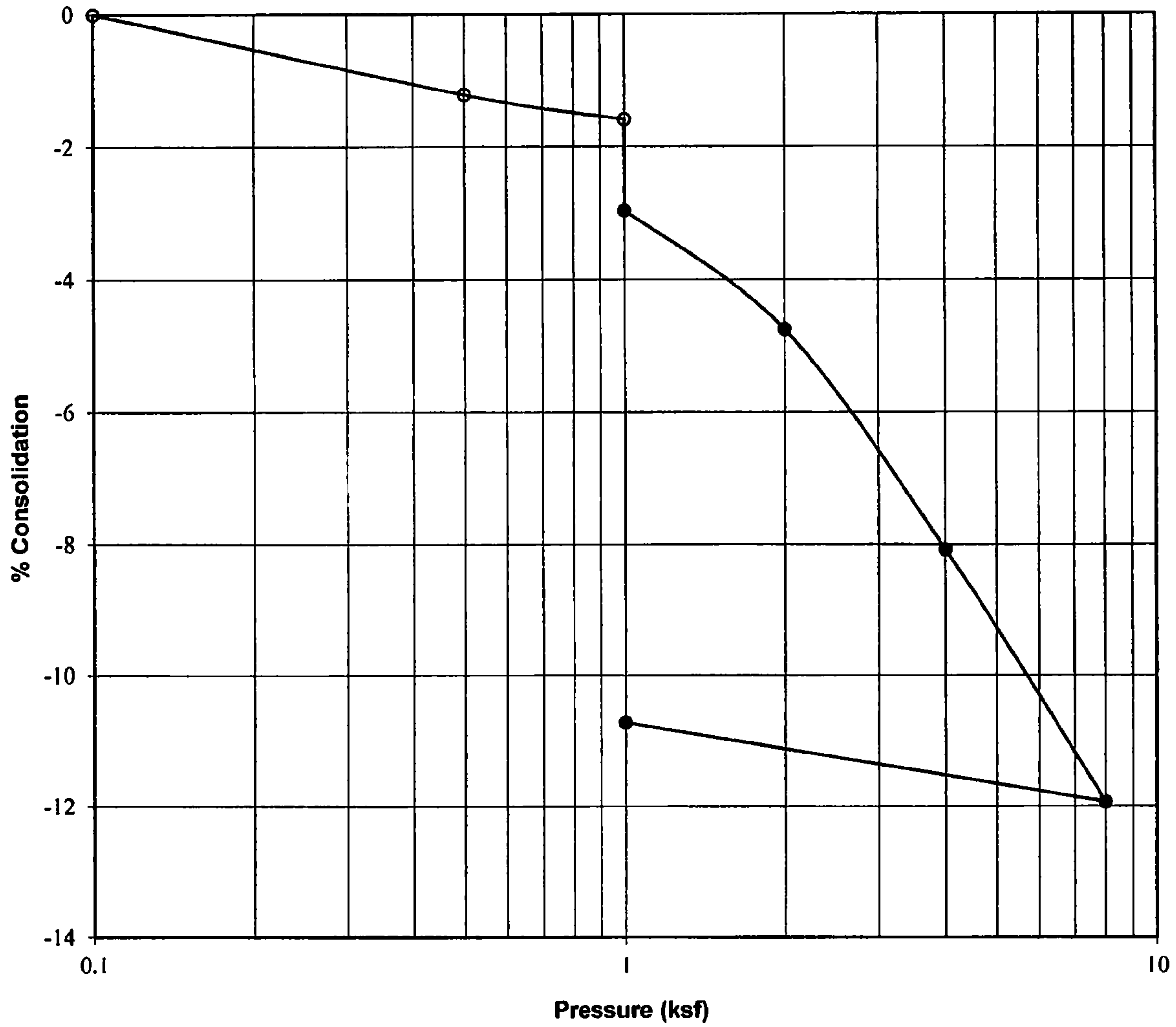
CONSOLIDATION - SWELL TEST



Project:	Penrod Properties
Location:	TP-1
Sample Depth, ft:	5
Description:	Block
Soil Type:	Lean CLAY with gravel (CL)
Natural Moisture, %:	30
Dry Density, pcf:	92
Liquid Limit:	35
Plasticity Index:	11
Water Added at:	1 ksf
Percent Collapse:	0.1

PROJECT NO.: 189047		**FIGURE NO.:** 9

CONSOLIDATION - SWELL TEST



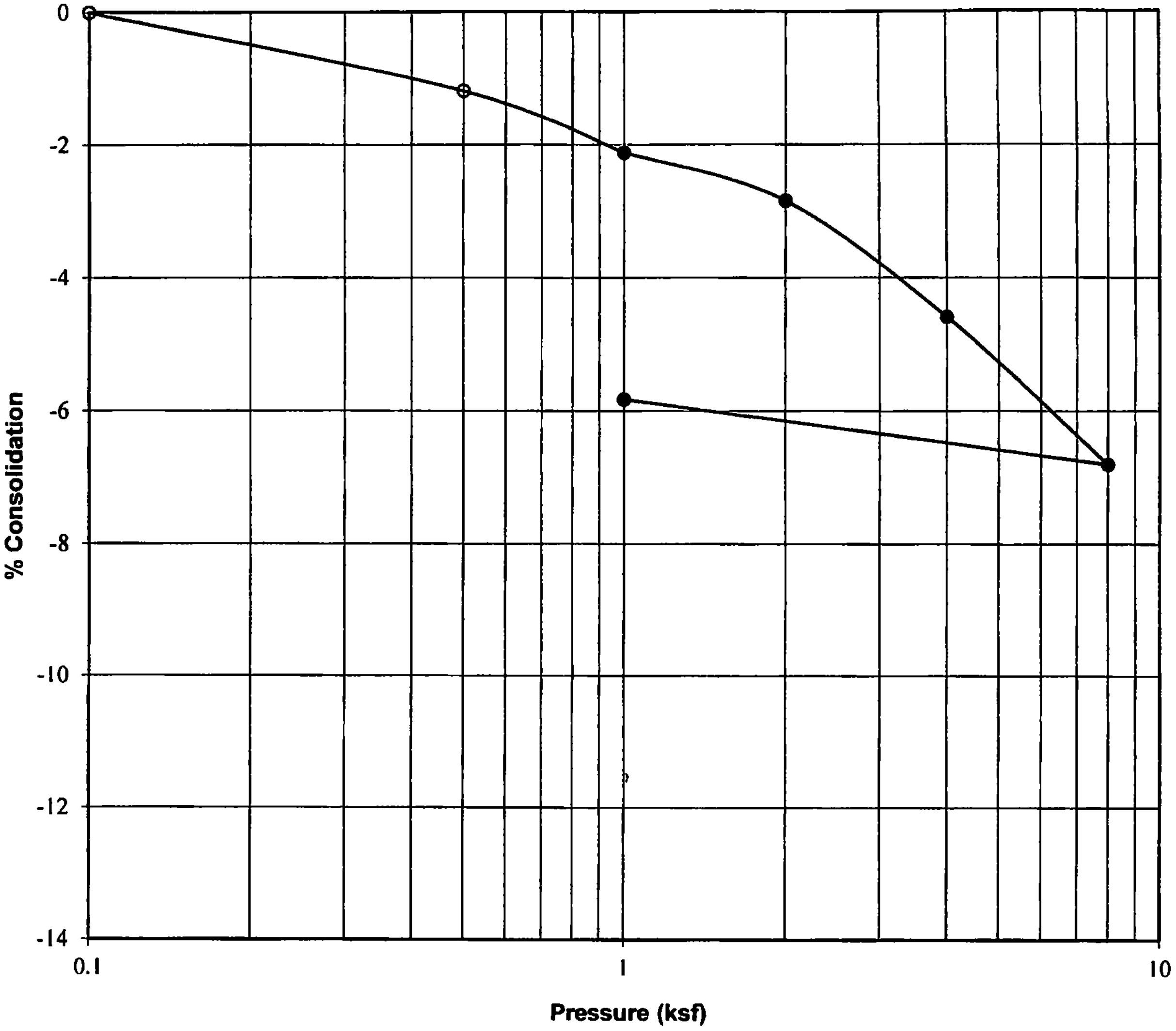
Project:	Penrod Properties
Location:	TP-2
Sample Depth, ft:	2
Description:	Block
Soil Type:	Elastic SILT with sand (MH)
Natural Moisture, %:	52
Dry Density, pcf:	69
Liquid Limit:	52
Plasticity Index:	27
Water Added at:	1 ksf
Percent Collapse:	1.4

PROJECT NO.: 189047

EARTHTEC ENGINEERING

FIGURE NO.: 10

CONSOLIDATION - SWELL TEST



Project:	Penrod Properties
Location:	TP-3
Sample Depth, ft:	5
Description:	Block
Soil Type:	Lean CLAY (CL)
Natural Moisture, %:	33
Dry Density, pcf:	91
Liquid Limit:	35
Plasticity Index:	13
Water Added at:	1 ksf

PROJECT NO.: 189047	EARTHTEC ENGINEERING	**FIGURE NO.:** 11

APPENDIX A

TIMPVIEW ANALYTICAL LABORATORIES

Timpview Analytical Laboratories

A Chemtech-Ford, Inc. Affiliate
1384 West 130 South Orem, UT 84058 (801) 229-2282

Certificate of Analysis

Earthtec Testing & Engineering
Caleb Allred
1497 W 40 S
Lindon, UT 84042
DW System # :

Work Order #: 18J0479
PO# / Project Name: 189047
Receipt: 10/8/18 16:12
Batch Temp °C: 16.4
Date Reported: 10/15/2018

Sample Name: **189047 TP-1 @ 2**

Collected: 10/5/18 13:00 **Matrix:** Solid **Collected By:** Client

Parameter	Lab ID #	Method	Analysis Date / Time	Result	Units	MRL	Flags
Sulfate, Soluble (IC)	18J0479-01	EPA 300.0	10/12/18	277	mg/kg dry	13	
Total Solids	18J0479-01	SM 2540G	10/10/18	74.8	%	0.1	

Comment:

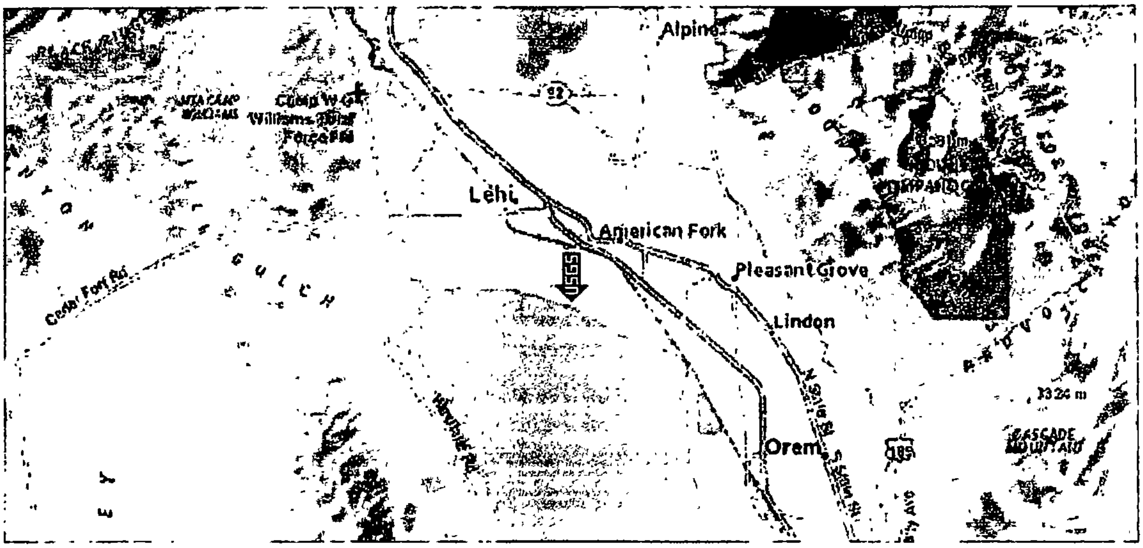
Reviewed by: Joyce Applegate

Joyce Applegate, Project Manager

USGS Design Maps Summary Report

User-Specified Input

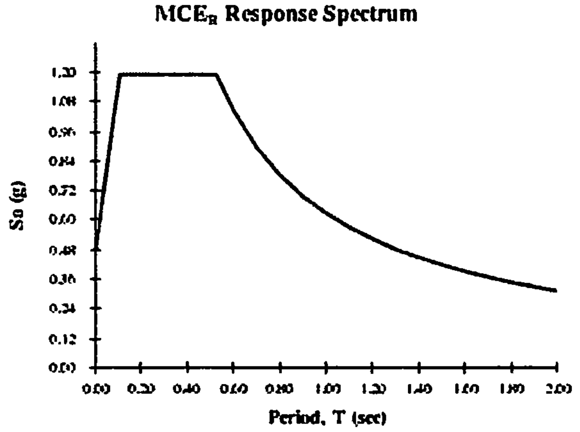
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	40.364°N, 111.823°W
Site Soil Classification	Site Class D - "Stiff Soil"
Risk Category	I/II/III

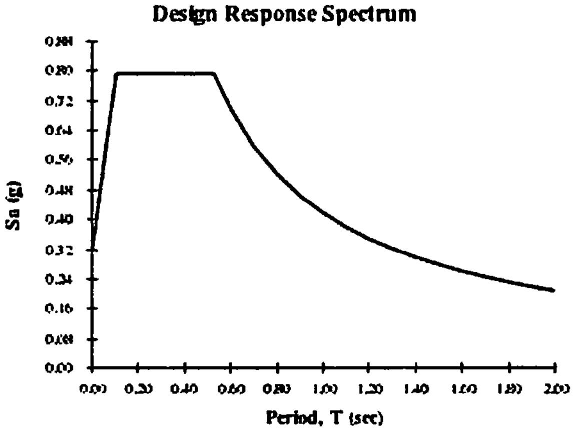


USGS-Provided Output

S_S =	1.138 g	S_{MS} =	1.189 g	S_{DS} =	0.793 g
S_1 =	0.384 g	S_{M1} =	0.627 g	S_{D1} =	0.418 g

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


MCE_R Response Spectrum


Design Response Spectrum

For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (40.364°N, 111.823°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	$S_S = 1.138$ g
From Figure 22-2 [2]	$S_1 = 0.384$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

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

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

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

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

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

For Site Class = D and S_S = 1.138 g, F_a = 1.045

Table 11.4-2: Site Coefficient F_v

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

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

For Site Class = D and S_1 = 0.384 g, F_v = 1.631

Equation (11.4-1): $S_{MS} = F_a S_S$ = 1.045 x 1.138 = 1.189 g

---

Equation (11.4-2): $S_{M1} = F_v S_1$ = 1.631 x 0.384 = 0.627 g

---

Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4-3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3}$ x 1.189 = 0.793 g

---

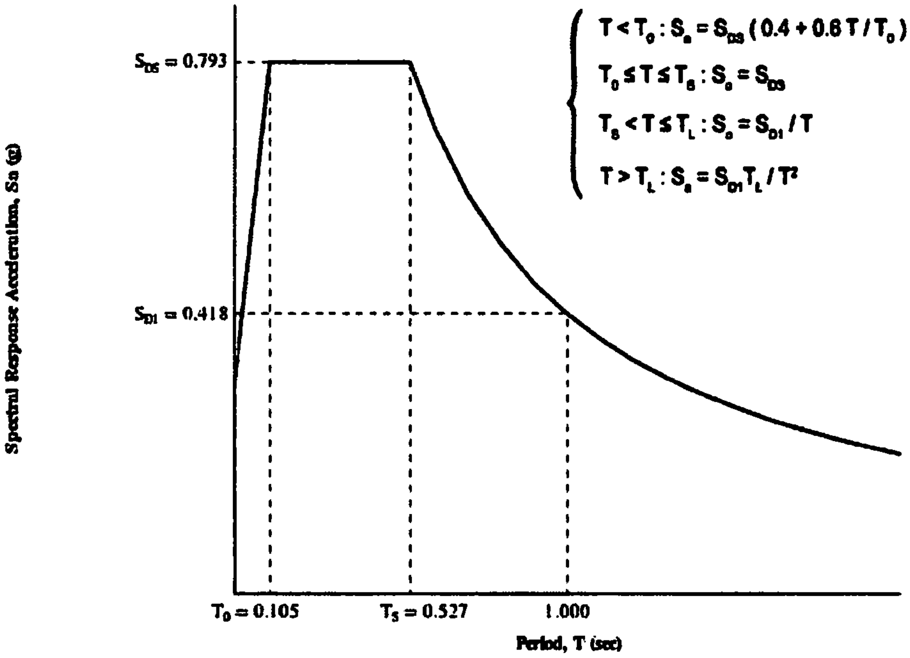
Equation (11.4-4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3}$ x 0.627 = 0.418 g

---

Section 11.4.5 — Design Response Spectrum

From Figure 22-12 [3] T_L = 8 seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.

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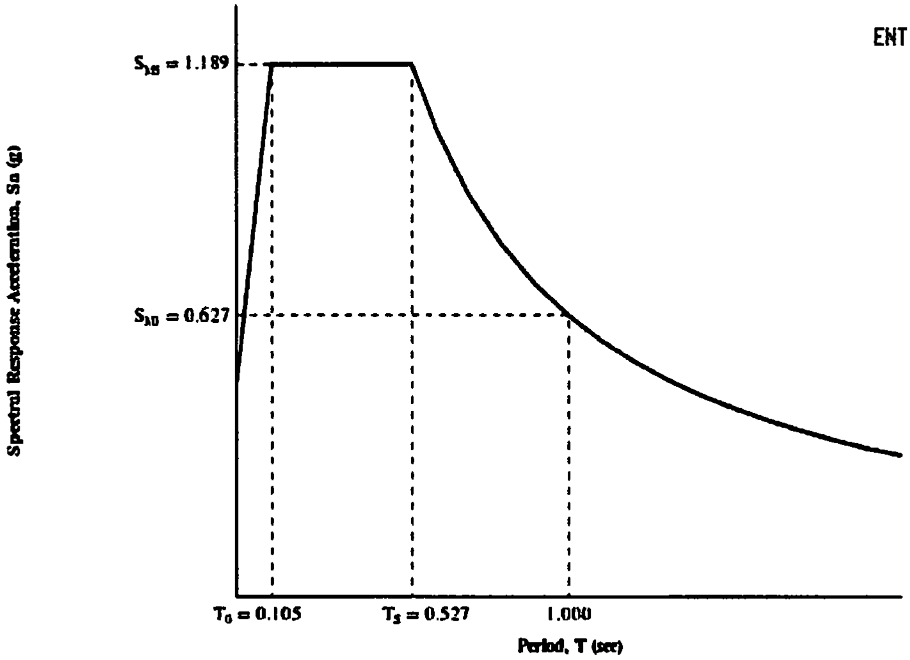


Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.480

Equation (11.8-1): $PGA_M = F_{PGA}PGA = 1.020 \times 0.480 = 0.49$ g

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.480 g, F_{PGA} = 1.020

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.831

From Figure 22-18 [6] C_{R1} = 0.837

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

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

For Risk Category = I and S_{DS} = 0.793 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

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

For Risk Category = I and S_{D1} = 0.418 g, Seismic Design Category = D

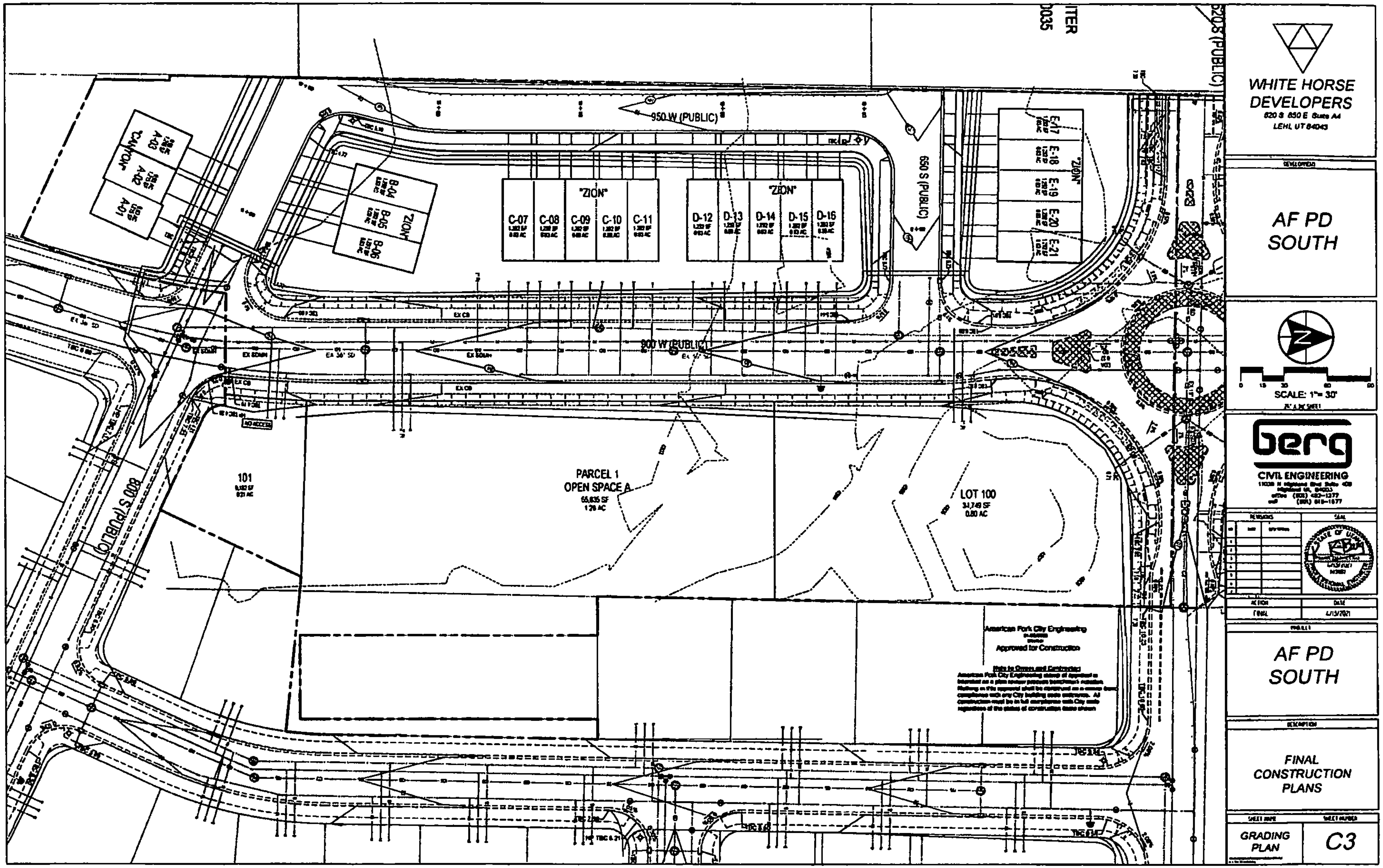
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf


WHITE HORSE DEVELOPERS
620 S 650 E Suite A4
LEHI, UT 84043
AF PD SOUTH
SCALE: 1"= 30'
0
15
30
60
90
berg
CIVIL ENGINEERING
ACTION
FINAL
DATE
4/15/2021
AF PD SOUTH
FINAL CONSTRUCTION PLANS
GRADING PLAN
C3
620 S (PUBLIC)
950 W (PUBLIC)
650 S (PUBLIC)
900 W (PUBLIC)
800 S (PUBLIC)
"ZION"
E-17
E-18
E-19
E-20
E-21
D-12
D-13
D-14
D-15
D-16
C-07
C-08
C-09
C-10
C-11
B-04
B-05
B-06
"CANYON"
A-01
A-02
A-03
LOT 100
34,749 SF
0.80 AC
PARCEL 1
OPEN SPACE A
65,835 SF
1.26 AC
101
NO ACCESS
American Fork City Engineering
Approved for Construction

CMT ENGINEERING
LABORATORIES

September 18, 2019

Mr. Ben Hunter
City of American Fork
275 East 200 North
American Fork, Utah 84003

RE: Geotechnical Review
AFPD South Subdivision
6820 West 7333 North
American Fork, Utah
CMT Job No. 12566

Mr. Hunter,

As you requested, this letter presents our review of the report titled "Geotechnical Study, AFPD, Penrod Properties, 6820 West 7333 North, American Fork, Utah" prepared by Earthtec Engineering, Project No. 189047 and dated October 26, 2018. We reviewed the report with respect to the current American Fork Sensitive Lands Ordinance, specifically Section 4-2-2, as follows:

1. The nature, distribution and classification of soils encountered to a maximum depth of about 31.5 feet were provided, which is more than 10 feet below proposed excavations and well below the depth of influence from structures.

2. The strength of existing soils, bearing capacity of supporting soils, and soil settlement estimateswere properly addressed. Lateral pressures were not provided since it was anticipated that below-grade walls will not be constructed. Trench excavation limitations were addressed via recommendations for temporary excavations. Pavement recommendations were provided, which included 12 inches of road base (more than required by the Ordinance).

3. Groundwater levels that may affect the development were addressed, including potential groundwater fluctuations, but an estimated depth of high groundwater levels was not provided.

4. Appropriate laboratory testing for classification, consistency, strength and consolidation conditions, and soil liquefaction potential were provided in the report.

5. Slope stability is not an issue for this relatively flat site.

6. Potential frost action based on material type and groundwater levels was appropriately addressed by recommending that footings be placed on a minimum 24 inches of structural fill.

7. Frost depth was addressed (30 inches).

8. Geologic and hydrologic hazards per Section 4-2-4 of the Ordinance were appropriately addressed in the report and the Geotechnical/Geologic certificate was provided.

9. Soil constraints, such as compressible soils, were addressed in the report, as were high groundwater, organic soils (topsoil), and a liquefaction study.

10. The report is not in accordance with the guidelines and recommendations of the "American Fork Sensitive Lands Geologic Hazards Study" Chapter 5. The recommended depth of borings in Chapter 5 for evaluating liquefaction is 40 feet, and the reviewed report included 1 boring that only extended to a depth of about 31.5 feet.

In summary, two items were not addressed to meet Section 4-2-2 of the current American Fork Sensitive Lands Ordinance, specifically items 3 and 10 above.

If we can answer any questions or be of further assistance, please call.

Sincerely,
CMT Engineering Laboratories

LICENSED PROFESSIONAL ENGINEER
71715
WILLIAM G.
TURNER
9/18/19
STATE OF UTAH

William G. Turner, P.E.
Senior Geotechnical Engineer

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April 20, 2022

White Horse Developers
Attn: Mr. Jake Horan
520 South 850 East, Suite A-4
Lehi, UT 84043

Re: Response to Review
Lakeshore Landing, Penrod Properties (AFPD)
6820 West 7333 North
American Fork, Utah
Job No: 189047

Mr. Horan:

This letter is a response to the review by CMT of the geotechnical report[1] completed in 2018.

3. Groundwater levels that may affect the development were addressed, including potential groundwater fluctuations, but an estimated depth of high groundwater levels was not provided.

> **Groundwater was encountered at 2 to 2½ feet in the explorations. The area had been flood irrigated at the time of our study but no evidence of higher groundwater levels were observed in the soils.**

10. The report is not in accordance with the guidelines and recommendations of the "American Fork Sensitive Lands Geologic Hazards Study" Chapter 5. The recommended depth of borings in Chapter 5 for evaluating liquefaction is 40 feet, and the reviewed report included 1 boring that only extended to a depth of about 31.5 feet.

> In the referenced report by RG&G in Chapter 5 (page 18) dated December 2006 it states:
>
> *"Single lots, residential subdivision of fewer than nine lots, multi-family dwellings with fewer than four units per acre, and single-story commercial buildings of less than 5,000 square feet do not require a sit-specific liquefaction study, even when located with the High and Moderate liquefaction potential areas. Other exceptions also apply, as outlined in Chapter 19.75 of the Salt Lake County Geologic Hazards Ordinance. The definition of "Critical Facilities" is also provided in the ordinance.*
>
> *We recommend that American Fork City's liquefaction study requirements be modeled after the Salt Lake County ordinance. Salt Lake County require a minimum boring depth of 45 feet below final ground surface. Based on a review of boring logs and liquefaction analyses, it is our opinion that a minimum boring depth of 40 feet below existing ground is sufficient for the American Fork area. Deeper investigations should be performed if deemed necessary by the geotechnical engineer preparing the geotechnical report. We recommend that liquefaction investigations include a boring to a depth of at least 40 feet for all critical facilities, as well as for other facilities located within the High or Moderate*

---

[1] Geotechnical Study, AF PD, Penrod Properties, 6820 West 7333 North, American Fork, Utah, Earthtec Engineering, Project No.189047, October 26, 2018.

liquefaction zones delineated on Figure 6 and meeting minimum size, occupancy, and/or land use criteria set by the city."

It should be noted that in the last sentence of the second paragraph, the recommendation if for all critical facilities. This is not considered a critical facility. In addition, in the executive summary it states:

"We recommend that all developers, owners, and potential owners be advised of the potential seismic hazards, including ground shaking, tectonic subsidence and related flooding, and liquefaction. For facilities designed according to the IBC seismic provisions and located within the "moderated" or "high" liquefaction hazard zones identified on Figure 6, we recommend that the Site Class be based on a site-specific subsurface investigation to a depth of at least 30 feet. Supplemented by at least one investigation to a depth of at least 70 feet and located within 2,000 feet of the site."

Boring AF-06-3 is located within 2,000 feet of the site

General Conditions

The information presented in this letter applies only to the soils encountered during the field investigation on the subject site. It should be noted that Earthtec Engineering was not involved with the selection of the foundation system being used, surface drainage control, floor slab design and construction, backfill compaction requirements against foundation walls, mass grading of the site, or any other aspect of the building construction. Site grading activities completed in other areas such as driveways, sidewalks, or detached structures, were not observed during this site visit, are outside of the scope of our work and are not addressed in this letter. The observations and recommendations presented in this letter were conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in this area at this time. No warranty or representation is intended in our proposals, contracts, reports, or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

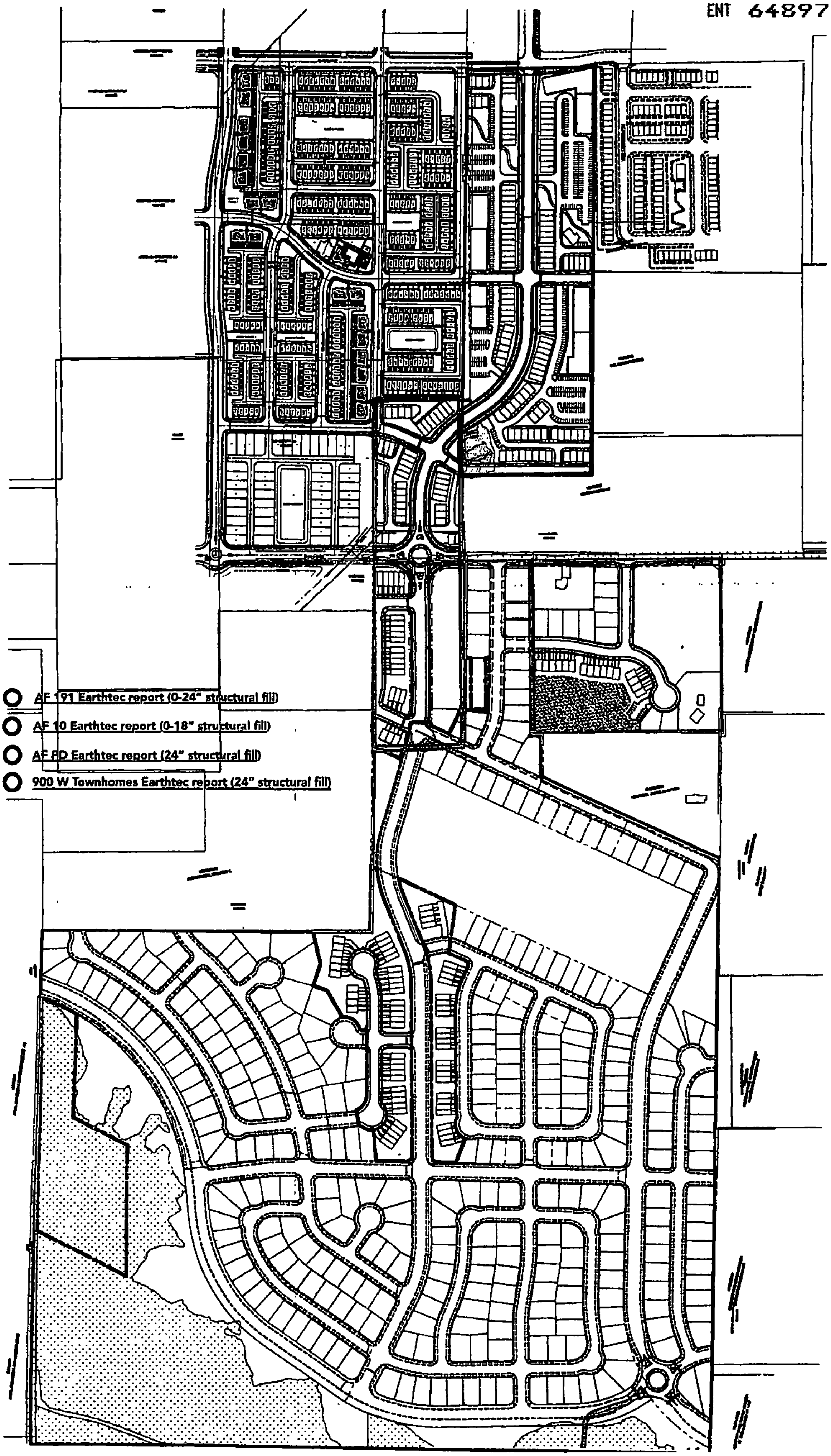
Respectfully;
EARTHTEC ENGINEERING

No. 5567049-2202
TIMOTHY ALLAN MITCHELL
Electronically generated on 4/20/2022

Jeremy A. Balleck, E.I.T.
Staff Engineer

Timothy A. Mitchell, P.E.
Senior Geotechnical Engineer

JB/tm


○ AF 191 Earthtec report (0-24" structural fill)
○ AF 10 Earthtec report (0-18" structural fill)
○ AF PD Earthtec report (24" structural fill)
○ 900 W Townhomes Earthtec report (24" structural fill)