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

ENT 153298:2021 PG 1 of 85
ANDREA ALLEN
UTAH COUNTY RECORDER
2021 Sep 02 11:57 am FEE 0.00 BY JG
RECORDED FOR AMERICAN FORK CITY

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

This Notice is recorded to bind the attached Geotechnical Study dated 4/15/2020 along with the site grading plan to the property generally located at 1100 W 250 S (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 11 day of MARCH, 20 21.

OWNER(S):

(Signature)

JASON E. TOKARSKI
(Printed Name)

MEMBER
(Title)

(Signature)

JASON E. TOKARSKI
(Printed Name)

MEMBER
(Title)

STATE OF UTAH)
§
COUNTY OF Salt Lake)

On the 11 day of March, 2021, personally appeared before me Jason E. Tokarski 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.

RUTH LARSEN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 695380
COMM. EXP. 07-02-2021

Ruth Larsen
Notary Public
My Commission Expires: 07-26-2021

Approved as to form: American Fork City Attorney

Rev. 12/4/18

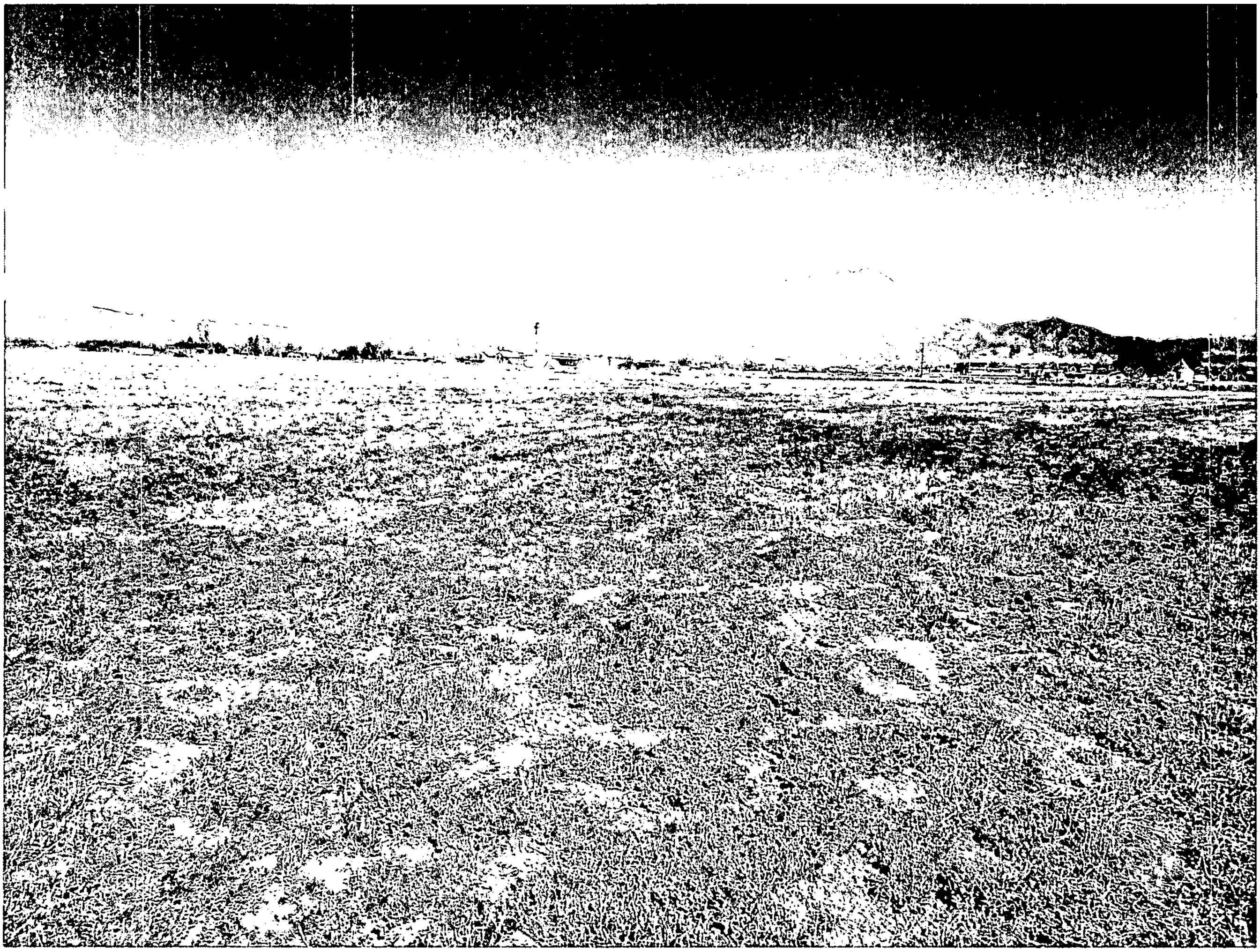
EXHIBIT 1: Legal Description

Beginning at a point being North 89°59'22" East, 1,195.73 feet along section line and South 45.03 feet from the West Quarter Corner of Section 22, Township 5 South, Range 1 East Salt Lake Base & Meridian, and running;

thence Northwesterly 31.53 feet along the arc of a 20.00 foot radius curve to the right (center bears North 00°36'30" East and the chord bears North 44°13'28" West 28.37 feet with a central angle of 90°20'03");
thence North 00°56'33" East 78.13 feet;
thence Northwesterly 187.86 feet along the arc of a 792.00 foot radius curve to the left (center bears North 89°03'27" West and the chord bears North 05°51'10" West 187.42 feet with a central angle of 13°35'26");
thence North 12°38'53" West 163.84 feet;
thence Northwesterly 167.94 feet along the arc of a 708.00 foot radius curve to the right (center bears North 77°21'07" East and the chord bears North 05°51'10" West 167.54 feet with a central angle of 13°35'26");
thence North 00°56'33" East 114.14 feet;
thence Northeasterly 31.19 feet along the arc of a 20.00 foot radius curve to the right (center bears South 89°03'27" East and the chord bears North 45°37'01" East 28.12 feet with a central angle of 89°20'56");
thence South 89°42'31" East 600.72 feet;
thence Southeasterly 31.52 feet along the arc of a 20.00 foot radius curve to the right (center bears South 00°17'29" West and the chord bears South 44°33'18" East 28.36 feet with a central angle of 90°18'26");
thence South 00°35'56" West 712.78 feet;
thence Southwesterly 23.56 feet along the arc of a 15.00 foot radius curve to the right (center bears North 89°24'05" West and the chord bears South 45°36'13" West 21.21 feet with a central angle of 90°00'35");
thence North 89°23'30" West 529.44 feet to the point of beginning.

Contains 450,463 Square Feet or 10.341 Acres

GeoStrata



Geotechnical Investigation

American Fork TOD

6941 West 7750 North
American Fork, Utah

April 15, 2020

Prepared For:

Neighborly Ventures
Attention: Mr. David Jacobson
2925 River Road South, Suite 100
Salem, Oregon 97302

GeoStrata Job No. 1524-001

Office - 14425 South Center Point Way Bluffdale, Utah 84065
Phone (801) 501-0583 | Fax (801) 501-0584

GeoStrata 14425 South Center Point Way Bluffdale, Utah 84065
T: (801) 501-0583 ~ F: (801) 501-0584

Prepared for:

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Attention: David Jacobsen
2925 River Road South, Suite 100
Salem, Oregon 97302

Geotechnical Investigation
American Fork TOD
Approximately 6941 West 7750 North
American Fork, Utah

GeoStrata Job No. 1524-001

4/15/2020
10183430-2202
CALEB RICHARD ALLRED

Caleb R. Allred, P.E.
Project Geotechnical Engineer

Reviewed by:

J. Scott Seal, P.E.
Geotechnical Manager

GeoStrata
14425 South Center Point Way
Bluffdale, UT 84065
(801) 501-0583

April 15, 2020

TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

This report presents the results of a geotechnical investigation conducted for the proposed **Error! Reference source not found.** which is to consist of 14 buildings that are 3-story garden style apartments to be located in American Fork, Utah. The purposes of this investigation were to assess the nature and engineering properties of the subsurface soils at the proposed site and to provide recommendations for general site grading and the design and construction of pavement, foundations, and slabs-on-grade.

Based on the subsurface conditions encountered at the site, it is our opinion that the subject site is suitable for the proposed construction provided that the recommendations contained in this report are complied with. Subsurface conditions were investigated through the advancement of ten exploratory test pits. Test pits ranged from 6 to 10 ½ feet below the existing grade. Based on our observations, the subject property is underlain by Pleistocene-aged Bonneville regressive lake cycle deposits. Groundwater was encountered in each of the test pits advanced for this project at a depth ranging from 2 ½ to 5 feet.

Foundations for the proposed structure may consist of conventional strip and/or spread footings founded on a minimum of 18 inches of properly compacted structural fill that extend to suitable native soils. Conventional strip and spread footings founded on undisturbed, native soils or on a minimum of 18-inches of properly placed and compacted structural fill may be proportioned for a maximum net allowable bearing capacity of **1,600 psf**. Due to the presence of relatively shallow groundwater, it is recommended that all final top of slab elevations be maintained a minimum of 36 inches above the groundwater elevation unless foundation drain systems are installed. Recommendations for general site grading, design of foundations, slabs-on-grade, moisture protection as well as other aspects of construction are included in this report.

A laboratory obtained CBR of 1.9 for near-surface soils was utilized in the pavement design. Based on assumed traffic loads, a pavement section of 3 inches of asphalt over 8 inches of untreated base course over 16 inches of granular borrow. Alternatively, a pavement section of 3 inches of asphalt over 20 inches of untreated base course may be utilized. Recommendations for general site grading, design of foundations, slabs-on-grade, moisture protection as well as other aspects of construction are included in this report.

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGIEERING REPORT:

Do not rely on the executive summary. The executive summary omits a number of details, any one of which could be crucial. Read and refer to the report in full. Do not rely on this report if this report was prepared for a different client, different project, different purpose, different site, and/or before important events occurred at the site or adjacent to it. All recommendations in this report are confirmation dependent. A two-page document prepared by GBA explains these items with greater detail is found in Appendix D (Plates D-1 and D-2).

2.0 INTRODUCTION

2.1 PURPOSE AND SCOPE OF WORK

This report presents the results of a geotechnical investigation conducted for the proposed 10-acre property located at approximately 6941 West 7750 North in American Fork, Utah. The purposes of this investigation were to supplement a previously completed geotechnical investigation completed for a larger property in 2019 by GeoStrata, the results of which are presented in a report titled "Geotechnical Investigation, Ted Frandsen Property, 6941 West 7750 North, American Fork, Utah." Based on our understanding of the project, this portion of the development will consist of a clubhouse and 14 buildings that are 3-story garden style apartment buildings to be constructed on 10 acres of property. Our scope includes an exploration at each of the proposed structures to assess the nature and engineering properties of the subsurface soils at the subject site and to provide recommendations for general site grading and the design and construction of foundations and slabs-on-grade.

The scope of work completed for this study included a site reconnaissance, subsurface exploration, soil sampling, laboratory testing, engineering analyses, and preparation of this report. Our services were performed in accordance with our proposal and signed authorization, dated March 4, 2020. The recommendations contained in this report are subject to the limitations presented in the "Limitations" section of this report.

2.2 PROJECT DESCRIPTION

The roughly rectangular-shaped project site is located just south of 6941 West 7750 North in American Fork, Utah (see Plate A-1, Site Vicinity Map). Based on information provided from the client, we understand that the proposed development will consist of a central clubhouse and 14 buildings that are 3-story garden style apartments. Structural plans were not available at the time this report was prepared; however, we anticipate footing loads on the order of 3 to 6 kips per lineal foot and column loads of up to 80 kips.

3.0 METHOD OF STUDY

3.1 SUBSURFACE INVESTIGATION

As part of this investigation, subsurface conditions were investigated through the advancement of ten exploratory test pits. The test pits were advanced to depths ranging from 6 to 10½ feet below the existing site grade. During our 2019 geotechnical investigation (completed for a larger property that includes the subject property), GeoStrata advanced four exploratory test pits (TP-1, TP-2, TP-3, and TP-7) and one exploratory borehole (B-1) within the subject 10-acre parcel. The test pits excavated as part of our 2019 investigation ranged in depth from 7½ to 12 feet below the existing site grade while the borehole persisted to a depth of 51½ feet below the site grade. Information obtained from our current field investigation will be supplemented with information obtained from our 2019 investigation. The approximate locations of both our 2020 and 2019 explorations are shown on the *Exploration Location Map*, Plate A-2 in Appendix A. The exploration points were selected to provide an exploration near each of the proposed structures and provide a representative cross section of the subsurface soil conditions. Subsurface soil conditions as encountered in the explorations were logged at the time of our investigation by a qualified geotechnical engineer and are presented on the enclosed Test Pit and Boring Logs, B-1 to B-19 in Appendix B. A fence diagram of the boreholes is included on Plate B-20 in Appendix B. A *Key to USCS Soil Symbols and Terminology* is presented on Plate B-21.

All samples were transported to our laboratory for testing to evaluate engineering properties of the various earth materials observed. The soils were classified according to the *Unified Soil Classification System* (USCS) by the Geotechnical Engineer. Classifications for the individual soil units are shown on the attached Exploration Logs B-1 to B-19.

3.2 LABORATORY TESTING

Geotechnical laboratory tests were conducted on samples obtained during our field investigation. The laboratory testing program was designed to evaluate the engineering characteristics of onsite earth materials. Laboratory tests conducted during this investigation include:

- Grain Size Distribution Analysis (ASTM D422)
- Atterberg Limits Test (ASTM D4318)
- Density-Moisture Relationship Test (Proctor Test) (ASTM D698)
- California Bearing Ratio Test (CBR) (ASTM D1883-05)
- Collapse Potential Test (ASTM D 5333)

- 1-D Consolidation Test (ASTM D2435)
- Water-soluble sulfate concentration for cement type recommendations
- Resistivity and pH to evaluate corrosion potential of ferrous metals in contact with site soils.

The results of laboratory tests are presented on the Exploration Logs in Appendix B (Plates B-1 to B-19), the Laboratory Summary Table and the test result plates presented in Appendix C (Plates C-1 and C-18).

3.3 ENGINEERING ANALYSIS

Engineering analyses were performed using soil data obtained from the laboratory test results and empirical correlations from material density, depositional characteristics and classification. Appropriate factors of safety were applied to the results consistent with industry standards and the accepted standard of care.

4.0 GENERALIZED SITE CONDITIONS

4.1 SURFACE CONDITIONS

During the time of out investigation, the property currently existed as agricultural land planted in alfalfa. The northern most boundary of the property was approximately 330 feet south of 7750 N. Access to the property was through an unmarked dirt road running along the western most boundary of the property. During the time of our investigation a 2 foot dich had been dug along the western property boundary. The site is relatively flat, having a maximum topographic relief of approximately 6¼ feet.

4.2 SUBSURFACE CONDITIONS

As mentioned previously, the subsurface conditions were investigated through the advancement of ten exploratory test pits, four previously completed exploratory test pits, and one previously completed exploratory boring. The test pits ranged from 6 to 12 feet below the existing grade, and the boring extended to 51½ feet below the existing grade. Subsurface soil conditions as encountered in the explorations were logged at the time of our investigation by a qualified geotechnical engineer and are presented on the enclosed Test Pit and Boring Logs, Plates B-1 to B-19 in Appendix B. A Key to USCS Soil Symbols and Terminology is presented on Plate B-21. The soil and moisture conditions encountered during our investigation are discussed below.

4.2.1 Soils

Based on our observations and geologic literature review, the subject area is overlain by 1½ feet of organic rich topsoil comprised of clay. Underlying the topsoil, we encountered deposits that are mapped by Machette (1992) as consisting of Pleistocene-aged fine-grained and coarse-grained lacustrine deposits associated with the transgressive phase of the Bonneville lake cycle. Descriptions of the soil units encountered are described below:

Topsoil: Where observed, the topsoil consisted of a moist, dark brown to black clay. This unit was observed to have an organic appearance and texture, with roots throughout. Approximately 18-inches of topsoil were encountered in each of the test pits and in the bore hole and is expected to overlie the majority of the site.

Pleistocene-aged Lacustrine Deposits: Fine-grained deposits were encountered in each of explorations and were generally observed to consist of fine-grained soils overlying coarse-grained soils. The fine-grained soils consisted of soft to stiff, moist to wet, brown to grey-brown, Lean CAY (CL) and SILT (ML) each with various amounts of fine- to medium-grained sand and gravel. These deposits occasionally contained fine pinholes throughout. Coarse-grained soils were encountered in our borehole exploration at a depth of 20 feet, and consisted of loose to dense, medium brown to black, wet Silty SAND (SM) with inner-bedded laminations approximately 1 foot thick of SILT (ML) and Lean CLAY(CL). These deposits persisted to the full depth of our explorations (51½ feet).

The stratification lines shown on the enclosed Borehole and Test Pit Logs represent the approximate boundary between soil types. The actual in-situ transition may be gradual. Due to the nature and depositional characteristics of the native soils, care should be taken in interpolating subsurface conditions between and beyond the exploration locations.

4.2.2 Groundwater Conditions

Groundwater was encountered in each of the site explorations at depths ranging from 2½ to 5 feet below the existing site grade. GeoStrata previously installed piezometers at the site in 2019 to measure the depth of groundwater at a later time in order to get additional groundwater elevation measurements after the groundwater elevation had equilibrated. GeoStrata returned to the site on March 30, 2020 in order to take additional readings. The results of our readings are summarized in the following table;

Piezometer Location	Depth to Groundwater (ft.)
TP-3 (2019)	4.5
TP-7 (2019)	4

The fence diagram on Plate B-20 in Appendix B shows groundwater between the elevation of 4509 and 4514 feet. Seasonal fluctuations in precipitation, surface runoff from adjacent properties, or other on or offsite sources may increase moisture conditions; groundwater conditions can be expected to rise several feet seasonally depending on the time of year. Due to the potential presence of elevated groundwater as well as the fine-grained nature of the exposed soils, it is recommended that foundation drains be incorporated into the design of the project. Recommendations concerning the foundation drains may be found in Section 6.6 of this report.

4.2.3 Hydro-Collapse Potential

Collapse (often referred to as "hydro-collapse") is a phenomena whereby undisturbed soils exhibit volumetric strain and consolidation upon wetting under increased loading conditions. Collapsible soils can cause differential settling of structures and roadways. Collapsible soils do not necessarily preclude development and can be mitigated by over-excavating porous, potentially collapsible soils and replacing with engineered fill and by controlling surface drainage and runoff. For some structures that are particularly sensitive to differential settlement, or in areas where collapsible soils are identified at great depth, a deep foundation system should be considered.

Soils that have a potential to collapse under increased loading and moisture conditions are typically characterized by a pinhole structure and relatively low unit weights. In general, potentially collapsible soils are observed in fine-grained soils that include clay and silt, although collapsible soils may include sandy soils. Results of our laboratory testing indicated that the subsurface soils have a low collapse potential, with the collapse potential ranging from 0.03 to 0.24 percent. As such, it is anticipated that collapsible soils will not present a risk to the foundation elements within the proposed development if the recommendations presented in this report are incorporated into the design and construction of the structures.

4.2.4 Compressible Soils

A soil's compressibility is a function of several properties of the soil, as well as on the depositional history and previously loading of the material. Soils with relatively low OCR (Over Consolidation Ratio) are more likely to experience excessive settlement when a load from a footing or other source is applied. GeoStrata completed a total of six consolidation tests on samples obtained during our field investigation. Results of our testing indicate that the near-surface fine-grained soils have the potential to settle excessively upon loading. As such, it is likely that highly compressible soils are present at the site. Remediation of these soils includes over-excavation and replacement with properly placed and compacted structural fill.

5.0 GEOLOGIC CONDITIONS

5.1 GEOLOGIC SETTING

The site is located in American Fork, Utah, at an elevation ranging from approximately 4,513 to 4,519 feet above sea level in the Utah Valley. The Utah Valley represents a deep, sediment-filled structural basin of Cenozoic age flanked by uplifted blocks, the Wasatch Range on the east, and the Lake and East Tintic Mountains on the west. The Wasatch Range is the easternmost expression of pronounced Basin and Range extension in north-central Utah.

The near-surface geology of the Utah Valley is dominated by sediments, which were deposited within the last 30,000 years by Lake Bonneville (Hintze, 1993). The lacustrine sediments near the mountain front consist mostly of gravel and sand. As the lake receded, streams began to incise large deltas formed at the mouths of major canyons along the Wasatch Range, and the eroded material was deposited in shallow lakes and marshes in the basin and in a series of recessional deltas and alluvial fans. Sediments toward the center of the valley are predominately deep-water deposits of clay, silt and fine sand. However, these deep-water deposits are in places covered by a thin post-Bonneville alluvial cover. Most surficial deposits along the Wasatch fault zone were deposited during the Bonneville Lake Cycle that was the last cycle of Lake Bonneville between approximately 32 to 10 ka (thousands of years ago) and in the Holocene (< 10 ka). As mentioned previously, the surficial sediments at the site are mapped as consisting of Pleistocene- to Holocene-aged fine-grained lacustrine deposits associated with the transgressive phase of the Bonneville lake cycle.

5.2 SEISMICITY AND FAULTING

The site lies within the north-south trending belt of seismicity known as the Intermountain Seismic Belt (ISB) (Hecker, 1993). The ISB extends from northwestern Montana through southwestern Utah. There are no known active faults that pass under or immediately adjacent to the subject property (Black and others, 2003). An active fault is defined as a fault that has had activity within the Holocene (<11ka). No active faults are mapped through or immediately adjacent to the site (Black and others, 2003, and Machette, 1992). The site is located approximately 5 miles southwest of the Provo section of the Wasatch Fault Zone. The Provo segment is one of the longest sections of the Wasatch Fault Zone (Hecker, 1993) and is estimated to be approximately 43 miles long with a reported rupture length of 37 miles and a maximum potential to produce earthquakes up to magnitude (M_s) 7.5 to 7.7 (Black et al, 2003). During the

Quaternary Period there is evidence that as many as 10 to 15 earthquakes have occurred along this segment in the last 15,000 years (Hecker, 1993). The site is also located approximately 2½ miles northeast of the mapped Utah Lake Faults and Folds (ULFF). The ULFF consists of several northeast- to northwest-trending faults and folds located beneath Utah Lake and are reported to have been active in the past 15 ka (Black et al, 2003). However, since the ULFF is at the bottom of a large lake these faults are poorly understood – as such, the USGS does not include ULFF in their fault database for seismic hazard analysis. Analysis of the ground shaking hazard along the Wasatch Front suggests that the Wasatch Fault Zone is the single greatest contributor to the seismic hazard in the Salt Lake City region. Each of the faults listed above show evidence of Holocene-aged movement, and is therefore considered active.

Spectral responses for the Risk-Targeted Maximum Considered Earthquake (MCE_R) are shown in the table below. These values generally correspond to a one percent probability of structure collapse in 50 years for a "firm rock" site. To account for site effects, site coefficients which vary with the magnitude of spectral acceleration are used. Based on our field exploration to 50 feet, it is our opinion that this location is best described as a Site Class D (default). The spectral accelerations are calculated based on the site's approximate latitude and longitude of 40.3710° and -111.8252° respectively and the Seismic Design Maps web-based application at https://seismicmaps.org/.

Description	Value
Site Class	D
S_s - MCE_R ground motion (period – 0.2s)	1.231
S_1 - MCE_R ground motion (period – 1.0s)	0.445
F_a - Site amplification factor at 1.0s	1.200
F_v - Site amplification factor at 1.0s	1.855
PGA - MCE_G peak ground acceleration	0.55
PGA_M – Site modified peak ground acceleration	0.605

It should be noted that our investigation did not include a site-specific ground motion hazard analysis and a Site Class D (default) has been used to determine the seismic parameters presented above based on SPT blowcount and seismic shear wave velocity correlations (Wair et al, 2012) to the maximum depths explored of 51½ feet. The seismic parameters presented herein may be used for design of the proposed structures provided that structural design allows for the ground motion hazard analysis exception in ASCE 7-16 Section 11.4.8. Alternatively, GeoStrata may be contacted to complete a ground motion hazard analysis in accordance with ASCE 7-16 Chapter 21.

5.3 LIQUEFACTION

Certain areas within the intermountain region possess a potential for liquefaction during seismic events. Liquefaction is a phenomenon whereby loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup resulting from dynamic loading, such as that caused by an earthquake. Among other effects, liquefaction can result in densification of such deposits causing settlements of overlying layers after an earthquake as excess pore water pressures are dissipated. The primary factors affecting liquefaction potential of a soil deposit are: (1) level and duration of seismic ground motions; (2) soil type and consistency; and (3) depth to groundwater.

Based on our review of the *Liquefaction Special Study Areas, Wasatch Front and Nearby Areas, Utah*, the site is located in an area currently designated as having a "High" liquefaction potential. "High" liquefaction potential indicates that the area has a 50 percent probability of having an earthquake within a 100-year period that will be strong enough to cause liquefaction. The near-surface soils observed within our test pits consisted largely of fine-grained soils with interbedded seams of coarse sand. Groundwater was observed to be at depths ranging from 2½ to 5 feet below the surface. Due to the mapped designation, the potential for liquefaction at the site was assessed by using Rocscience's Settle3 Liquefaction analysis. This program used Idriss and Boulanger (2004) and NCEER (1997) equations and methods to determine when liquefaction is triggered, and calculates settlement according to the equations, and methods presented the following published procedures: Ishihara & Yoshimine (1992), Tokimatsu & Seed (1984), Wu (2003), Cetin (2009) and Pradel (2009). Our analysis considered the design-level seismic event (an event with a 2 percent probability of occurrence in 50 years, or an event having a 2,475-year average return period). This is a slight deviation from the Martin and Lew 1999 recommendations, which recommends that the 10 percent in 50 years ground motion (10PE50/ARP 475 years), or *Design Basis Earthquake* (DBE) should be used for analysis. Our analysis also considered the deaggregation targets of the seismic event is estimated to produce a maximum PGA of 0.55g and the moment magnitude for the site (the earthquake magnitude having the greatest contribution to the hazard), which is estimated to be 7.03 Mw (https://earthquake.usgs.gov/hazards/interactive/).

Based on our analysis, soil layers encountered at depths between 34 to 45 feet are considered susceptible to liquefaction during a design-level seismic event. The analysis suggests approximately 6 inches of liquefaction-induced settlement could occur as a result of a design level seismic event occurring at the site.

We evaluated the potential for surface manifestations and damage arising from liquefaction based on the Ishihara (1985) method, assuming existing soil conditions. The Ishihara liquefaction-induced-damage curve used is for a 0.19g maximum ground acceleration (the 200 gal curve on the Ishihara chart), which is appropriate for the site considering magnitude scaling factors (in Japan, a magnitude scaling factor is typically applied to the PGA to account for a 7.7-7.8 Mw). Based on this analysis, there appears to be a 96 percent probability of 1½ inches of settlement making a surface manifestation and related damage from liquefaction for existing soil conditions.

Estimates of seismically-induced settlement are addressed in Section 6.3.4.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

6.1 GENERAL CONCLUSIONS

Supporting data upon which the following recommendations are based have been presented in the previous sections of this report. The recommendations presented herein are governed by the physical properties of the earth materials encountered and tested as part of our subsurface exploration and the anticipated design data discussed in the **PROJECT DESCRIPTION** section. If subsurface conditions other than those described herein are encountered in conjunction with construction, and/or if design and layout changes are initiated, GeoStrata must be informed so that our recommendations can be reviewed and revised as changes or conditions may require.

Based on the subsurface conditions encountered at the site, it is our opinion that the subject site is suitable for the proposed development provided that the recommendations contained in this report are incorporated into the design and construction of the project.

Based on our field observations, the site is overlain by approximately 18 inches of clayey topsoil. It is recommended that this topsoil unit be removed in all areas underlying proposed structures, fill sections, concrete flatwork, or pavement sections. It is likewise recommended that this material not be used as structural fill in these areas, but may be utilized in landscaped areas.

As mentioned previously, groundwater was measured in our test pits and piezometers as being located at a depth ranging from 2½ to 5 feet below the existing site grade. As such, GeoStrata recommends that all top of slab elevations be maintained a minimum of 36-inches above the groundwater elevation unless foundation drains be incorporated into the design of the project. In addition, the contractor should anticipate using a dewatering system and additional shoring in all excavations extending deeper than 2 feet.

The following sub-sections present our recommendations for general site grading, design of foundations, slabs-on-grade, and lateral earth pressures.

6.2 EARTHWORK

Prior to the placement of foundations, general site grading is recommended to provide proper support for foundations, exterior concrete flatwork, and concrete slabs-on-grade. Site grading is also recommended to provide proper drainage and moisture control on the subject property and to aid in preventing differential settlement of foundations as a result of variations in subgrade moisture conditions.

6.2.1 General Site Preparation and Grading

Within areas to be graded (below proposed structures, fill sections, concrete flatwork, or pavement sections), any existing vegetation, topsoil, undocumented fill, debris, or otherwise unsuitable soils should be removed. Any soft, loose, or disturbed soils should also be removed. If over-excavation is required, the excavation should extend a minimum of one foot laterally for every foot of depth of over-excavation. Excavations should extend laterally at least two feet beyond flatwork, pavements, and slabs-on-grade. Following the removal of vegetation, topsoil, undocumented fill, unsuitable soils, and loose or disturbed soils, as described above, site grading may be conducted to bring the site to design elevations.

Based on our observations of the test pits and borehole excavated for the site investigation, there are approximately 18 inches of topsoil overlying the subject site. This material should be removed prior to placement of structural fill, structures, concrete flatwork and roadways. In addition, all undocumented fill soils (if encountered) should likewise be removed. A GeoStrata representative should observe the site preparation and grading operations to assess that the recommendations presented in this report are complied with.

6.2.2 Soft Soil Stabilization

Soft or pumping soils may be exposed in excavations at the site. Once exposed, all subgrade surfaces beneath proposed structure, pavements, and flat work concrete should be proof rolled with a piece of heavy wheeled-construction equipment. If soft or pumping soils are encountered, these soils should be stabilized prior to construction of footings. Stabilization of the subgrade soils can be accomplished using a clean, coarse angular material worked into the soft subgrade. We recommend the material be greater than 2-inch diameter, but less than 6 inches. A locally available pit-run gravel may be suitable but should contain a high percentage of particles larger than 2 inches and have less than 7 percent fines (material passing the No. 200 sieve). A pit-run gravel may not be as effective as a coarse, angular material in stabilizing the soft soils and may require more material and greater effort. The stabilization material should be worked (pushed) into the soft subgrade soils until a firm relatively unyielding surface is established. Once a firm, relatively unyielding surface is achieved, the area may be brought to final design grade using structural fill.

In large areas of soft subgrade soils, stabilization of the subgrade may not be practical using the method outlined above. In these areas it may be more economical to place a woven geotextile fabric against the soft soils covered by 18 inches of coarse, sub-rounded to angular material over the woven geotextile. An inexpensive non-woven geotextile "filter" fabric should also be placed over the top of the coarse, sub-rounded to rounded fill prior to placing structural fill or pavement section soils to reduce infiltration of fines from above. The woven geotextile should be Amoco 2004 or prior approved equivalent. The filter fabric should consist of an Amoco 4506, Amoco 4508, or equivalent as approved by the Geotechnical Engineer.

6.2.3 Excavation Stability

Based on Occupational Safety and Health Administration (OSHA) guidelines for excavation safety, trenches with vertical walls up to 5 feet in depth may be occupied, however, the presence of fill soils, loose soils, or wet soils may require that the walls be flattened to maintain safe working conditions. When the trench is deeper than 5 feet, we recommend a trench-shield or shoring be used as a protective system to workers in the trench. Based on our soil observations, laboratory testing, and OSHA guidelines, native soils at the site classify as Type C soils. Deeper excavations, if required, should be constructed with side slopes no steeper than one and one-half horizontal to one vertical (1.5H:1V). If wet conditions are encountered, side slopes should be further flattened to maintain slope stability. Alternatively shoring or trench boxes may be used to improve safe work conditions in trenches. The contractor is ultimately responsible for trench and site safety. Pertinent OSHA requirements should be met to provide a safe work environment. If site specific conditions arise that require engineering analysis in accordance with OSHA regulations, GeoStrata can respond and provide recommendations as needed.

We recommend that a GeoStrata representative be on-site during all excavations to assess the exposed foundation soils. We also recommend that the Geotechnical Engineer be allowed to review the grading plans when they are prepared in order to evaluate their compatibility with these recommendations.

6.2.4 Structural Fill and Compaction

All fill placed for the support of structures, concrete flatwork, or pavements should consist of structural fill. The native clayey soils may be utilized as structural fill; however, the contractor should be aware that native silt and clay soils may be difficult to moisture condition and compact. The contractor should have confidence that he anticipated method of compaction will be suitable for the type of structural fill used. All structural fill should be free of vegetation, debris or frozen material, and should contain no inert materials larger than 4 inches nominal size. Alternatively, an imported structural fill meeting the specifications below may be used. If soil is imported for use as structural fill, we recommend that it be a relatively well graded granular soil with a maximum of 50 percent passing the No. 4 mesh sieve and a maximum fines content (minus No.200 mesh sieve) of 25 percent. All structural fill soils should be approved by the Geotechnical Engineer prior to placement. Clay and silt particles in imported structural fill should have a liquid limit less than 35 and a plasticity index less than 15 based on the Atterberg Limit's test (ASTM D-4318). The contractor should anticipate testing all soils used as structural fill frequently to assess the maximum dry density, fines content, and moisture content, etc.

Soils not meeting the aforementioned criteria may be suitable for use as structural fill. These soils should be evaluated on a case-by-case basis and should be approved by the Geotechnical Engineer prior to use.

All structural fill should be placed in maximum 6-inch loose lifts if compacted by small hand-operated compaction equipment, maximum 8-inch loose lifts if compacted by light-duty rollers, and maximum 10-inch loose lifts if compacted by heavy duty compaction equipment that is capable of efficiently compacting the entire thickness of the lift. We recommend that all structural fill be compacted on a horizontal plane, unless otherwise approved by the geotechnical engineer. Structural fill should be compacted to at least 95% of the maximum dry density as determined by ASTM D-1557 where total fill thickness is less than 5 feet. Where total structural fill thickness is 5 feet or more, structural fill should be compacted to at least 98% of the maximum dry density (ASTM D-1557). The moisture content should be at or slightly above the optimum moisture content at the time of placement and compaction. Also, prior to placing any fill, the excavations should be observed by the geotechnical engineer to observe that any unsuitable materials or loose soils have been removed. In addition, proper grading should precede placement of fill, as described in the **General Site Preparation and Grading** subsection of this report (Section 6.2.1).

The gradation, placement, moisture, and compaction recommendations contained in this section meet our minimum requirements but may not meet the requirements of other governing agencies such as city, county, or state entities. If their requirements exceed our recommendations, their specifications should override those presented in this report.

6.3 FOUNDATIONS

The foundations for the proposed structures may consist of conventional strip and/or spread footings. Strip and spread footings should be a minimum of 20 and 36 inches wide, respectively, and exterior shallow footings should be embedded at least 30 inches below final grade for frost protection and confinement. Interior foundation elements not subjected to the effects of frost should be embedded a minimum of 18 inches for confinement.

6.3.1 Installation and Bearing Material

Due to the presence of moderately compressible soils at the site, it is recommended that foundation elements should be established on a minimum of 18-inches of properly placed and compacted structural fill that extend to suitable native soils. Foundation elements should not be established on topsoil, frozen soils, rubbish, undocumented fill soils, or otherwise unsuitable soils, and if these soils are encountered, they should be over-excavated until suitable, native soils are exposed. The site may then be brought back up to design grade using properly placed and compacted structural fill. Structural fill should meet material recommendations and be placed and compacted as recommended in Section 6.2.4 of this report.

6.3.2 Bearing Pressure

Conventional strip and spread footings founded as described above may be proportioned for a maximum net allowable bearing capacity of **1,600 pounds per square foot (psf).** The recommended net allowable bearing pressure refers to the total dead load and can be increased by 1/3 to include the sum of all loads including wind and seismic.

6.3.3 Static Settlement

Settlements of properly designed and constructed conventional footings, founded as described above, are anticipated to be less than 1 inch. Differential settlements should be on the order of half the total settlement over 30 feet.

6.3.4 Dynamic Settlement

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

We have performed analyses to estimate the potential dynamic settlement using the methods developed by Tokimatsu and Seed (1987), based on the MCE ground motion. Our analysis was conducted for borehole B-1 and is based on existing soil conditions with groundwater assumed at 5 feet below the existing ground surface. Based on our analysis, the potential *total* dynamic settlement occurring as a result of a design-level seismic event is *calculated* to be approximately 6 inches.

Surface manifestation of liquefaction, including total and differential settlement, will likely be somewhat less than calculated, since the site is underlain by approximately 34 feet of non-liquefiable soil. It is our qualitative engineering judgment that the potential for surface manifestation of liquefaction at this site is low (see discussion in Section 5.3). As such, for design purposes, GeoStrata recommends that dynamic differential settlement be modeled as 1½ inches over a horizontal distance of 40 feet. Recommendations for the mitigation of this settlement are provided in Section 6.3.5 of this report.

6.3.5 Granular Columns and Helical Piers

If the foundations for the proposed structures cannot be designed to withstand up to 1½-inches of differential settlement due to liquefaction, the foundations should be supported on either granular columns or a deep foundation system such as helical piers. Granular columns are the preferred method because they will substantially reduce or eliminate the potential for liquefaction of the native soil if properly designed and installed. Granular columns are particularly effective in controlling liquefaction because they reduce the potential for it in four ways: (1) Reduce the shearing stresses on the native soil due to stress concentration within the stiffer granular columns; (2) they act as drainage wells, thereby allowing generated excess pore water pressures to dissipate rapidly, resulting in lower magnitudes of excess pore water pressure; (3) they increase the density of the native soil; and (4) they increase the confining pressures in the native soil. Research conducted in New Zealand by the University of Texas at Austin following the 2010-2011 Christchurch earthquakes in which liquefaction was a major hazard, proved the effectiveness of granular columns, and in particular Geopier Rammed Aggregate Piers, in controlling liquefaction. The granular columns should extend throughout the liquefiable sand layers observed in the range of 5 to 18 feet below the existing site grade. A contractor specializing in granular column design and installation should be consulted for the design and installation of granular columns if they are used to support the concrete pad.

Deep foundations (piles) are typically not a good choice of foundation support in granular soils that are expected to undergo significant deformations due to liquefaction. Post-earthquake evaluations have shown that piles will typically shear off along the bottom of the footing when significant liquefaction occurs in the soils beneath the footing. In addition, piles do not reduce the potential for liquefaction to any significant degree. However, in this case, because of time constraints and the relatively small movements anticipated from liquefaction, deep foundations may be a viable alternative. One option in this case is the use of helical piers. A helical pier is a steel shaft, usually square, with helices similar to a large screw that can provide foundation support to various types of structures. Helical pier foundations should be designed to penetrate below the liquefiable soil layer, which extends to depths of approximately 18 to 20 feet in each of the borings and CPT soundings advanced for this investigation, and bear on a competent layer of soil or rock. A helical pier contractor should be consulted for design of helical pier foundations.

6.3.6 Frost Depth

All exterior footings are to be constructed at least 30 inches below the ground surface for frost protection and confinement. This includes walk-out areas and may require fill to be placed around buildings. Interior footings not susceptible to frost conditions should be embedded at least 18 inches for confinement. If foundations are constructed through the winter months, all soils on which footings will bear shall be protected from freezing.

6.3.7 Construction Observation

A geotechnical engineer shall periodically monitor excavations prior to installation of footings. Inspection of soil before placement of structural fill or concrete is required to detect any field conditions not encountered in the investigation which would alter the recommendations of this report. All structural fill material shall be tested under the direction of a geotechnical engineer for material and compaction requirements.

6.4 EARTH PRESSURES AND LATERAL RESISTANCE

Lateral forces imposed upon conventional foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footing and the supporting subgrade. In determining the frictional resistance, coefficient of friction of 0.35 should be used for fine-grained native soils against concrete. A coefficient of friction of 0.44 should be used for coarse-grained native soils against concrete.

Ultimate lateral earth pressures from *granular* backfill acting against buried walls and structures may be computed from the lateral pressure coefficients or equivalent fluid densities presented in the following table:

Condition	Lateral Pressure Coefficient	Equivalent Fluid Density (pounds per cubic foot)
Active*	0.28	33
At-rest**	0.47	56
Passive*	7.33	880
Seismic Active***	0.84	100
Seismic Passive***	-3.59	-431

* Based on Coulomb's equation

** Based on Jaky

*** Based on Mononobe-Okabe Equation

These coefficients and densities assume level, granular backfill with no buildup of hydrostatic pressures. The force of the water should be added to the presented values if hydrostatic pressures are anticipated. If sloping backfill is present, we recommend the geotechnical engineer be consulted to provide more accurate lateral pressure parameters once the design geometry is established.

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

For seismic analyses, the *active* and *passive* earth pressure coefficient provided in the table is based on the Mononobe-Okabe pseudo-static approach and only accounts for the dynamic horizontal thrust produced by ground motion. Hence, the resulting dynamic thrust pressure *should be added* to the static pressure to determine the total pressure on the wall. The pressure distribution of the dynamic horizontal thrust may be closely approximated as an inverted triangle with stress decreasing with depth and the resultant acting at a distance approximately 0.6 times the loaded height of the structure, measured upward from the bottom of the structure.

The coefficients shown assume a vertical wall face. Hydrostatic and surcharge loadings, if any, should be added. Over-compaction behind walls should be avoided. Resisting passive earth pressure from soils subject to frost or heave, or otherwise above prescribed minimum depths of embedment, should usually be neglected in design.

6.5 CONCRETE SLAB-ON-GRADE CONSTRUCTION

Concrete slabs-on-grade should be constructed over at least 4 inches of compacted gravel overlying native soils or a zone of structural fill that is at least 12 inches thick. Disturbed native soils should be compacted to at least 95% of the MDD as determined by ASTM D-1557 (modified proctor) prior to placement of gravel. The gravel should consist of road base or clean drain rock with a ¾-inch maximum particle size and no more than 12 percent fines passing the No. 200 mesh sieve. The gravel layer should be compacted to at least 95 percent of the MDD of modified proctor or until tight and relatively unyielding if the material is non-proctorable. All concrete slabs should be designed to minimize cracking as a result of shrinkage. Consideration should be given to reinforcing the slab with welded wire, re-bar, or fiber mesh.

6.6 FOUNDATION DRAINAGE

As stated in Section 6.1 of this report, potentially saturated soils were encountered at a depth ranging from 2½ to 5 feet below the existing site grade. As such, it is recommended that all top of slab elevations be maintained a minimum of 36 inches above the elevation of the groundwater table. In addition, the IBC Section 1805 Dampproofing and Waterproofing recommends the construction of a foundation drain around any walls or portions thereof that retain earth and enclose spaces and floors below grade.

The foundation drain should consist of a 4 inch perforated pipe placed at or below the footing elevation. The pipe should be covered with at least 12 inches of free draining gravel (containing less than 5 percent passing the No 4 sieve) and be graded to a free gravity outfall or to a pumped sump. A separator fabric, such as Mirafi 140N, should separate the free draining gravel and native soil (i.e. the separator fabric should be placed between the gravel and the native soils at the bottom of the gravel, the side of the gravel where the gravel does not lie against the concrete footing or foundation and at the top of the gravel). We recommend that the gravel extend up the foundation wall to within 2 feet of the final ground surface. As an alternative, the gravel extending up the foundation wall may be replaced with a prefabricated drain panel, such as Ecodrain-E.

6.7 MOISTURE PROTECTION AND SURFACE DRAINAGE

Moisture should not be allowed to infiltrate the soils in the vicinity of the foundations. We recommend the following mitigation measures be implemented at the building location.

- The ground surface within 10 feet of the entire perimeter of the building should slope a minimum of five percent away from the structure. Alternatively, a slope of 5% is acceptable if the water is conveyed to a concrete ditch that will convey the water to a point of discharge that is at least 10 feet from the structures.
- Roof runoff devices (rain gutters) should be installed to direct all runoff a minimum of 10 feet away from the structure and preferably day-lighted to the curb where it can be transferred to the storm drain system. Rain gutters discharging roof runoff adjacent to or within the near vicinity of the structure may result in excessive differential settlement.
- We recommend irrigation around foundations be minimized by selective landscaping and that irrigation valves be constructed at least 5 feet away from foundations.
- Jetting (injecting water beneath the surface) to compact backfill against foundation soils may result in excessive settlement beneath the building and is not allowed.

- Backfill against foundations walls should consist of on-site native fine-grained soils and should be placed in lifts and compacted to 90% modified proctor to create a moisture barrier.

Failure to comply with these recommendations could result in excessive total and differential settlements causing structural damage.

6.7 PAVEMENT DESIGN

6.7.1 Stabilization of Pavement Section

The native soils encountered are soft and nearly saturated. If soft or pumping soils are encountered in the roadway excavations, these soils should be stabilized prior to placement of granular borrow or roadbase materials. Stabilization of the subgrade soils can be accomplished using a clean, coarse angular material worked into the soft subgrade. We recommend the material be greater than 2-inch diameter, but less than 6 inches. A locally available pit-run gravel may be suitable but should contain a high percentage of particles larger than 2 inches and have less than 7 percent fines (material passing the No. 200 sieve). A pit-run gravel may not be as effective as a coarse, angular material in stabilizing the soft soils and may require more material and greater effort. The stabilization material should be worked (pushed) into the soft subgrade soils until a firm relatively unyielding surface is established. Once a firm, relatively unyielding surface is achieved, the area may be brought to final design grade using the provided pavement sections in Section 6.7.3 and Section 6.7.4.

In some areas of soft subgrade soils, stabilization of the subgrade may not be practical using the method outlined above. In these areas it may be more economical to place one to several layers of geotextile or geogrid and granular fill material. Designs using the geotextiles or geogrid will depend on the encountered soils and proposed traffic conditions. We can provide these pavement design upon request.

6.7.2 Pavement Design Criteria

For pavement design, the following CBR laboratory test result was obtained and used in design:

Test Pit	Depth (ft)	Soil Type	CBR (%)
TP-03	2.0	CL	1.90

No traffic information was available at the time this report was prepared; therefore, GeoStrata has assumed traffic counts for access roads. We assumed that vehicle traffic in and out of paved area would consist of approximately 500 passenger car trips per day, 50 pick-up trucks, and 5 medium duty tandem axle trucks, and 2 heavy-duty trucks with a 20-year design life for a total traffic load of 50,000 ESALs. We have further assumed that the traffic will be relatively consistent over the design life of the pavement sections because of no collector roads in the development. Therefore, no growth factor was applied in calculation of loading for each pavement sections' design life.

6.7.3 Standard Pavement Section Design

The table below presents recommended pavements sections based on the above assumptions.

Asphalt Concrete (in)	Untreated Base Course (in)	Granular Subbase (in)
3.0	8	16
3.0	20	---

Asphalt has been assumed to be a high stability plant mix and base course material (road base) composed of crushed stone with a minimum CBR of 70. Untreated base course should be compacted to at least 95% of the maximum dry density according to ASTM D1557. If traffic conditions vary significantly from our stated assumptions, GeoStrata should be contacted so we can modify our pavement design parameters accordingly. Specifically, if the traffic counts are significantly higher or lower, we should be contacted to revise the pavement section design as necessary. The pavement section thickness above assumes that the majority of the construction traffic including cement trucks, cranes, loaded haulers, etc. has ceased. If a significant volume of construction traffic occurs after the pavement section has been constructed, the owner should anticipate maintenance or a decrease in the design life of the pavement area.

The pavement section thicknesses above assume that there is no mixing over time between the road base and the softer native layers below. In order to prevent mixing or fines migration, and thereby prolong the life of the pavement section, we recommend that the owner give consideration to placing a non-woven filter fabric between the native soils and the road base. We recommend that a Propex Geotex® NW-401, NW-601, or a GeoStrata-approved equivalent be used.

6.7.4 Woven Geotextile Reinforced Pavement Section

Alternatively, a woven geotextile can be considered to stabilize the soft on-site soils. The product Mirafi RS380i provides shear strength and load distribution for roadway construction on soft soils. The product additionally acts as a separation between the clayey subgrade and the pavement section. Using the Tencate web pavement design application, we recommend the following pavement section design:

Asphalt Concrete (in)	Untreated Base Course (in)	Granular Subbase (in)	Woven Geotextile
3.0	14	---	RS380i

Asphalt has been assumed to be a high stability plant mix. Base course material (road base) composed of crushed stone with a minimum CBR of 70. The native subgrade is to be cleared, grubbed and excavated as required to the required elevation to fit the pavement section. Topsoil, debris or other unsuitable material should be removed. We recommend the subgrade be prepared with equipment with low ground pressure and not include vibration. The surface of the subgrade should be relatively smooth and level. Depressions or bumps greater than 6 inches should be graded out. The geosynthetics should be placed directly on the prepared subgrade and rolled out in the direction of travel flat and tight with no folds or wrinkles. Adjacent rolls should be overlapped 30 inches, as per Mirafi recommendation. Aggregate fill should be end-dumped from the edge of previously-placed material in a full 12 inch lift spreading from the middle outward. Untreated base course should be compacted to at least 95% of the maximum dry density according to ASTM D1557.

The pavement sections discussed above meet our minimum recommendations for pavement design. It should be noted that more stringent pavement section requirements may be enforced by American Fork City or other governing agency.

6.8 SOIL CORROSION

One (1) soil sample tested for soil chemical reactivity. Chemical reactivity tests were performed to determine soil pH, resistivity, and concentrations of water-soluble sulfate ions. Results from these tests are summarized in the table below.

Bore Hole Number	Depth (ft)	Sulfate (ppm)	Resistivity (Ω-cm)	Soil pH
TP-1	6	46.1	1,300	7.95

Test results indicate that the soluble sulfate concentrations of 46.1 ppm. Based on the American Concrete Institute (ACI) Building Code, these concentrations represent "negligible" degree of sulfate attack on concrete structures. Type I/II Portland Cement Concrete (PCC) may be used for concrete elements in contact with the onsite soils or properly placed and compacted granular structural fill.

Laboratory soil resistivity has a direct impact on the degree of corrosion in underground steel structures. A decrease in resistivity relates to an increase in corrosion activity and therefore dictates that protective treatment to be used. Results from the laboratory resistivity tests indicate a range of resistivity of 1,300 ohm-cm. Based on the resistivity test results, the onsite soils are considered to be "corrosive" if saturated in the field.

Results of the ion hydrogen concentration (pH) tests were 7.95. Concentrations above 7 are considered basic and are less likely to contribute to corrosion attack on subsurface steel structures.

Anticipated underground steel structures (i.e., pipes, exposed steel) should be protected against corrosion.

7.0 CLOSURE

7.1 LIMITATIONS

The recommendations contained in this report are based on our limited field exploration, laboratory testing, and understanding of the proposed construction. The subsurface data used in the preparation of this report were obtained from the explorations made for this investigation. It is possible that variations in the soil and groundwater conditions could exist between and beyond the points explored. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site that are different from those described in this report, GeoStrata should be immediately notified so that we may make any necessary revisions to recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, GeoStrata should be notified.

This report was prepared in accordance with the generally accepted standard of practice at the time the report was written. No warranty, expressed or implied, is made.

It is the Client's responsibility to see that all parties to the project including the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

7.2 ADDITIONAL SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during construction. GeoStrata staff should be on site to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation, earthwork and structural fill placement.
- Observation of foundation soils to assess their suitability for footing placement.
- Observation of soft/loose soils over-excavation.
- Observation of temporary excavations and shoring.
- Consultation as may be required during construction.
- Quality control and observation of concrete placement.

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

We appreciate the opportunity to be of service on this project. Should you have any questions regarding the report or wish to discuss additional services, please do not hesitate to contact us at your convenience at (801) 501-0583.

8.0 REFERENCES CITED

Anderson, L.R, Keaton, J.R., Eldredge, S.N., 1994, Liquefaction-Potential Map for a Part of Utah County, Utah, Utah Geological Survey, Public Information Series 28.

Black, B.D., Hecker, S., Hylland, M.D., Christenson, G.E., and McDonald G.N., 2003, Quaternary Fault and Fold Database and Map of Utah: Utah geological Survey Map 193DM.

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

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

Hecker, S., 1993, Quaternary Tectonics of Utah with Emphasis on Earthquake-Hazard Characterization: Utah Geological Survey Bulletin 127.

Hintze, L. F., 1980, Geologic Map of Utah: Utah Geological and Mineral Survey Map-A-1, scale 1:500,000.

Hintze, L.F. 1993, Geologic History of Utah: Brigham Young University Studies, Special Publication 7, 202 p.

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

Ishihara, K., 1985, Stability of Natural Deposits during Earthquakes, Proceedings, 11th International Conference on Soil Mechanics and Foundation Engineering, Vol. 1, pp. 321-376.

Machette, M.N., 1992, Surficial Geologic Map of the Wasatch Fault Zone, Eastern Part of Utah Valley, Utah County and Parts of Salt Lake and Juab Counties, Utah, U.S. Geological Survey, Miscellaneous Investigations Series, Map I-2095

Martin, G.R., and Lew, M. (Co-chairs and Editors), 1999, Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California, published by SCEC, March 1999.

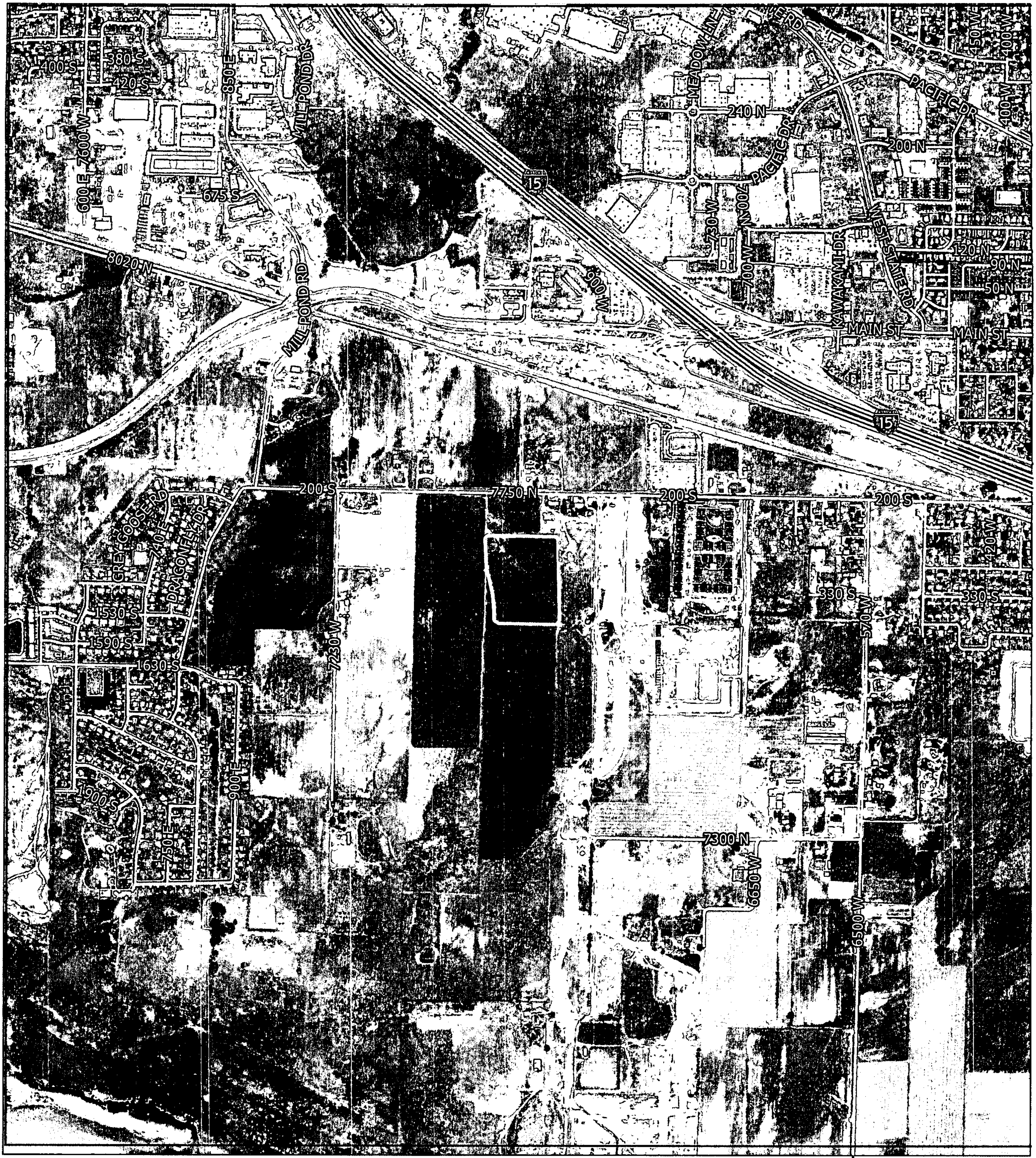
Scott, W.E., McCoy, W.D., Shorba, R.R., and Rubin, Meyer, 1983, Reinterpretation of the exposed record of the last two cycles of Lake Bonneville, western United States: Quaternary Research, v.20, p. 261-285.

Stokes, W.L., 1986, Geology of Utah: Utah Museum of Natural History and Utah Geological and Mineral Survey Occasional Paper Number 6, 280 p.

Tokimatsu, K., and Seed, H.B., 1987, Evaluation of Settlement in Sands due to Earthquake Shaking, Journal of Geotechnical Engineering Division, ASCE, Vol. 113, No. 8, August 1987

Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Liam Finn, W.D., Harder Jr., L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.C., Marcuson III, W.F., Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., Stokoe II, K.H., 2001, Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, in *Journal of Geotechnical and GeoEnvironmental Engineering*, pp. 817-833, October 2001.

APPENDIX A



600 0 600 1200 1800 2400 ft

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GeoStrata

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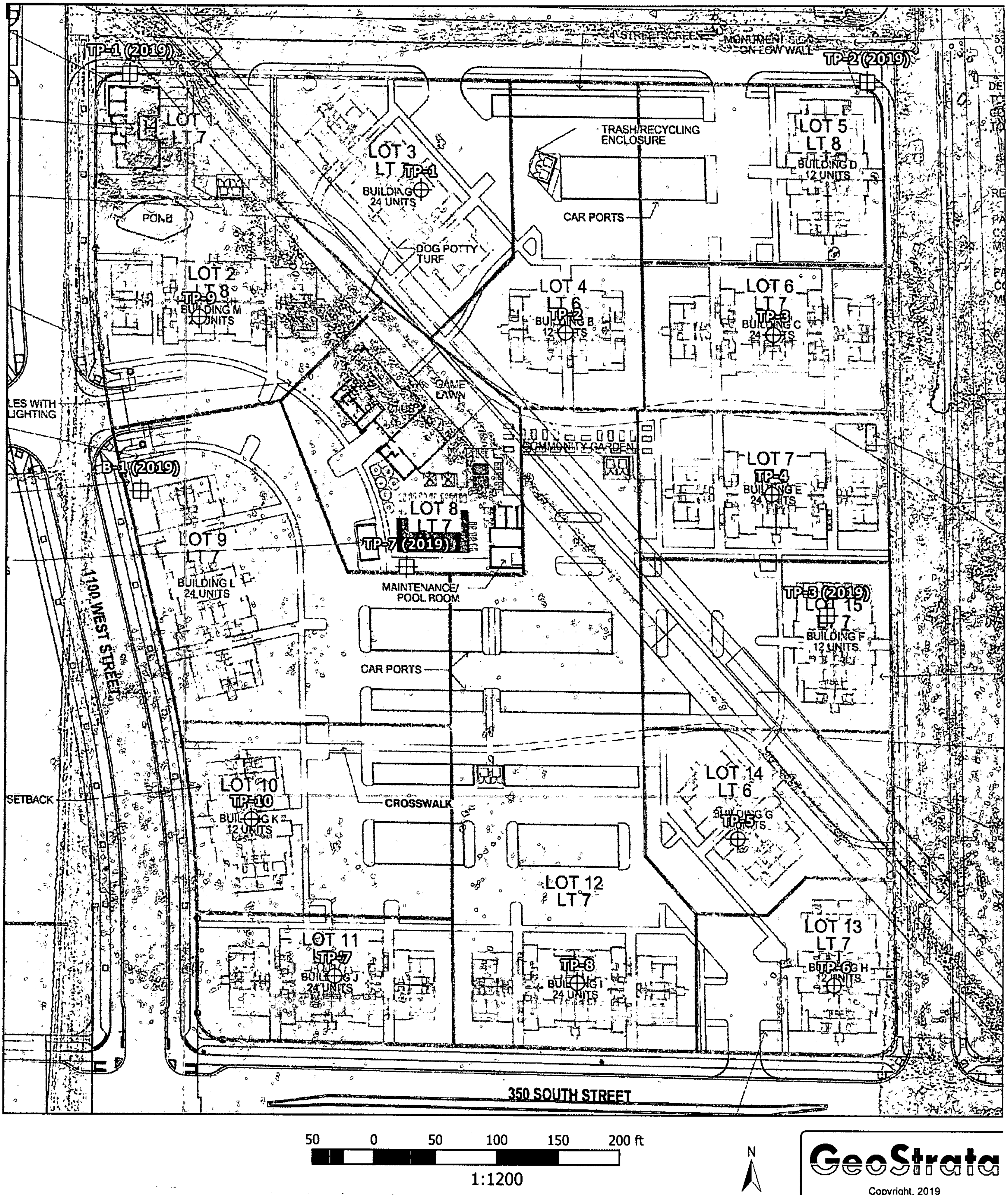
Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Site Vicinity Map

Plate A-1

Legend

☐ Site Boundary



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Legend

⊞	Approximate Locations of 2019 Explorations
⊕	Approximate Test Pit Locations

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Exploration Location Map

Plate A-2

APPENDIX B

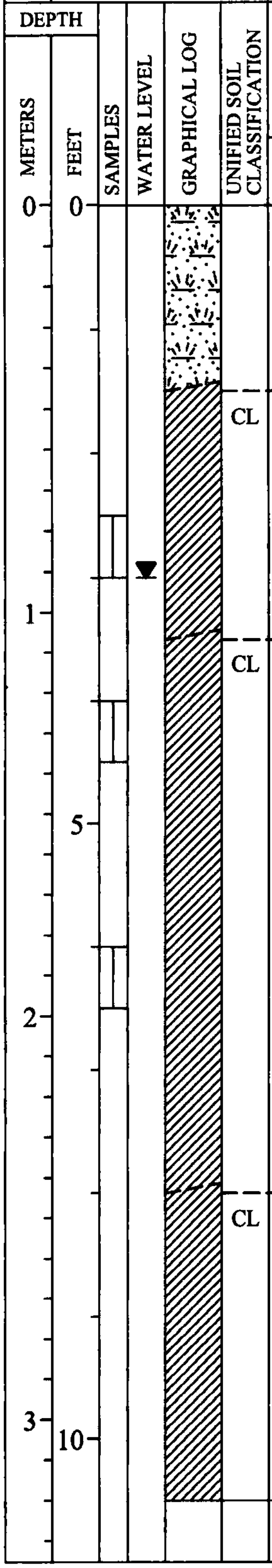
DATE
STARTED: 3/30/20
COMPLETED: 3/30/20
BACKFILLED: 3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

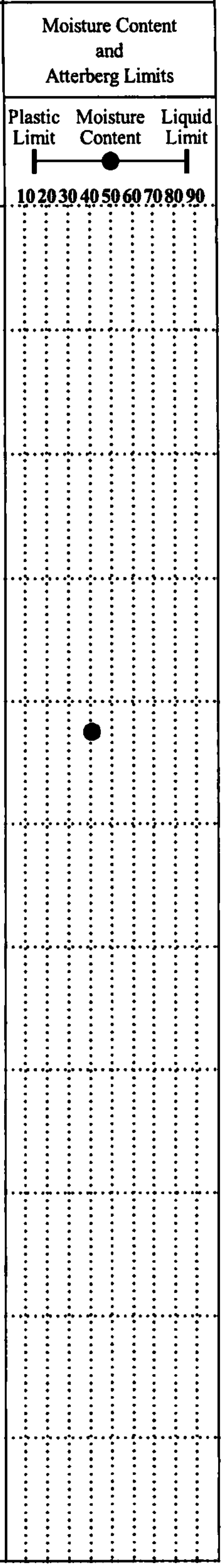
GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-01
Sheet 1 of 1

LOCATION
NORTHING 14,663,105.46 EASTING 1,410,572.55 ELEVATION 4,516.77



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	TOPSOIL; Lean Clay - dark brown, minor organics throughout					
CL	Lean CLAY with sand - medium stiff, grey with tan mottling, moist to wet, large root casts and small pinholes throughout					
	- water @ 3 feet			75.7		
CL	- black					
			40.7	75.7		
	- grey with Fe staining throughout					
CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter					
	Bottom of Test Pit @ 10.5 Feet					



GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate B-1

DATE		
STARTED:	3/30/20	
COMPLETED:	3/30/20	
BACKFILLED:	3/30/20	

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

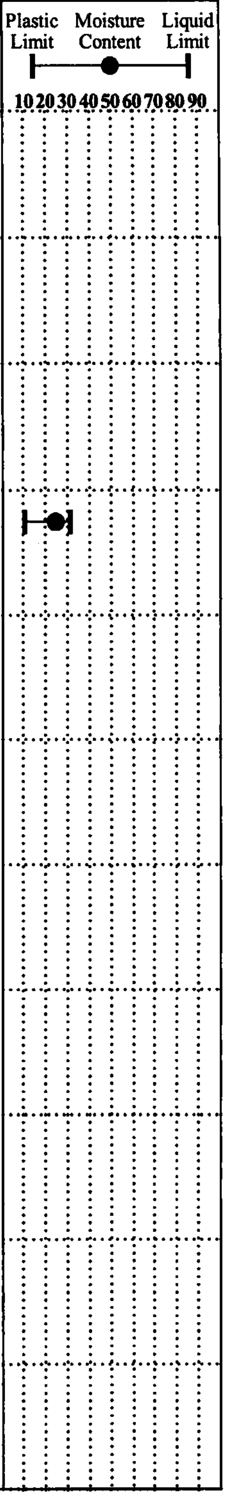
GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-02
Sheet 1 of 1

LOCATION
NORTHING 14,662,992.27 EASTING 1,410,690.01 ELEVATION 4,514.76

DEPTH (METERS)	DEPTH (FEET)	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				TOPSOIL; Lean Clay - dark brown, minor organics throughout					
				CL	Sandy Lean CLAY - medium stiff to soft, medium brown, moist to wet, large root casts and small pinholes throughout					
1		◫					24.4	61.8	31	21
			▼							
	5	◫			- water @ 5 feet					
					- grey with Fe staining throughout					
2										
				CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter					
					Bottom of Test Pit @ 9 Feet					
3	10									

Moisture Content and Atterberg Limits



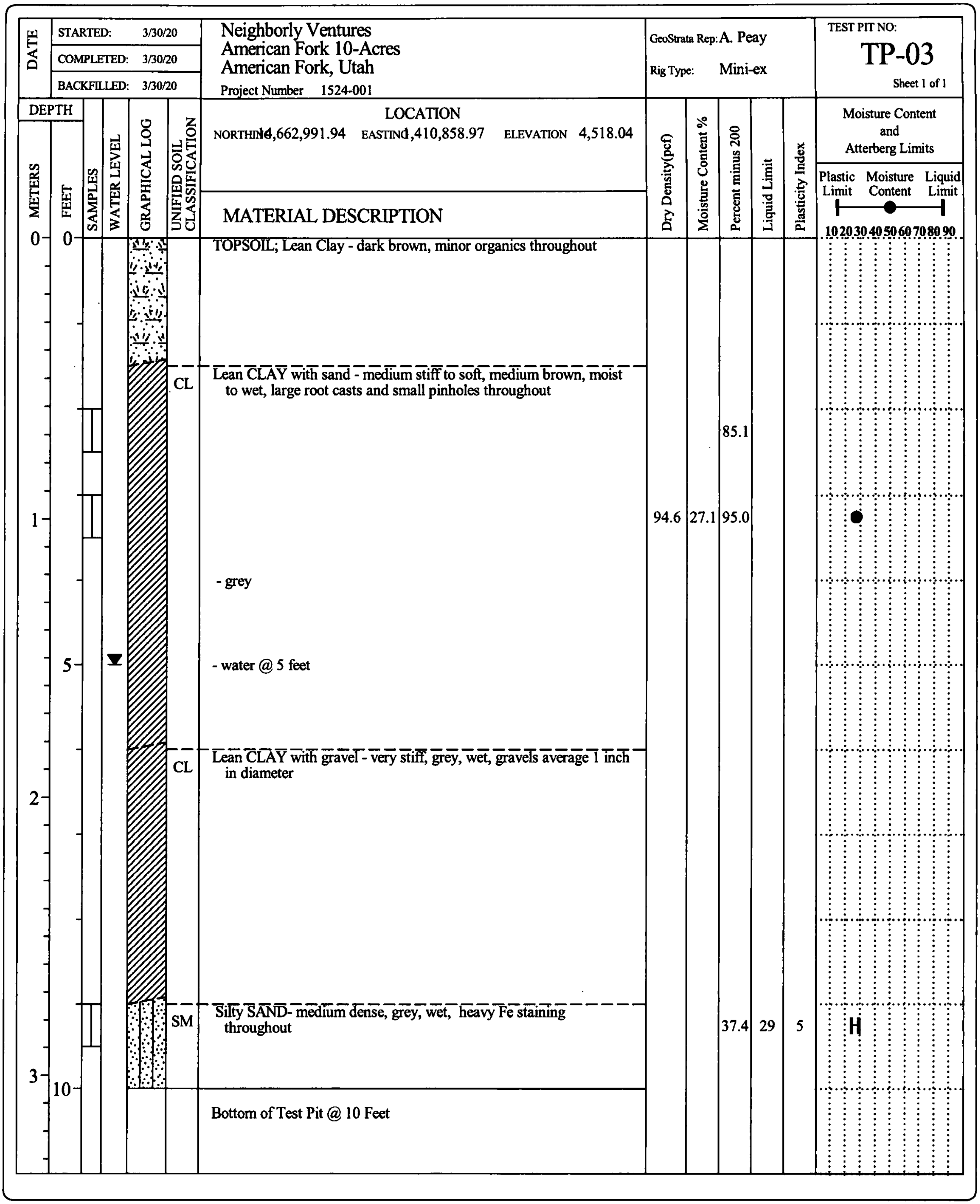
GeoStrata

SAMPLE TYPE
◫ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-2



DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-03
Sheet 1 of 1

LOCATION
NORTHIN4,662,991.94 EASTIN1,410,858.97 ELEVATION 4,518.04

DEPTH (FEET)	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0		TOPSOIL; Lean Clay - dark brown, minor organics throughout					
	CL	Lean CLAY with sand - medium stiff to soft, medium brown, moist to wet, large root casts and small pinholes throughout			85.1		
			94.6	27.1	95.0		
		- grey					
5		- water @ 5 feet					
	CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter					
	SM	Silty SAND- medium dense, grey, wet, heavy Fe staining throughout			37.4	29	5
10		Bottom of Test Pit @ 10 Feet					

GeoStrata

SAMPLE TYPE
▥ - GRAB SAMPLE
▣ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-3

DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-04
Sheet 1 of 1

LOCATION
NORTHING 14,662,865.63 EASTING 1,410,858.31 ELEVATION 4,517.16

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit ├─●─┤ Moisture Content, Liquid Limit; 10 20 30 40 50 60 70 80 90)
0	0					TOPSOIL; Lean Clay - dark brown, minor organics throughout						
				▨	CL	Lean CLAY with sand - medium stiff to soft, grey, moist to wet						
1			▼	▨		- water @ 3 feet						
	5			▨								
2		▯		▨								
				▨	CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter						
		▯				Bottom of Test Pit @ 9 Feet						
3	10											

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-4

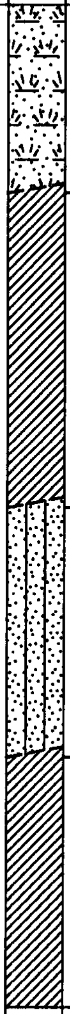
DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-05
Sheet 1 of 1

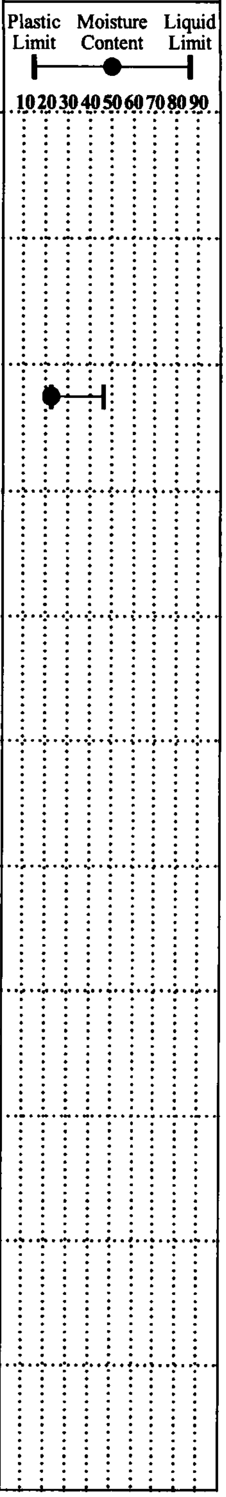
LOCATION
NORTHING 4,662,587.41 EASTING 1,410,833.05 ELEVATION 4,514.80



SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
			TOPSOIL; Lean Clay - dark brown, minor organics throughout					
		CL	Lean CLAY - medium stiff to soft, grey, moist to wet					
			- pinholes throughout					
▯				96.3	22.1	90.4	46	24
	▼		- water @ 3 feet, tan					
▯		SM	Silty SAND - dense, grey, wet					
		CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter					
			Bottom of Test Pit @ 8 Feet					

DEPTH: METERS 0, 1, 2, 3; FEET 0, 5, 10

Moisture Content and Atterberg Limits



LOG OF TEST PITS (B) EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-5

DATE
STARTED: 3/30/20
COMPLETED: 3/30/20
BACKFILLED: 3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

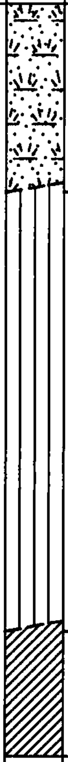
GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-06
Sheet 1 of 1

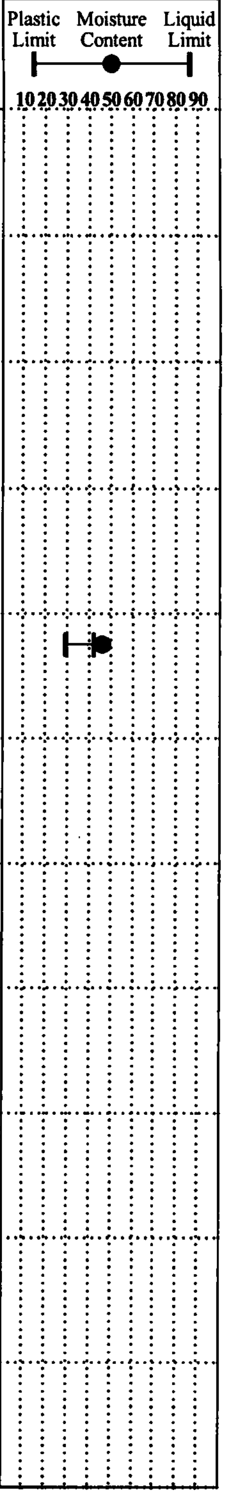
LOCATION
NORTHING 14,662,468.97 EASTING 1,410,913.10 ELEVATION 4,514.14

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				TOPSOIL; Lean Clay - dark brown, minor organics throughout					
				ML	SILT with sand - medium stiff to soft, grey, moist to very moist					
1										
			▼		- water @ 4 feet					
		▯				72.2	46.0	74.6	42	13
	5			CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter					
					- bottom of test pit at 6 feet due to extensive test pit wall collapse					
2					Bottom of Test Pit @ 6 Feet					
3	10									

GRAPHICAL LOG



Moisture Content and Atterberg Limits



GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

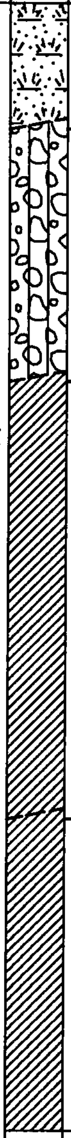
Plate B-6

DATE					
STARTED:	3/30/20	Neighborly Ventures American Fork 10-Acres American Fork, Utah Project Number 1524-001	GeoStrata Rep: A. Peay Rig Type: Mini-ex	TEST PIT NO: **TP-07** Sheet 1 of 1
COMPLETED:	3/30/20			
BACKFILLED:	3/30/20			

LOCATION

NORTHING 14,662,475.21 EASTING 1,410,505.62 ELEVATION 4,513.09

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits
0	0					TOPSOIL; Lean Clay - dark brown, minor organics throughout						
					GM	Silty GRAVEL with sand - dense, grey, moist, Fe staining throughout, sub-rounded gravels up to 1 inch in diameter						
					CL	Lean CLAY with sand - medium stiff, grey, moist to wet						
1			▼			- water @ 3.5 feet						
	5											
2					CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter						
						Bottom of Test Pit @ 9 Feet						
3	10											



Plastic Limit ├ Moisture Content ● Liquid Limit ┤

10 20 30 40 50 60 70 80 90

GeoStrata

SAMPLE TYPE

- ▯ - GRAB SAMPLE
- ▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL

- ▼- MEASURED
- ▽- ESTIMATED

NOTES:

Plate B-7

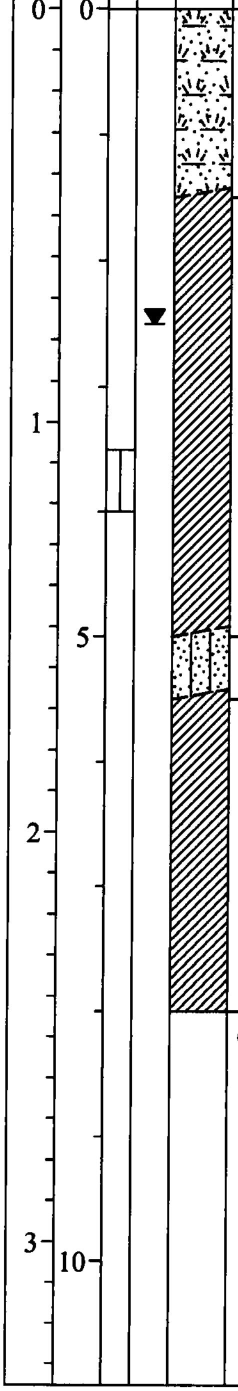
DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-08
Sheet 1 of 1

LOCATION
NORTHING 14,662,471.27 EASTING 1,410,700.50 ELEVATION 4,513.32



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	TOPSOIL; Lean Clay - dark brown, minor organics throughout					
CL	Lean CLAY with sand - medium stiff to soft, grey, moist to wet - water @ 2.5 feet					
SM	Silty SAND - dense, medium brown, wet					
CL	Lean CLAY with sand - stiff, grey, wet					
CL	Lean CLAY with gravel - very stiff, grey, wet, gravels average 1 inch in diameter Bottom of Test Pit @ 8 Feet					

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate B-8

DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

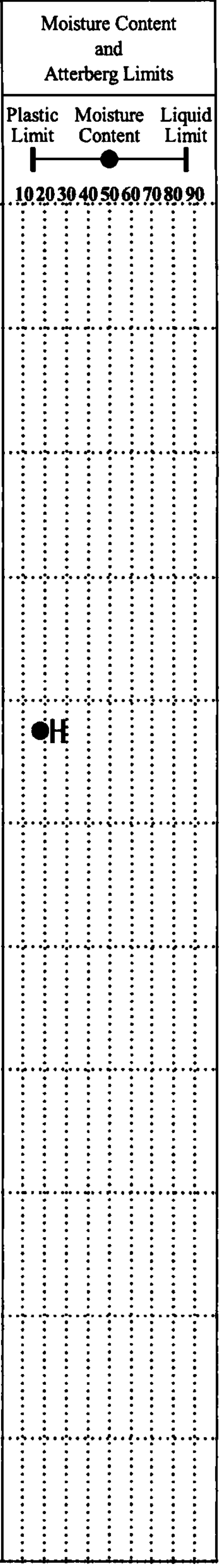
GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-09
Sheet 1 of 1

LOCATION
NORTHING 14,663,005.88 EASTING 1,410,390.96 ELEVATION 4,514.67

DEPTH: METERS 0, 1, 2, 3; FEET 0, 5, 10

SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
			TOPSOIL; Lean Clay - dark brown, minor organics throughout					
▯		SM	Silty SAND - dense, tan with black mottling, minor organics throughout					
▯	▼	ML	SILT with sand - medium stiff, grey, very moist, Fe staining throughout - water @ 4.5 feet - blue-grey	109.2	17.4	81.7	28	5
			Bottom of Test Pit @ 9.5 Feet					



GeoStrata

SAMPLE TYPE
- ▯ - GRAB SAMPLE
- ▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- ▼ - MEASURED
- ▽ - ESTIMATED

NOTES:

Plate
B-9

LOG OF TEST PITS (B) EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

DATE	
STARTED:	3/30/20
COMPLETED:	3/30/20
BACKFILLED:	3/30/20

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

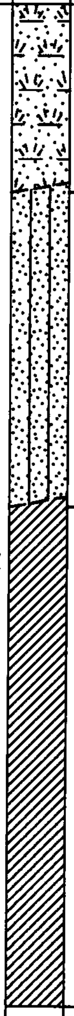
GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
TP-10
Sheet 1 of 1

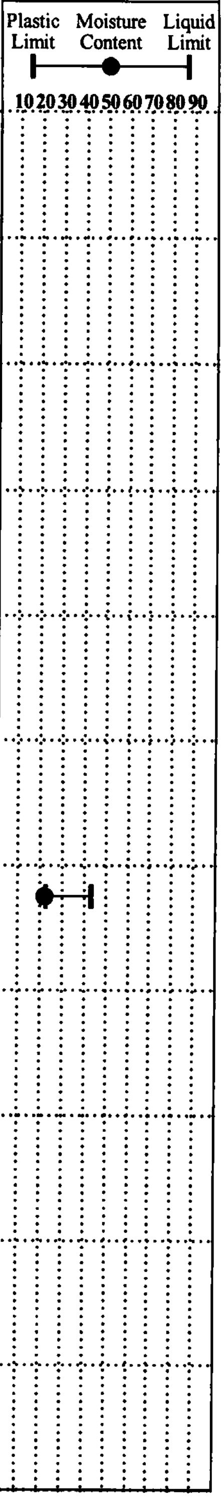
LOCATION
NORTHING 4,662,603.32 EASTING 1,410,435.12 ELEVATION 4,513.65

UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	TOPSOIL; Lean Clay - dark brown, minor organics throughout					
SM	Silty SAND - dense, tan with black mottling, minor organics throughout					
CL	Lean CLAY - medium stiff, grey, wet, Fe staining throughout					
		94.7	21.7	91.0	43	21
	Bottom of Test Pit @ 8 Feet					

DEPTH: METERS 0, 1, 2, 3; FEET 0, 5, 10
SAMPLES | WATER LEVEL ▼ | GRAPHICAL LOG



Moisture Content and Atterberg Limits



LOG OF TEST PITS (B) EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-10

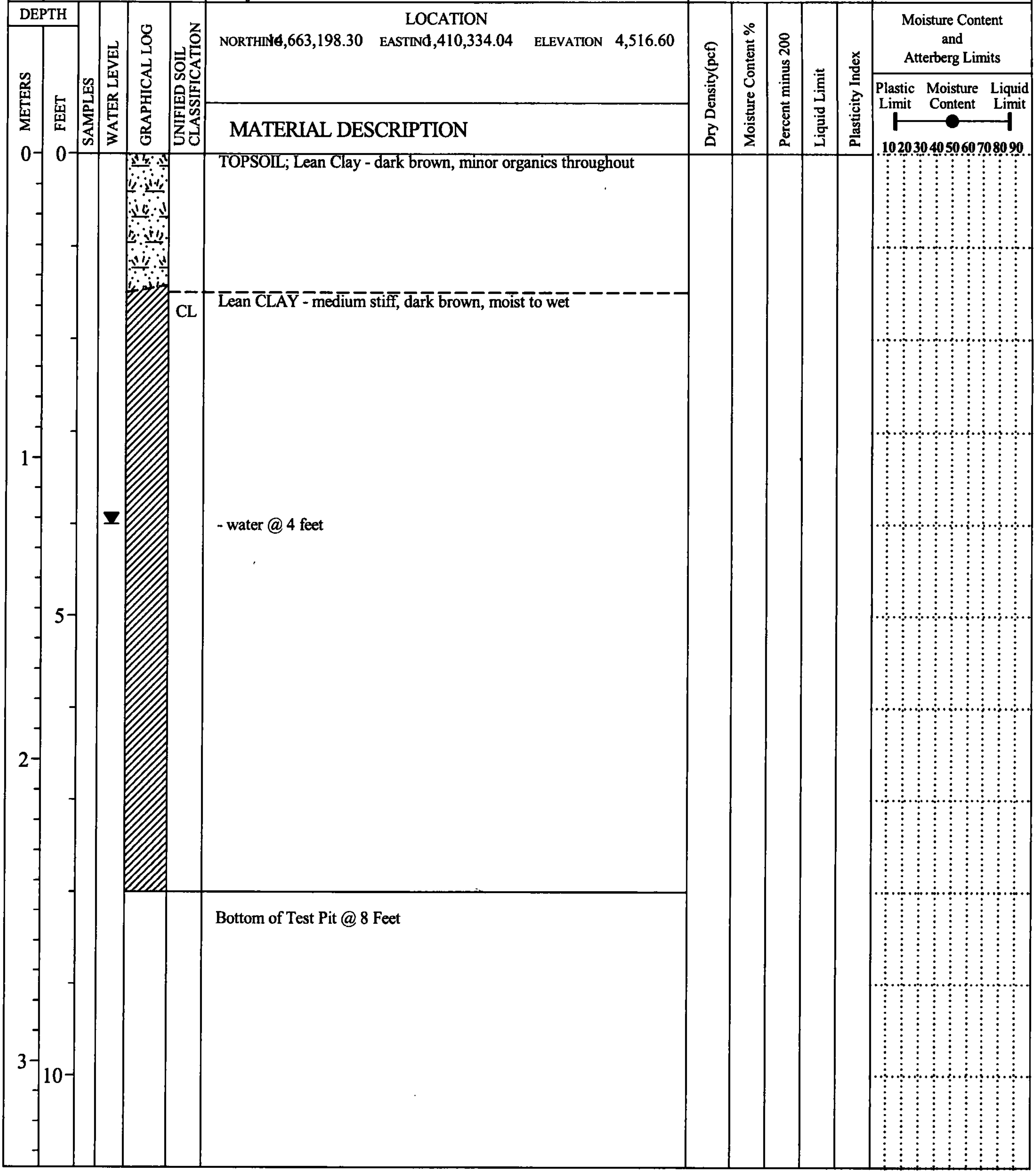
DATE		
STARTED:	4/26/19	
COMPLETED:	4/26/19	
BACKFILLED:	4/26/19	

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
V-TP-1
Sheet 1 of 1

LOCATION
NORTHING 14,663,198.30 EASTING 1,410,334.04 ELEVATION 4,516.60



MATERIAL DESCRIPTION

Depth (feet)	USCS	Material Description
0		TOPSOIL; Lean Clay - dark brown, minor organics throughout
	CL	Lean CLAY - medium stiff, dark brown, moist to wet
4		- water @ 4 feet
8		Bottom of Test Pit @ 8 Feet

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-11

DATE	
STARTED:	4/26/19
COMPLETED:	4/26/19
BACKFILLED:	4/26/19

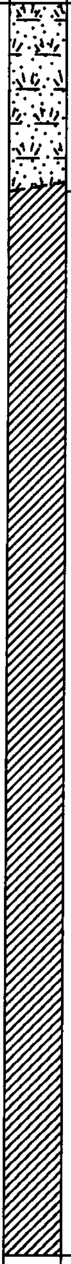
Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
V-TP-2
Sheet 1 of 1

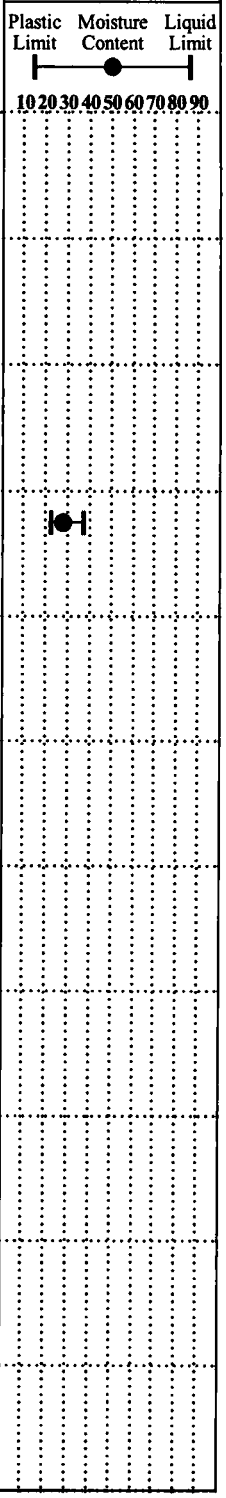
LOCATION
NORTHING 14,663,188.46 EASTING 1,410,938.69 ELEVATION 4,519.26

MATERIAL DESCRIPTION



DEPTH (FEET)	DEPTH (METERS)	SAMPLES	WATER LEVEL	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				TOPSOIL; Lean Clay - dark brown, minor organics throughout					
	1	▯				80.9	27.7	80.6	37	15
5			▼	CL	Lean CLAY with sand - medium stiff, dark brown, wet, occasional gravel throughout					
	2									
10	3				Bottom of Test Pit @ 10 Feet					

Moisture Content and Atterberg Limits



GeoStrata

SAMPLE TYPE
- ▯ - GRAB SAMPLE
- ▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
- ▼- MEASURED
- ▽- ESTIMATED

NOTES:

Plate
B-12

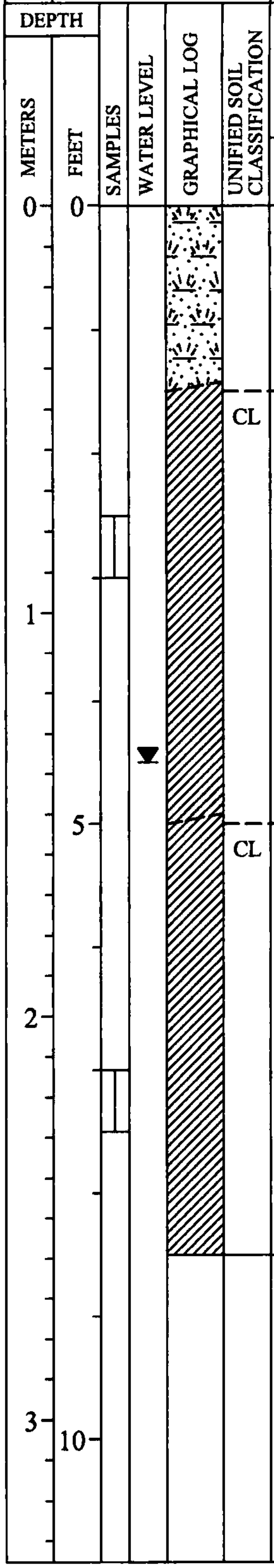
DATE
STARTED: 4/26/19
COMPLETED: 4/26/19
BACKFILLED: 4/26/19

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

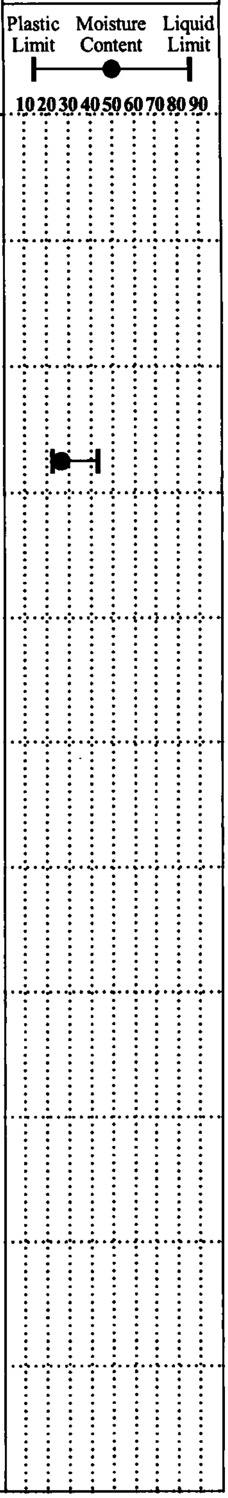
TEST PIT NO:
V-TP-3
Sheet 1 of 1

LOCATION
NORTHING 14,662,768.19 EASTING 1,410,903.59 ELEVATION 4,516.21



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	TOPSOIL; Lean Clay - dark brown, minor organics throughout					
CL	Lean CLAY - medium stiff, grey with tan mottling, moist to wet, large root casts and small pinholes throughout					
		91.1	26.3	94.6	43	21
	- water @ 4.5 feet					
CL	Lean CLAY with gravel - medium stiff, medium brown, wet, gravels are less then ¼ inch in diameter					
	- olive and blue grey mottling					
	Bottom of Test Pit @ 8.5 Feet					

Moisture Content and Atterberg Limits



GeoStrata
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SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-13

LOG OF TEST PITS (B) EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

DATE
STARTED: 4/26/19
COMPLETED: 4/26/19
BACKFILLED: 4/26/19

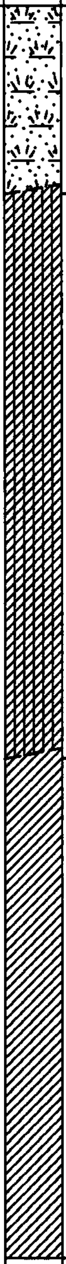
Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: Mini-ex

TEST PIT NO:
V-TP-7
Sheet 1 of 1

LOCATION
NORTHING 14,662,804.93 EASTING 1,410,561.40 ELEVATION 4,514.96

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits
0	0					TOPSOIL; Lean Clay - dark brown, minor organics throughout						
					CL-ML	Silty Lean CLAY - medium stiff, medium brown, moist to wet						
		▯										
1												
			▼			- water @ 4 feet						
	5											
		▯			CL	Lean CLAY with gravel - medium stiff, medium brown, wet, gravels are less then ¼ inch in diameter						
2												
3	10					Bottom of Test Pit @ 10 Feet						



Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

GeoStrata

SAMPLE TYPE
▯ - GRAB SAMPLE
▮ - 3" O.D. THIN-WALLED HAND SAMPLER

WATER LEVEL
▼- MEASURED
▽- ESTIMATED

NOTES:

Plate
B-14

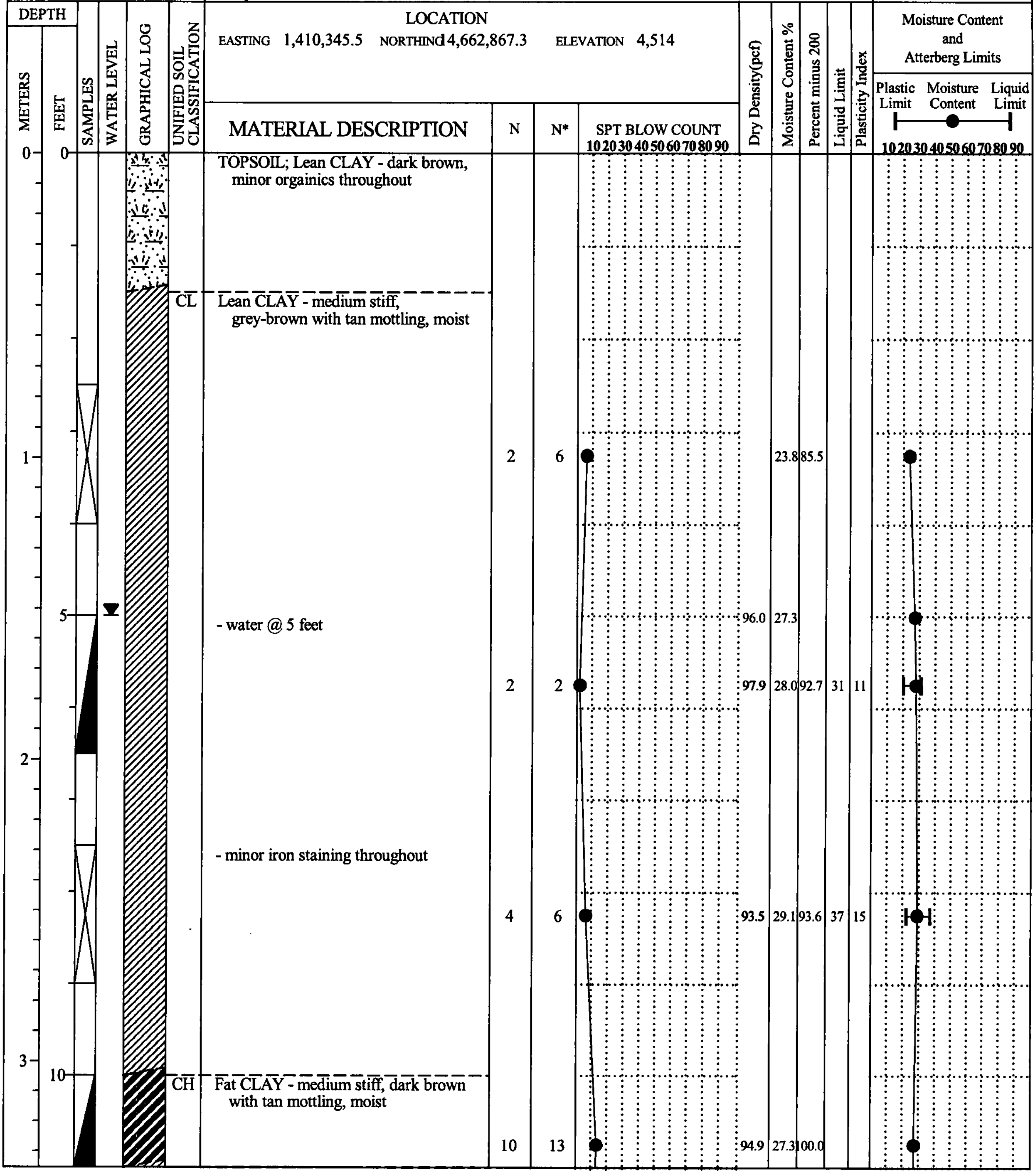
DATE	
STARTED:	4/25/19
COMPLETED:	4/25/19
BACKFILLED:	4/25/19

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: CME-75
Boring Type: HSA

Boring ID
V-B-1
Sheet 1 of 5

LOCATION
EASTING 1,410,345.5 NORTHING 4,662,867.3 ELEVATION 4,514



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	TOPSOIL; Lean CLAY - dark brown, minor orgainics throughout							
CL	Lean CLAY - medium stiff, grey-brown with tan mottling, moist							
		2	6		23.8	85.5		
	- water @ 5 feet			96.0	27.3			
		2	2	97.9	28.0	92.7	31	11
	- minor iron staining throughout							
		4	6	93.5	29.1	93.6	37	15
CH	Fat CLAY - medium stiff, dark brown with tan mottling, moist							
		10	13	94.9	27.3	100.0		

N - OBSERVED UNCORRECTED BLOW COUNT N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

SAMPLE TYPE
☒- 2" O.D./1.38" I.D. Split Spoon Sampler
◩- 2.5" O.D./2" I.D. California Split Spoon Sampler
◪- 3" O.D. Thin-Walled Shelby Sampler
▯- Grab Sample
▮- 2" O.D./1.625" I.D. Liner Sampler

NOTES:

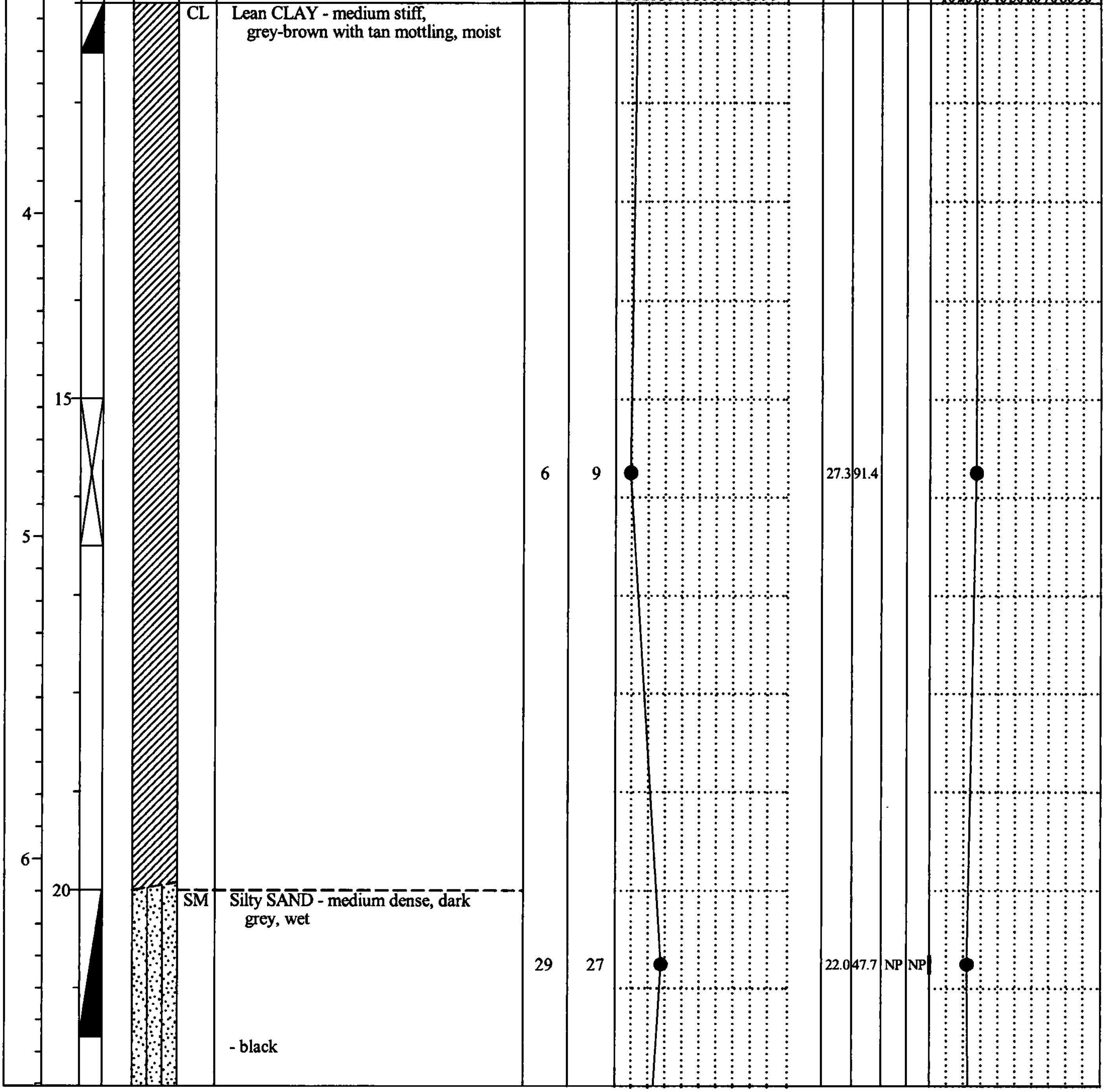
WATER LEVEL
▼- MEASURED ▽- ESTIMATED

Plate
B-15

DATE	STARTED: 4/25/19 COMPLETED: 4/25/19 BACKFILLED: 4/25/19	Neighborly Ventures American Fork 10-Acres American Fork, Utah Project Number 1524-001	GeoStrata Rep: A. Peay Rig Type: CME-75 Boring Type: HSA	Boring ID **V-B-1** Sheet 2 of 5

LOCATION

EASTING 1,410,345.5 NORTHING 4,662,867.3 ELEVATION 4,514



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
CL	Lean CLAY - medium stiff, grey-brown with tan mottling, moist							
		6	9		27.3	91.4		
SM	Silty SAND - medium dense, dark grey, wet							
		29	27		22.0	47.7	NP	NP
	- black							

N - OBSERVED UNCORRECTED BLOW COUNT N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

SAMPLE TYPE
- ☒ - 2" O.D./1.38" I.D. Split Spoon Sampler
- ◪ - 2.5" O.D./2" I.D. California Split Spoon Sampler
- ▨ - 3" O.D. Thin-Walled Shelby Sampler
- ▯ - Grab Sample
- ▮ - 2" O.D./1.625" I.D. Liner Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B-16

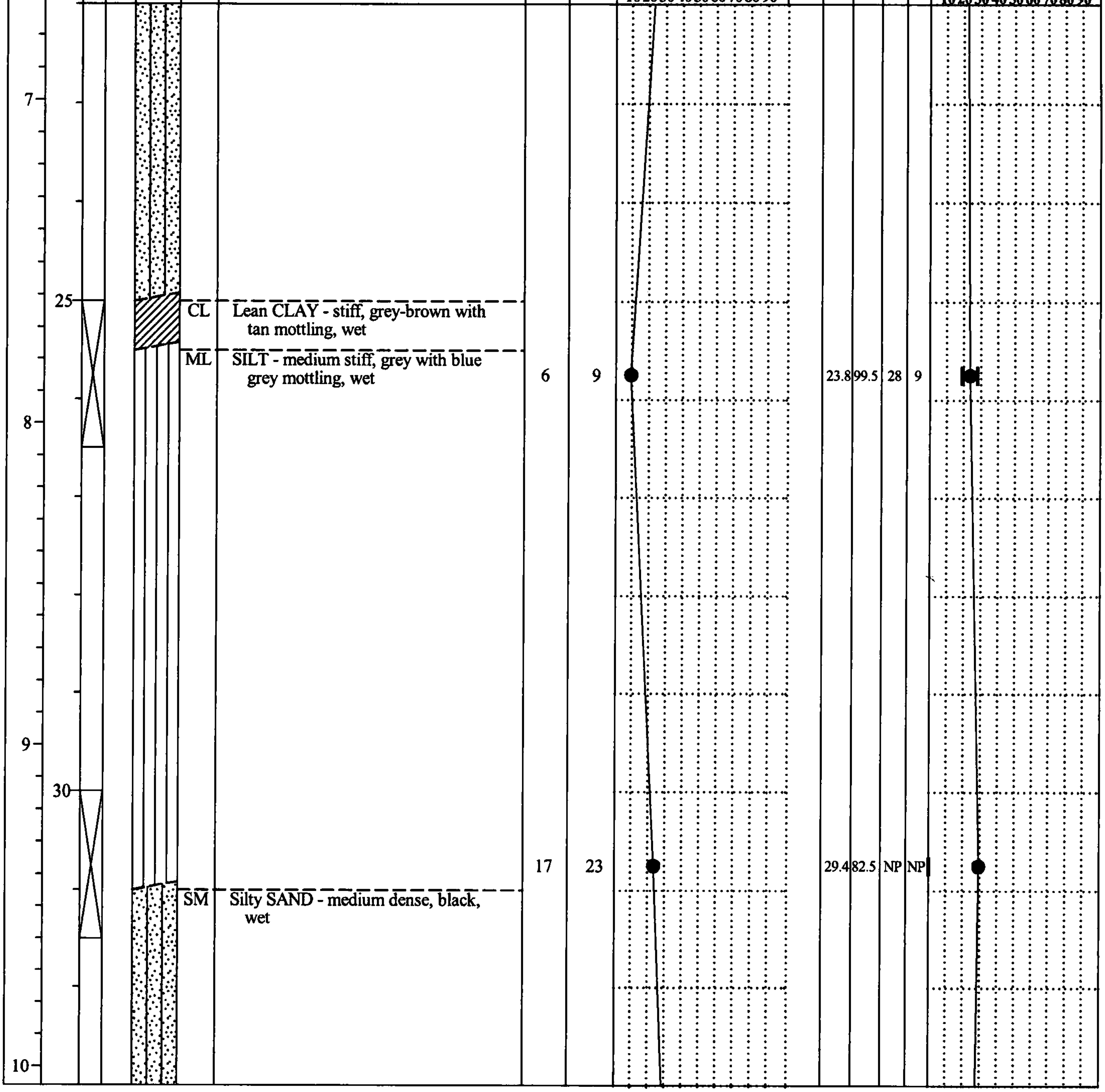
DATE	
STARTED:	4/25/19
COMPLETED:	4/25/19
BACKFILLED:	4/25/19

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

GeoStrata Rep: A. Peay
Rig Type: CME-75
Boring Type: HSA

Boring ID
V-B-1
Sheet 3 of 5

LOCATION
EASTING 1,410,345.5 NORTHING 4,662,867.3 ELEVATION 4,514



UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
CL	Lean CLAY - stiff, grey-brown with tan mottling, wet							
ML	SILT - medium stiff, grey with blue grey mottling, wet	6	9		23.8	99.5	28	9
		17	23		29.4	82.5	NP	NP
SM	Silty SAND - medium dense, black, wet							

N - OBSERVED UNCORRECTED BLOW COUNT N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

SAMPLE TYPE
- ☒ - 2" O.D./1.38" I.D. Split Spoon Sampler
- ▨ - 2.5" O.D./2" I.D. California Split Spoon Sampler
- ▨ - 3" O.D. Thin-Walled Shelby Sampler
- ▯ - Grab Sample
- ▮ - 2" O.D./1.625" I.D. Liner Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate
B-17

DATE	
STARTED:	4/25/19
COMPLETED:	4/25/19
BACKFILLED:	4/25/19

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number 1524-001

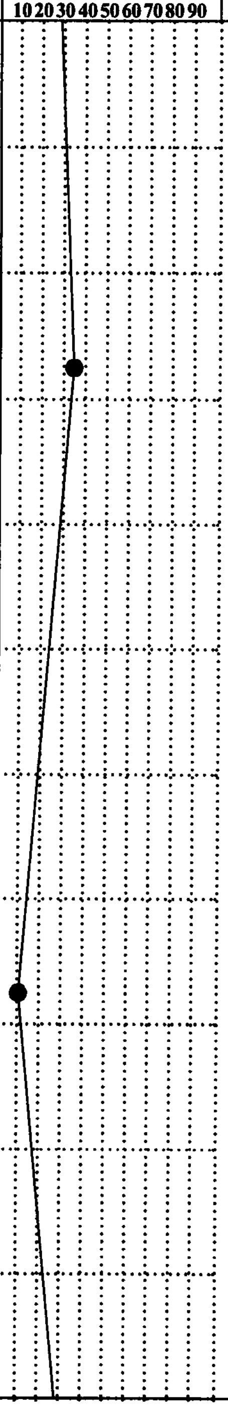
GeoStrata Rep: A. Peay
Rig Type: CME-75
Boring Type: HSA

Boring ID
V-B-1
Sheet 4 of 5

LOCATION
EASTING 1,410,345.5 NORTHING 4,662,867.3 ELEVATION 4,514

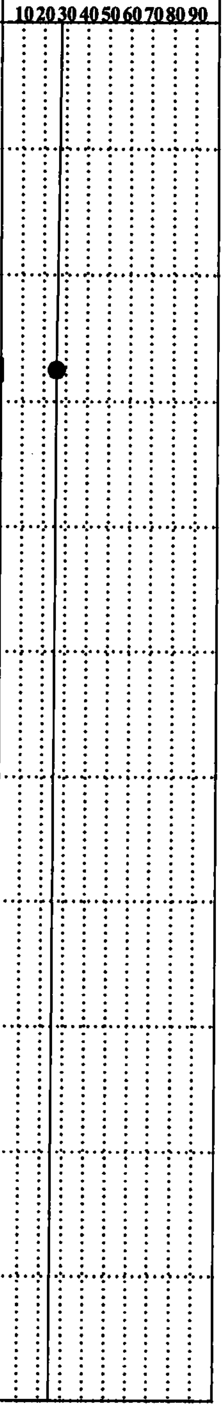
DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	35	☒					25	34		25.7	32.5	NP	NP
11													
12													
	40	☒				- no recovery	8	10					
13													

SPT BLOW COUNT



Moisture Content and Atterberg Limits

Plastic Limit ├ Moisture Content ● Liquid Limit ┤



N - OBSERVED UNCORRECTED BLOW COUNT N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

SAMPLE TYPE
☒ - 2" O.D./1.38" I.D. Split Spoon Sampler
◩ - 2.5" O.D./2" I.D. California Split Spoon Sampler
▨ - 3" O.D. Thin-Walled Shelby Sampler
▥ - Grab Sample
▮ - 2" O.D./1.625" I.D. Liner Sampler

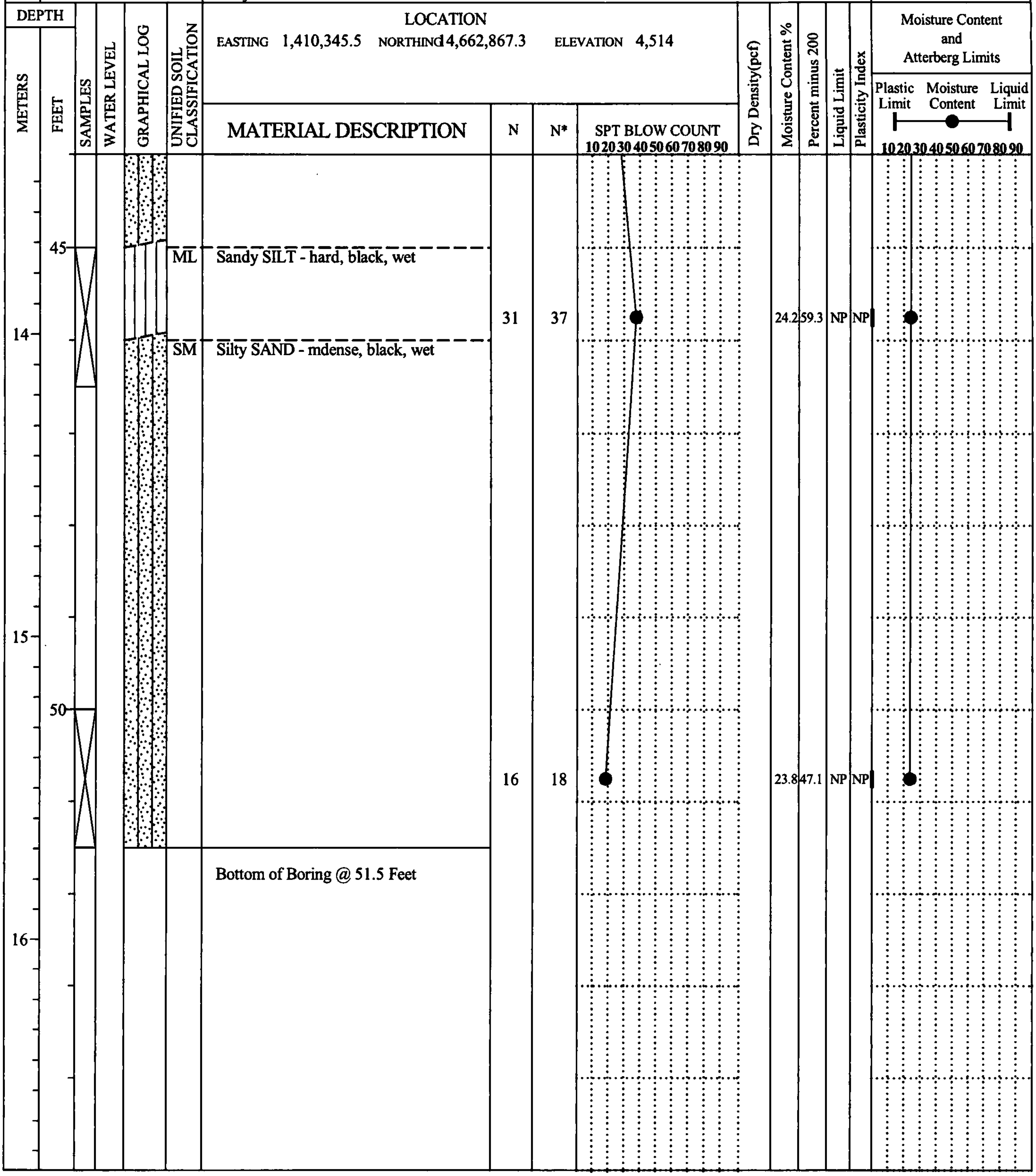
NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate
B-18

DATE				
STARTED:	4/25/19	Neighborly Ventures American Fork 10-Acres American Fork, Utah	GeoStrata Rep: A. Peay	Boring ID **V-B-1**
COMPLETED:	4/25/19		Rig Type: CME-75	
BACKFILLED:	4/25/19	Project Number 1524-001	Boring Type: HSA	Sheet 5 of 5

LOCATION
EASTING 1,410,345.5 NORTHING 4,662,867.3 ELEVATION 4,514



Feet	USCS	Material Description	N	N*	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
45	ML	Sandy SILT - hard, black, wet	31	37	24.2	59.3	NP	NP
	SM	Silty SAND - mdense, black, wet	16	18	23.8	47.1	NP	NP
		Bottom of Boring @ 51.5 Feet						

N - OBSERVED UNCORRECTED BLOW COUNT N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

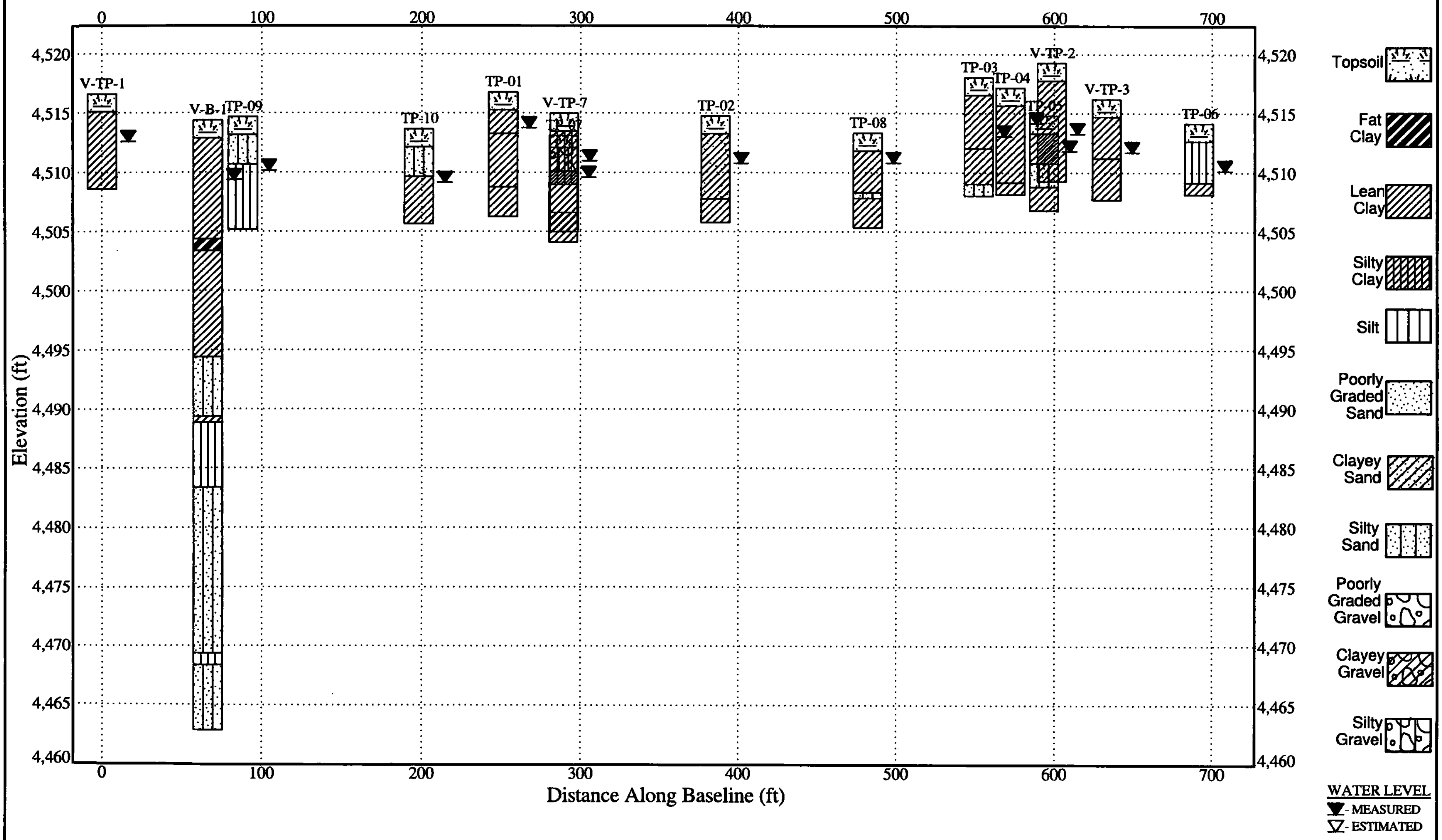
SAMPLE TYPE
☒ - 2" O.D./1.38" I.D. Split Spoon Sampler
▨ - 2.5" O.D./2" I.D. California Split Spoon Sampler
▨ - 3" O.D. Thin-Walled Shelby Sampler
▯ - Grab Sample
▮ - 2" O.D./1.625" I.D. Liner Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B-19



GeoStrata

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

B-20

UNIFIED SOIL CLASSIFICATION SYSTEM

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

LOG KEY SYMBOLS

⊕ BORING SAMPLE LOCATION

⧗ TEST-PIT SAMPLE LOCATION

▼ WATER LEVEL (level after completion)

▽ WATER LEVEL (level where first encountered)

CEMENTATION

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

OTHER TESTS KEY

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

MODIFIERS

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

MOISTURE CONTENT

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

STRATIFICATION

DESCRIPTION	THICKNESS	DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2"	OCCASIONAL	ONE OR LESS PER FOOT OF THICKNESS
LAYER	1/2 - 12"	FREQUENT	MORE THAN ONE PER FOOT OF THICKNESS

GENERAL NOTES

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

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

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

CONSISTENCY - FINE-GRAINED SOIL

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

GeoStrata

Soil Symbols Description Key

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate B-21

APPENDIX C

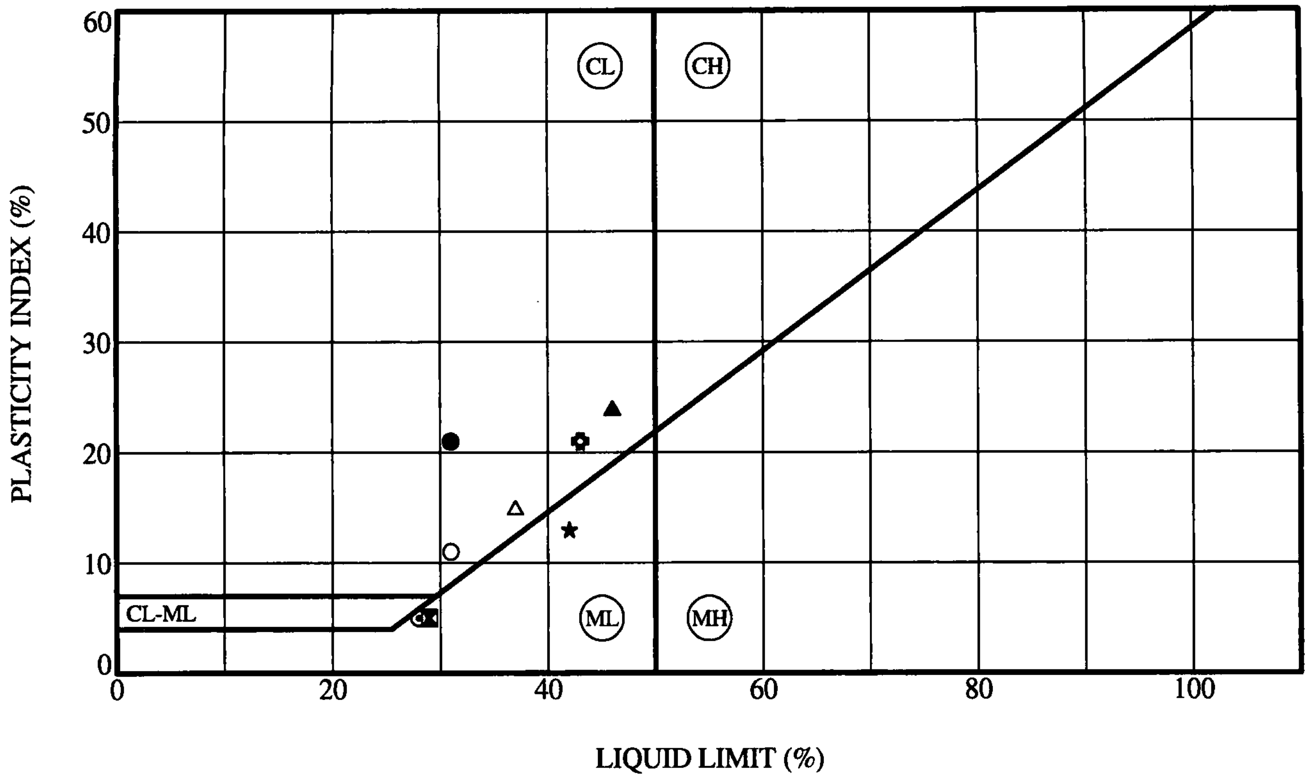
Test Pit No.	Sample Depth (feet)	USCS Soil Classification	Natural Moisture Content (%)	Natural Dry Density (pcf)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Gradation			Atterberg		Consolidation			Collapse (%)	CBR (%)	Sulfate Content (ppm)	Resistivity (Ω-cm)	pH
							Gravel (%)	Sand (%)	Fines (%)	LL	PI	Cc	Cr	OCR					
TP-01	2.5	CL					0.0	24.3	75.7										
TP-01	4	CL	40.7				0.0	24.3	75.7										
TP-01	6																46.1	1,300	7.95
TP-02	3	CL	24.4				0.8	37.4	61.8	31	21								
TP-03	2	CL			21.1	96.1	0.6	14.3	85.1							1.9			
TP-03	3	CL	27.1	94.6					95.0			0.114	0.026	7					
TP-03	9	SM					0.0	62.6	37.4	29	5								
TP-05	2	CL	22.1	96.3			0.0	9.6	90.4	46	24	0.116	0.03	18.7					
TP-06	4	ML	46	72.2			0.2	25.2	74.6	42	13	0.177	0.016	9.5					
TP-09	4	ML	17.4	109.2			0.0	18.3	81.7	28	5				0.24				
TP-10	6	CL	21.7	94.7			0.0	9.0	91.0	43	21	0.115	0.022	3.6					
V-B-1	2.5	CL	23.8				4.0	10.5	85.5										
V-B-1	5	CL	28	97.9			0.0	7.3	92.7	31	11				0.19				
V-B-1	5	CL	27.3	96								0.086	0.015	4.9					
V-B-1	7.5	CL	29.1	93.5			1.8	4.6	93.6	37	15								
V-B-1	10	CH	27.3	94.9			0.0	0.0	100.0										
V-B-1	15	CL	27.3				0.0	8.6	91.4										
V-B-1	20	SM	22				0.0	52.3	47.7	NP	NP								
V-B-1	25	CL	23.8				0.0	0.5	99.5	28	9								
V-B-1	30	ML	29.4				0.0	17.5	82.5	NP	NP								
V-B-1	35	SM	25.7				0.0	67.5	32.5	NP	NP								
V-B-1	45	ML	24.2				0.0	40.7	59.3	NP	NP								
V-B-1	50	SM	23.8				0.0	52.9	47.1	NP	NP								
V-TP-2	3	CL	27.7	80.9			0.0	19.4	80.6	37	15	0.125	0.018	9.8					
V-TP-3	2.5	CL	26.3	91.1			0.0	5.4	94.6	43	21				0.03				

GeoStrata

Lab Summary Report

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 1



	Sample Location	Depth (ft)	LL (%)	PL (%)	PI (%)	Fines (%)	Classification
●	**TP-02**	**3.0**	**31**	**10**	**21**	**61.8**	**Sandy Lean CLAY**
⊠	**TP-03**	**9.0**	**29**	**24**	**5**	**37.4**	**Silty SAND**
▲	**TP-05**	**2.0**	**46**	**22**	**24**	**90.4**	**Lean CLAY**
★	**TP-06**	**4.0**	**42**	**29**	**13**	**74.6**	**SILT with sand**
⊙	**TP-09**	**4.0**	**28**	**23**	**5**	**81.7**	**Silt with sand**
✿	**TP-10**	**6.0**	**43**	**22**	**21**	**91.0**	**Lean CLAY**
○	**V-B-1**	**5.0**	**31**	**20**	**11**	**92.7**	**Lean CLAY**
△	**V-B-1**	**7.5**	**37**	**22**	**15**	**93.6**	**Lean CLAY**

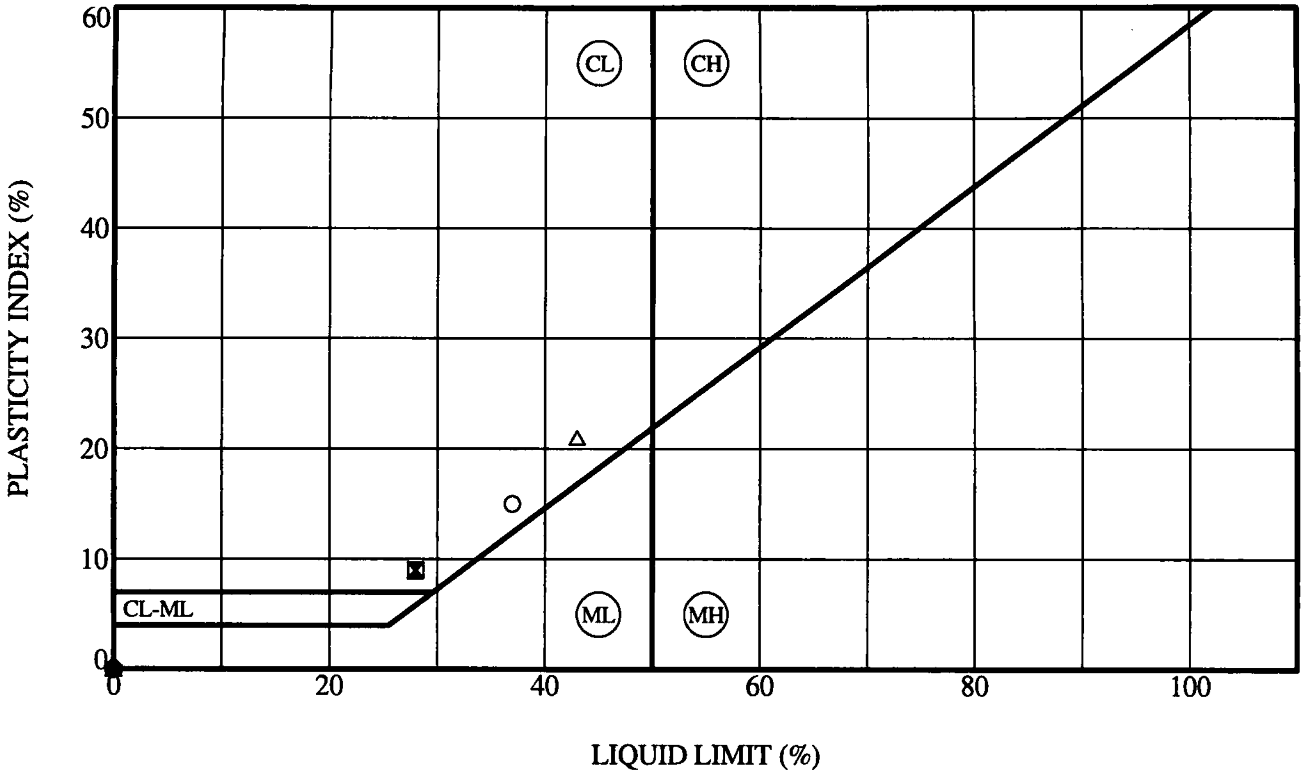
GeoStrata

ATTERBERG LIMITS' RESULTS - ASTM D 4318

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 2

C_ATTERBERG EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



Sample Location		Depth (ft)	LL (%)	PL (%)	PI (%)	Fines (%)	Classification
●	**V-B-1**	**20.0**	**NP**	**NP**	**NP**	**47.7**	**Silty SAND**
⊠	**V-B-1**	**25.0**	**28**	**19**	**9**	**99.5**	**Lean CLAY**
▲	**V-B-1**	**30.0**	**NP**	**NP**	**NP**	**82.5**	**SILT with sand**
★	**V-B-1**	**35.0**	**NP**	**NP**	**NP**	**32.5**	**Silty SAND**
⊙	**V-B-1**	**45.0**	**NP**	**NP**	**NP**	**59.3**	**Sandy SILT**
✿	**V-B-1**	**50.0**	**NP**	**NP**	**NP**	**47.1**	**Silty SAND**
○	**V-TP-2**	**3.0**	**37**	**22**	**15**	**80.6**	**Lean CLAY with sand**
△	**V-TP-3**	**2.5**	**43**	**22**	**21**	**94.6**	**Lean CLAY**

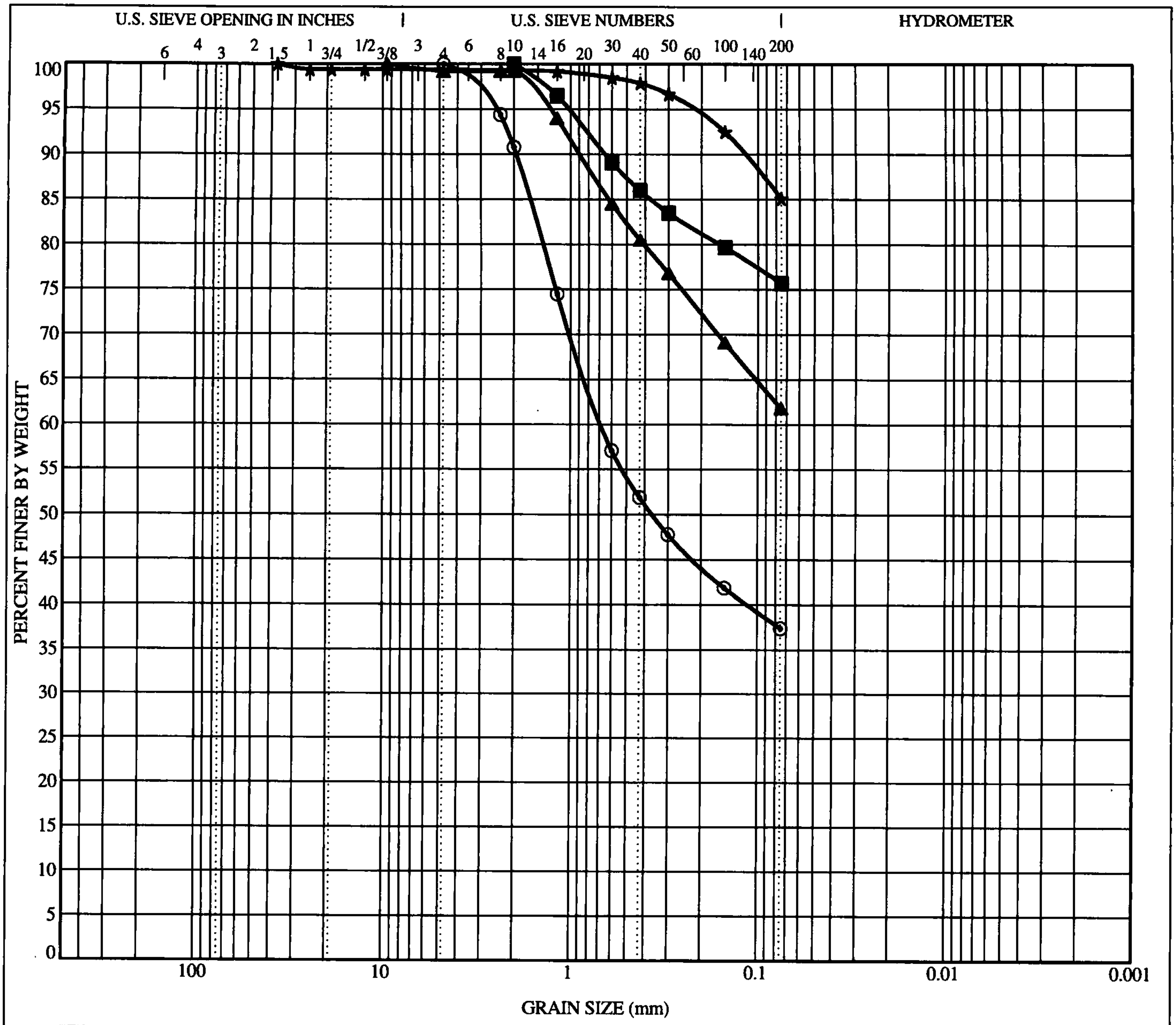
C_ATTERBERG EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

GeoStrata

ATTERBERG LIMITS' RESULTS - ASTM D 4318

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
● **TP-01**	**2.5**	**Lean CLAY with sand**					
⊠ **TP-01**	**4.0**	**Lean CLAY with sand**					
▲ **TP-02**	**3.0**	**Sandy Lean CLAY**	**31**	**10**	**21**		
★ **TP-03**	**2.0**	**Lean CLAY**					
⊙ **TP-03**	**9.0**	**Silty SAND**	**29**	**24**	**5**		

Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **TP-01**	**2.5**	**2**				**0.0**	**24.3**	**75.7**	
⊠ **TP-01**	**4.0**	**2**				**0.0**	**24.3**	**75.7**	
▲ **TP-02**	**3.0**	**9.5**				**0.8**	**37.4**	**61.8**	
★ **TP-03**	**2.0**	**37.5**				**0.6**	**14.3**	**85.1**	
⊙ **TP-03**	**9.0**	**4.75**	**0.672**			**0.0**	**62.6**	**37.4**	

C_GSD EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

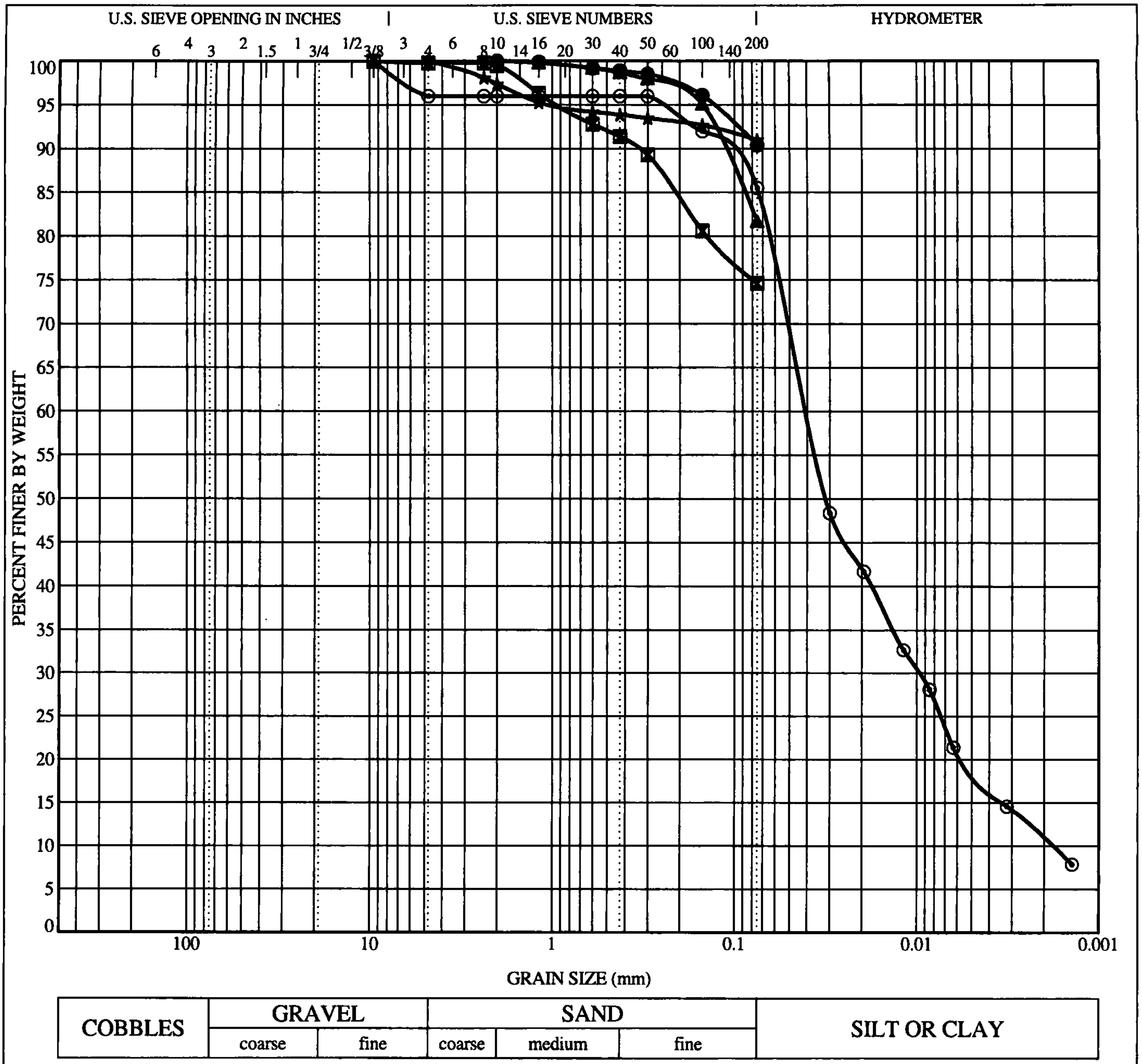
GeoStrata

GRAIN SIZE DISTRIBUTION - ASTM D422

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 4



Sample Location		Depth	Classification	LL	PL	PI	Cc	Cu
●	**TP-05**	**2.0**	**Lean CLAY**	**46**	**22**	**24**		
⊠	**TP-06**	**4.0**	**SILT with sand**	**42**	**29**	**13**		
▲	**TP-09**	**4.0**	**Silt with sand**	**28**	**23**	**5**		
★	**TP-10**	**6.0**	**Lean CLAY**	**43**	**22**	**21**		
⊙	**V-B-1**	**2.5**	**Lean CLAY**				**1.31**	**22.02**

Sample Loctaion		Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-05**	**2.0**	**2**				**0.0**	**9.6**	**90.4**	
⊠	**TP-06**	**4.0**	**9.5**				**0.2**	**25.2**	**74.6**	
▲	**TP-09**	**4.0**	**2**				**0.0**	**18.3**	**81.7**	
★	**TP-10**	**6.0**	**4.75**				**0.0**	**9.0**	**91.0**	
⊙	**V-B-1**	**2.5**	**9.5**	**0.04**	**0.01**	**0.002**	**4.0**	**10.5**	**74.7**	**10.8**

C_GSD EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

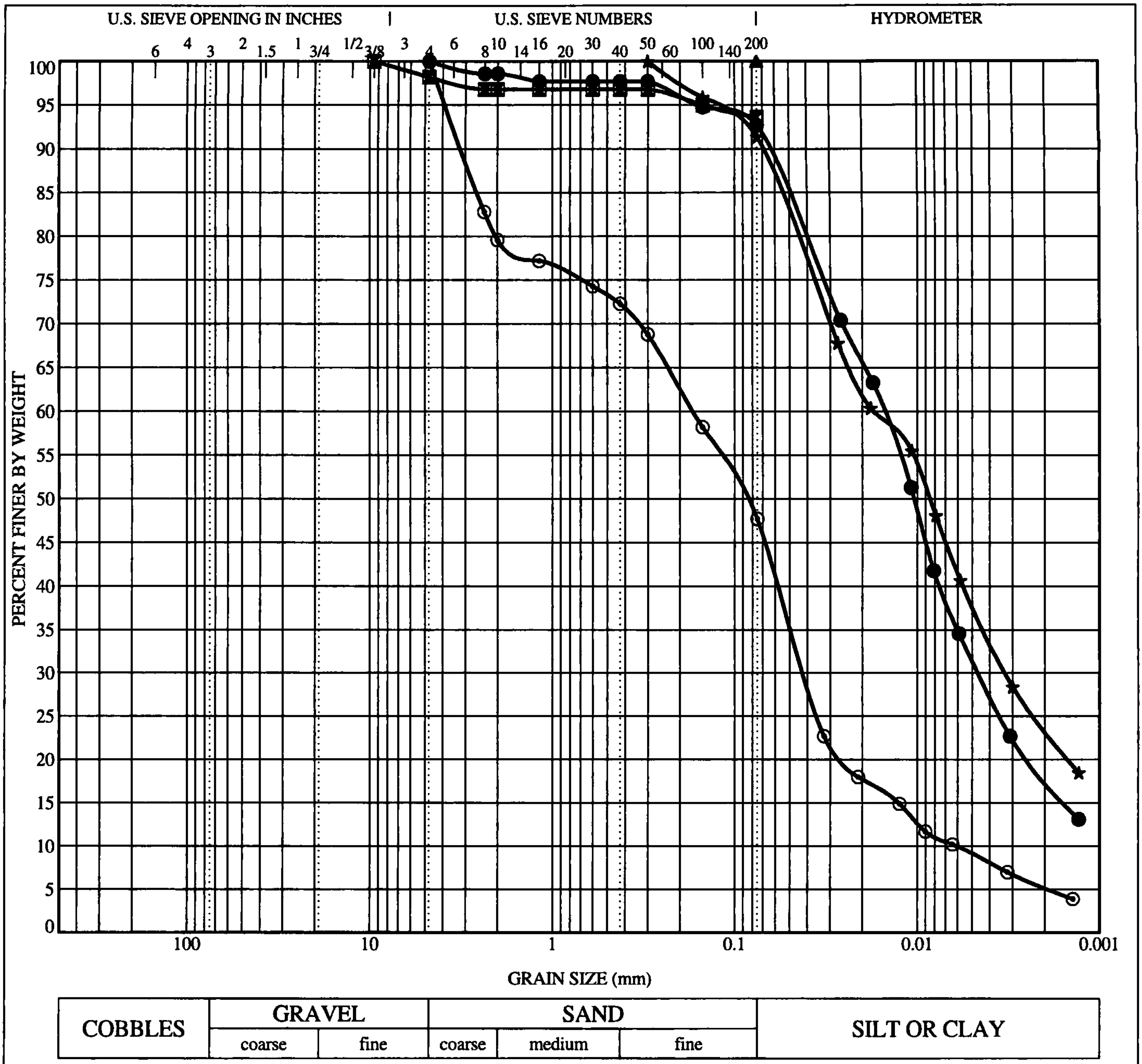
GeoStrata

GRAIN SIZE DISTRIBUTION - ASTM D422

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 5



Sample Location		Depth	Classification	LL	PL	PI	Cc	Cu
●	**V-B-1**	**5.0**	**Lean CLAY**	**31**	**20**	**11**		
⊠	**V-B-1**	**7.5**	**Lean CLAY**	**37**	**22**	**15**		
▲	**V-B-1**	**10.0**	**Fat CLAY**					
★	**V-B-1**	**15.0**	**Lean CLAY**					
⊙	**V-B-1**	**20.0**	**Silty SAND**	**NP**	**NP**	**NP**	**1.66**	**27.53**

Sample Loctaion		Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**V-B-1**	**5.0**	**4.75**	**0.015**	**0.005**		**0.0**	**7.3**	**74.8**	**17.9**
⊠	**V-B-1**	**7.5**	**9.5**				**1.8**	**4.6**	**93.6**	
▲	**V-B-1**	**10.0**	**0.075**				**0.0**	**0.0**	**100.0**	
★	**V-B-1**	**15.0**	**0.3**	**0.017**	**0.003**		**0.0**	**8.6**	**67.8**	**23.6**
⊙	**V-B-1**	**20.0**	**4.75**	**0.169**	**0.041**	**0.006**	**0.0**	**52.3**	**42.5**	**5.2**

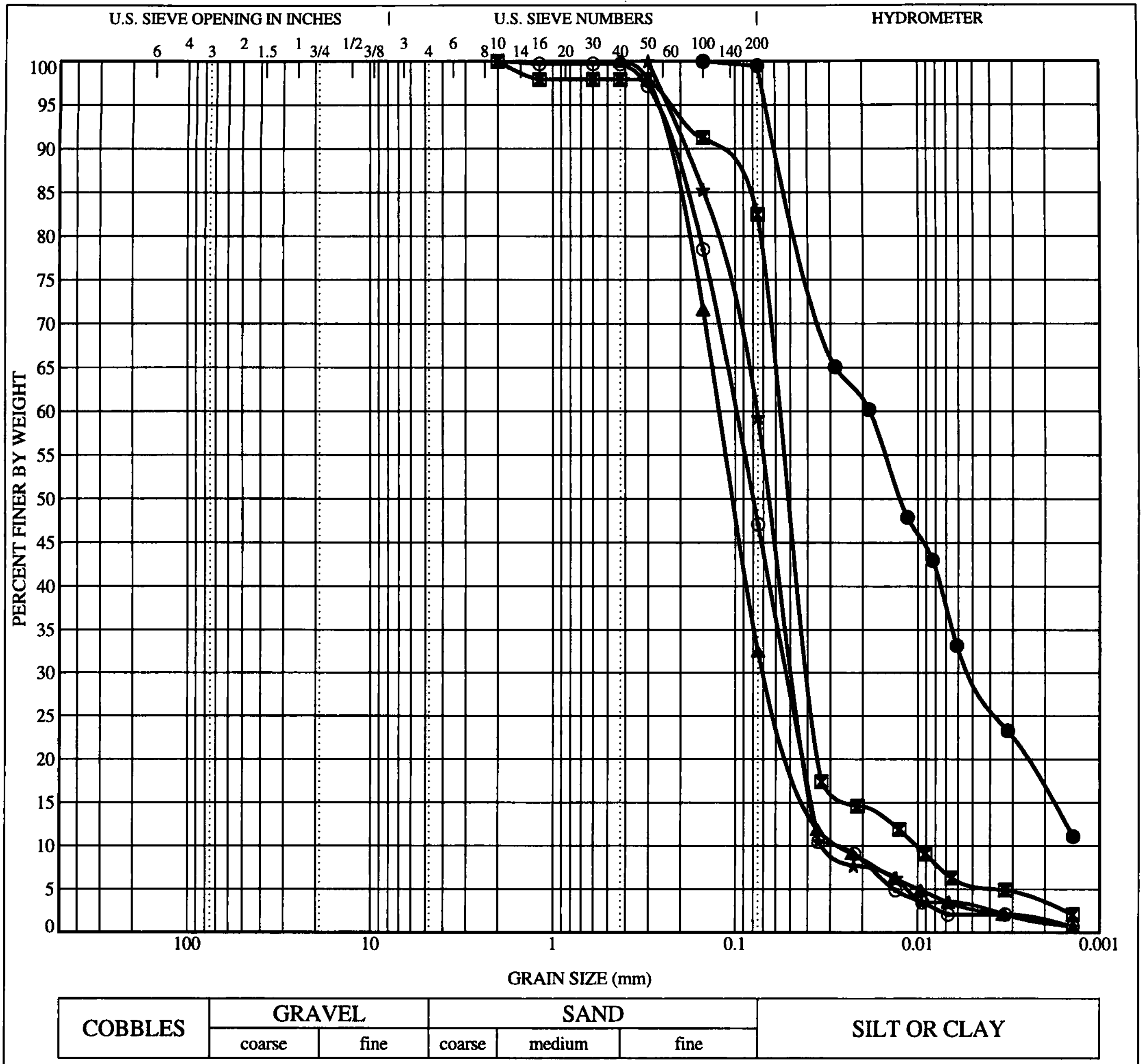
GRAIN SIZE DISTRIBUTION - ASTM D422

GeoStrata

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 6

C_GSD EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



	Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
●	**V-B-1**	**25.0**	**Lean CLAY**	**28**	**19**	**9**		
⊠	**V-B-1**	**30.0**	**SILT with sand**	**NP**	**NP**	**NP**	**2.67**	**5.62**
▲	**V-B-1**	**35.0**	**Silty SAND**	**NP**	**NP**	**NP**	**1.46**	**4.65**
★	**V-B-1**	**45.0**	**Sandy SILT**	**NP**	**NP**	**NP**	**0.91**	**2.38**
⊙	**V-B-1**	**50.0**	**Silty SAND**	**NP**	**NP**	**NP**	**0.93**	**3.36**

	Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**V-B-1**	**25.0**	**0.15**	**0.018**	**0.005**		**0.0**	**0.5**	**83.1**	**16.4**
⊠	**V-B-1**	**30.0**	**2**	**0.057**	**0.039**	**0.01**	**0.0**	**17.5**	**79.2**	**3.3**
▲	**V-B-1**	**35.0**	**0.425**	**0.122**	**0.068**	**0.026**	**0.0**	**67.5**	**31.2**	**1.3**
★	**V-B-1**	**45.0**	**0.3**	**0.076**	**0.047**	**0.032**	**0.0**	**40.7**	**58.0**	**1.3**
⊙	**V-B-1**	**50.0**	**2**	**0.1**	**0.052**	**0.03**	**0.0**	**52.9**	**45.8**	**1.3**

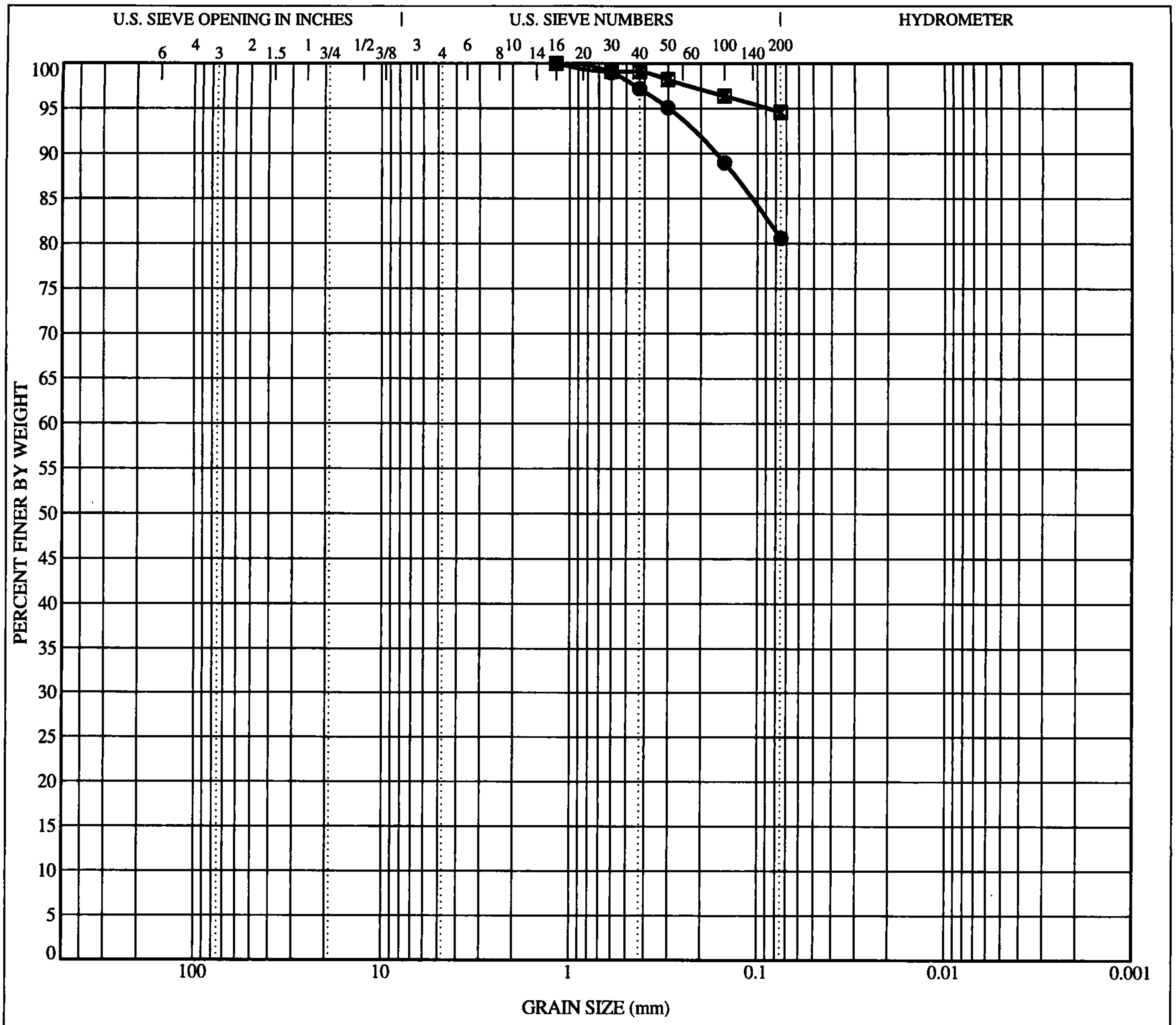
GeoStrata

GRAIN SIZE DISTRIBUTION - ASTM D422

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
●	**V-TP-2**	**3.0**	**Lean CLAY with sand**	**37**	**22**	**15**		
☒	**V-TP-3**	**2.5**	**Lean CLAY**	**43**	**22**	**21**		

	Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**V-TP-2**	**3.0**	**1.18**				**0.0**	**19.4**	**80.6**	
☒	**V-TP-3**	**2.5**	**1.18**				**0.0**	**5.4**	**94.6**	

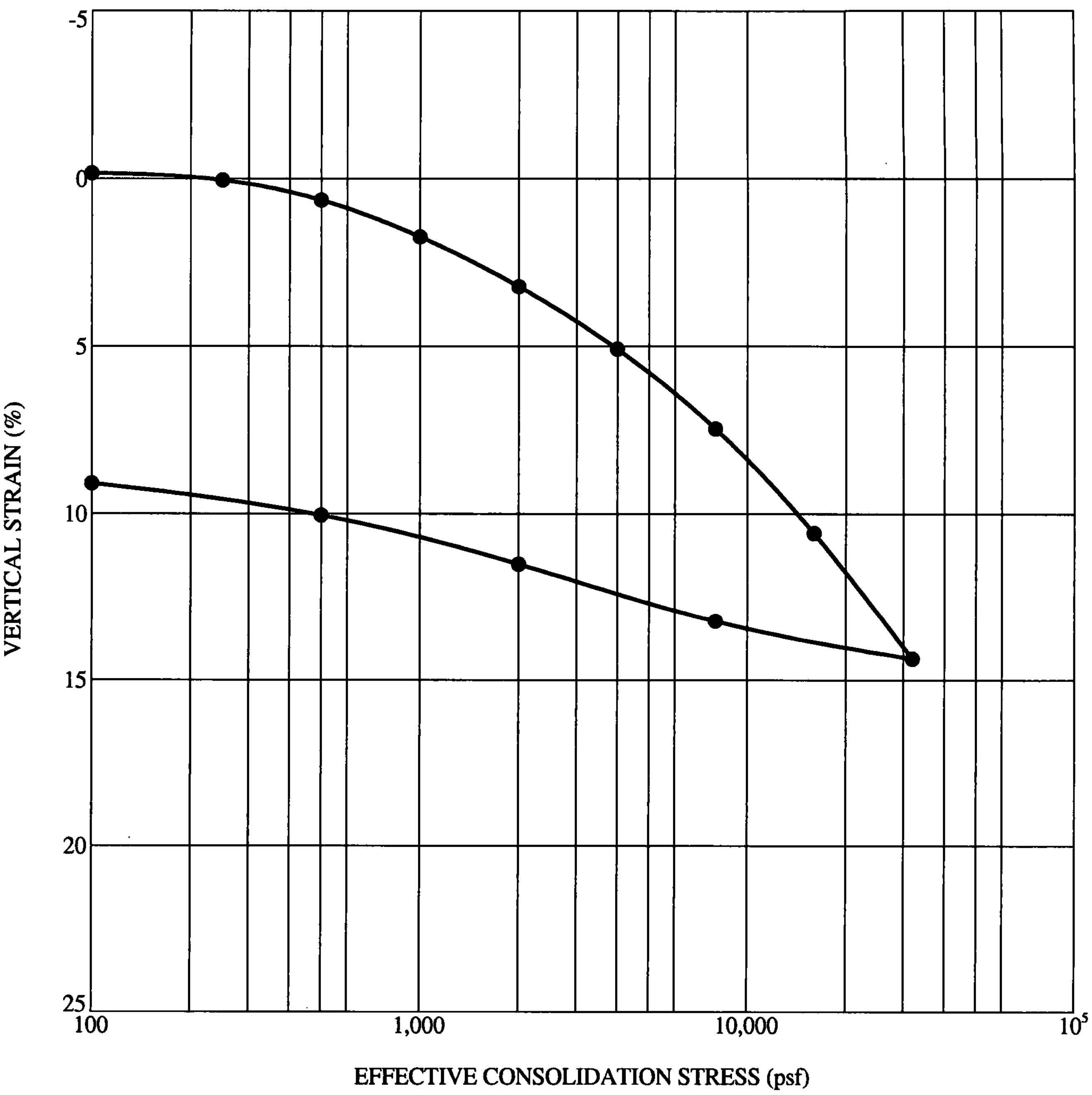
GeoStrata

GRAIN SIZE DISTRIBUTION - ASTM D422

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 8



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**TP-03**	**3.0**	**Lean CLAY**	**95**	**25**	**0.114**	**0.026**	**7.0**

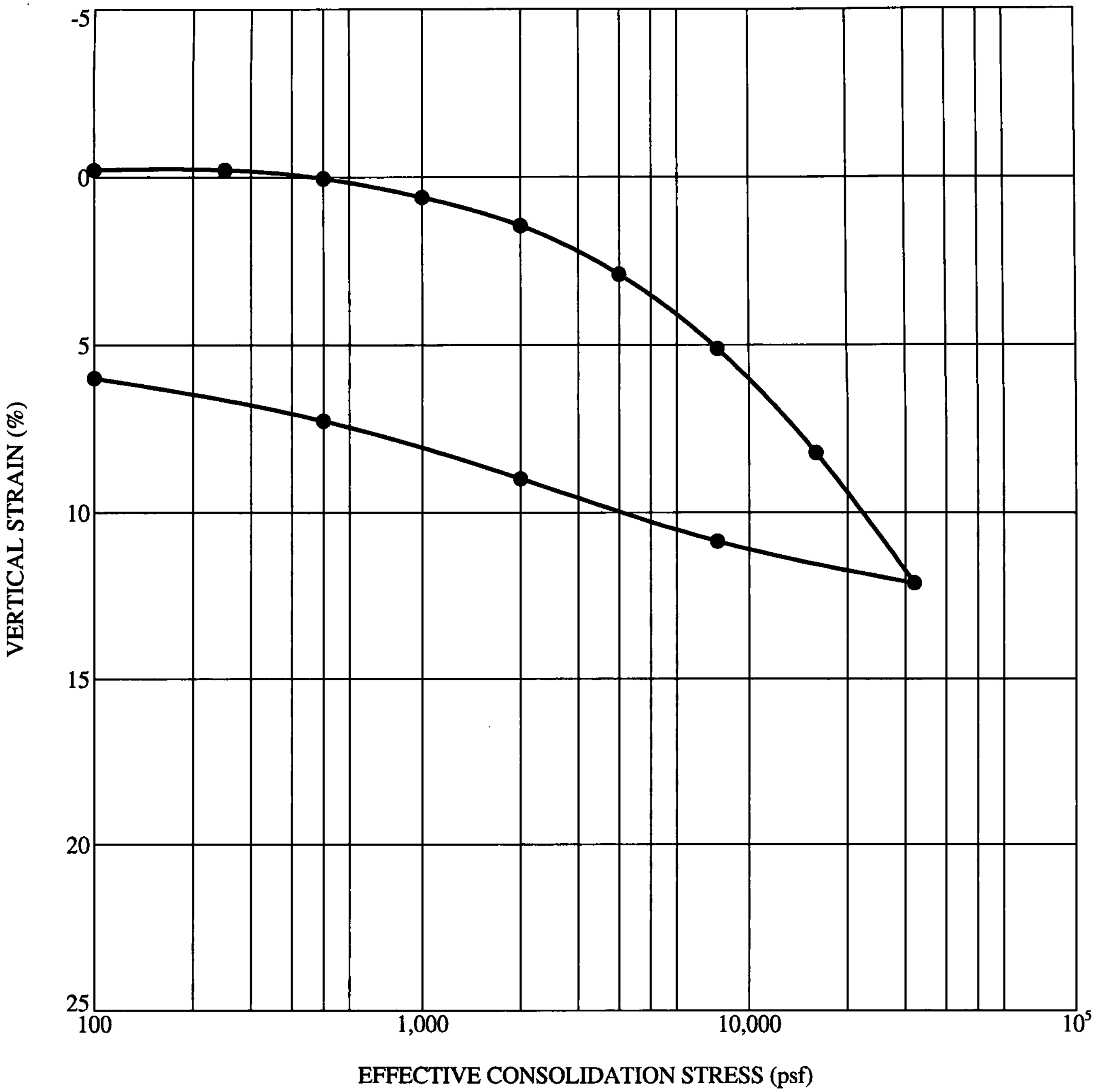
GeoStrata

1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 9

C_CONSOL EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**TP-05**	**2.0**	**Lean CLAY**	**96**	**25**	**0.116**	**0.030**	**18.7**

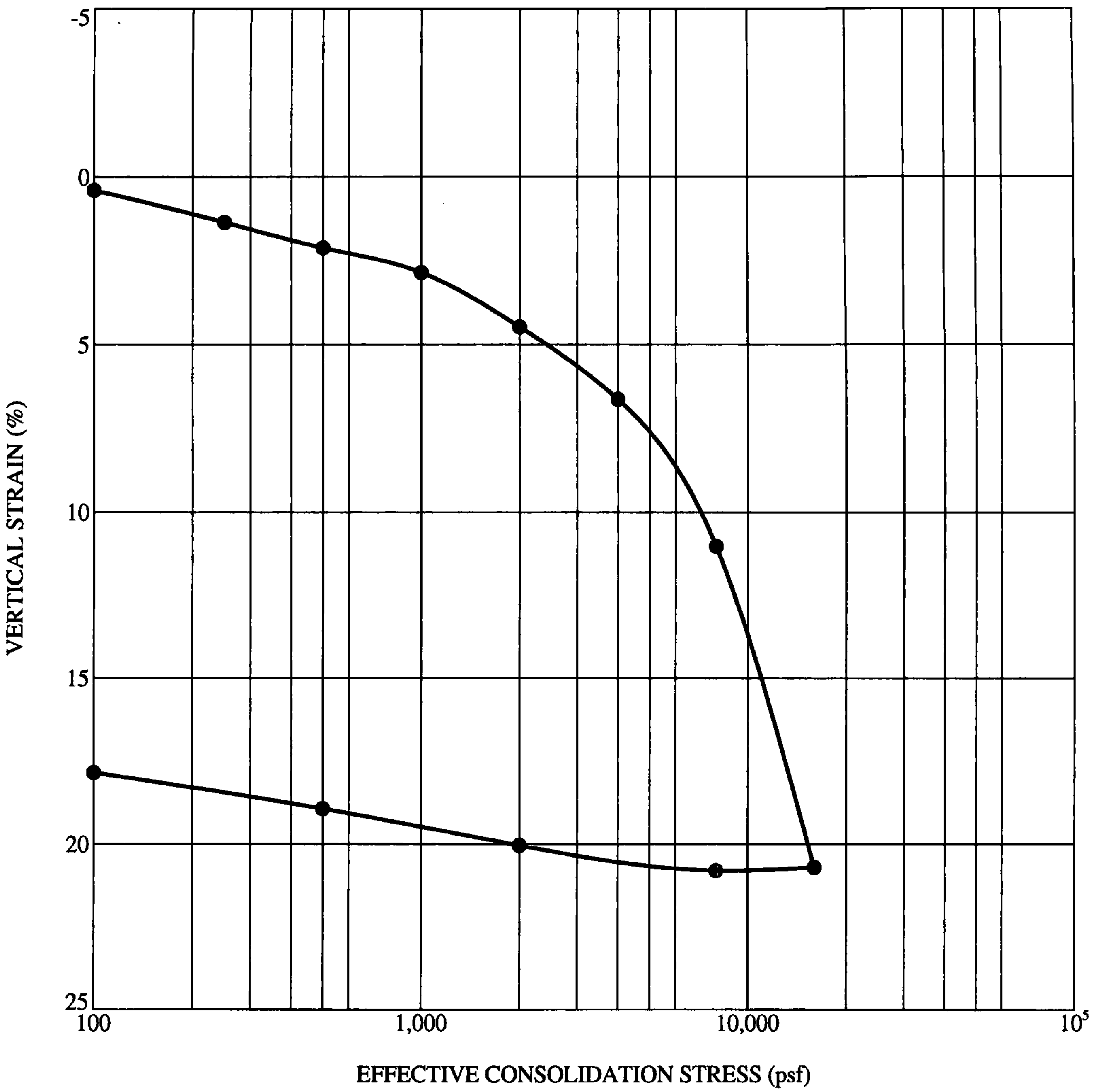
GeoStrata

1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 10



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**TP-06**	**4.0**	**SILT with sand**	**72**	**30**	**0.177**	**0.016**	**9.5**

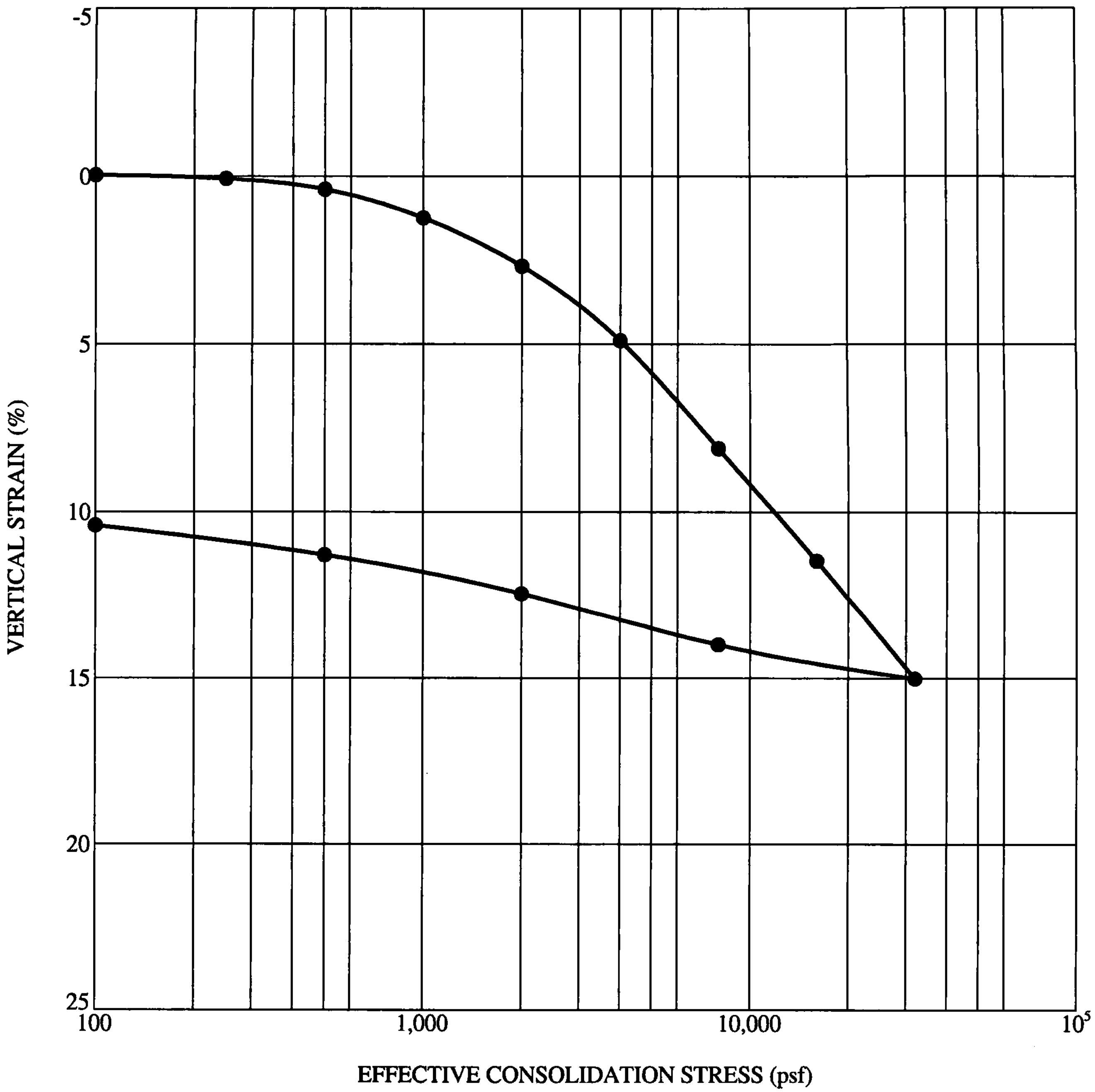
GeoStrata

1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 11

C_CONSOL EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**TP-10**	**6.0**	**Lean CLAY**	**95**	**22**	**0.115**	**0.022**	**3.6**

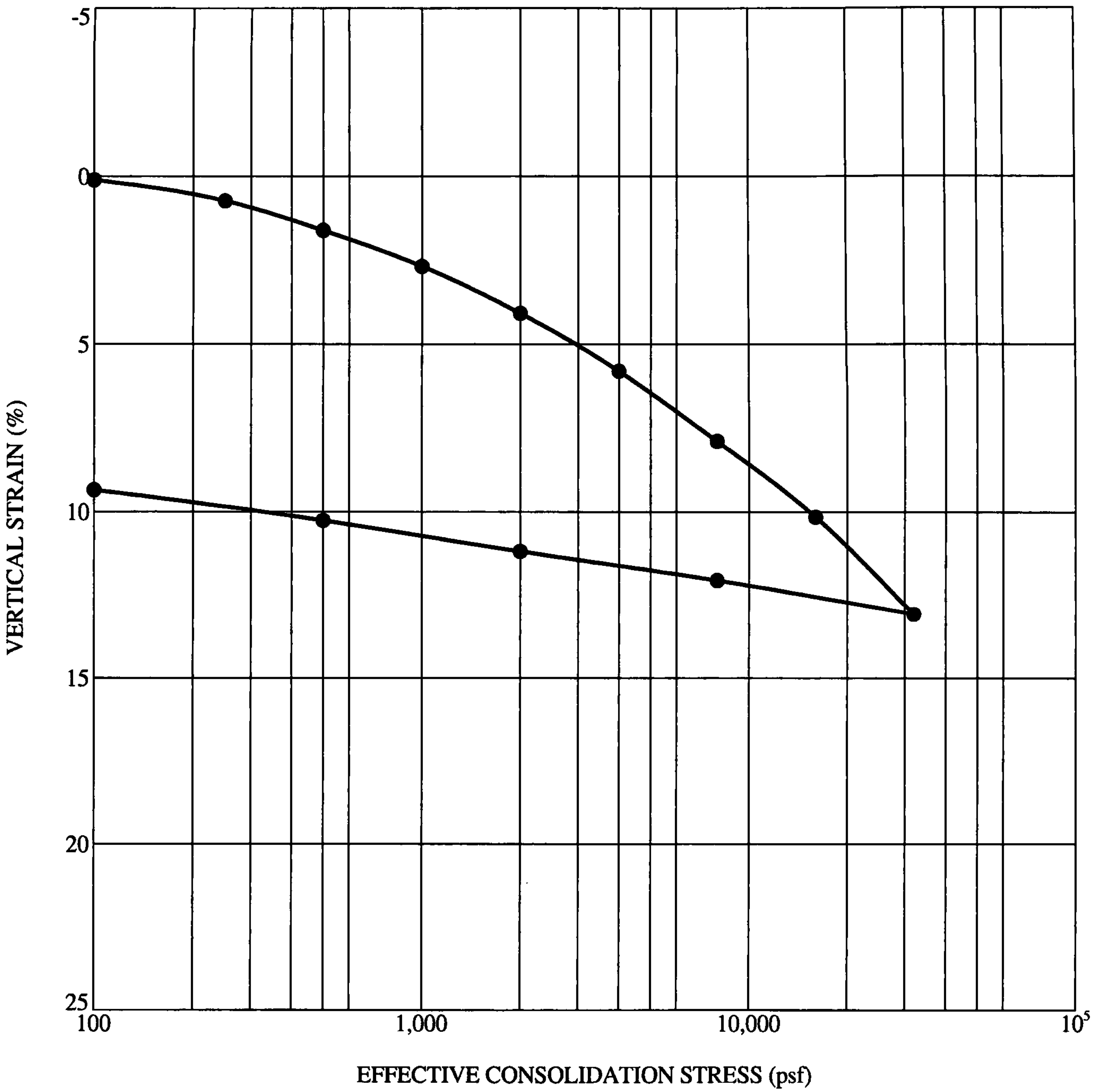
GeoStrata

1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 12



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**V-B-1**	**5.0**	**Lean CLAY**	**96**	**27**	**0.086**	**0.015**	**4.9**

GeoStrata

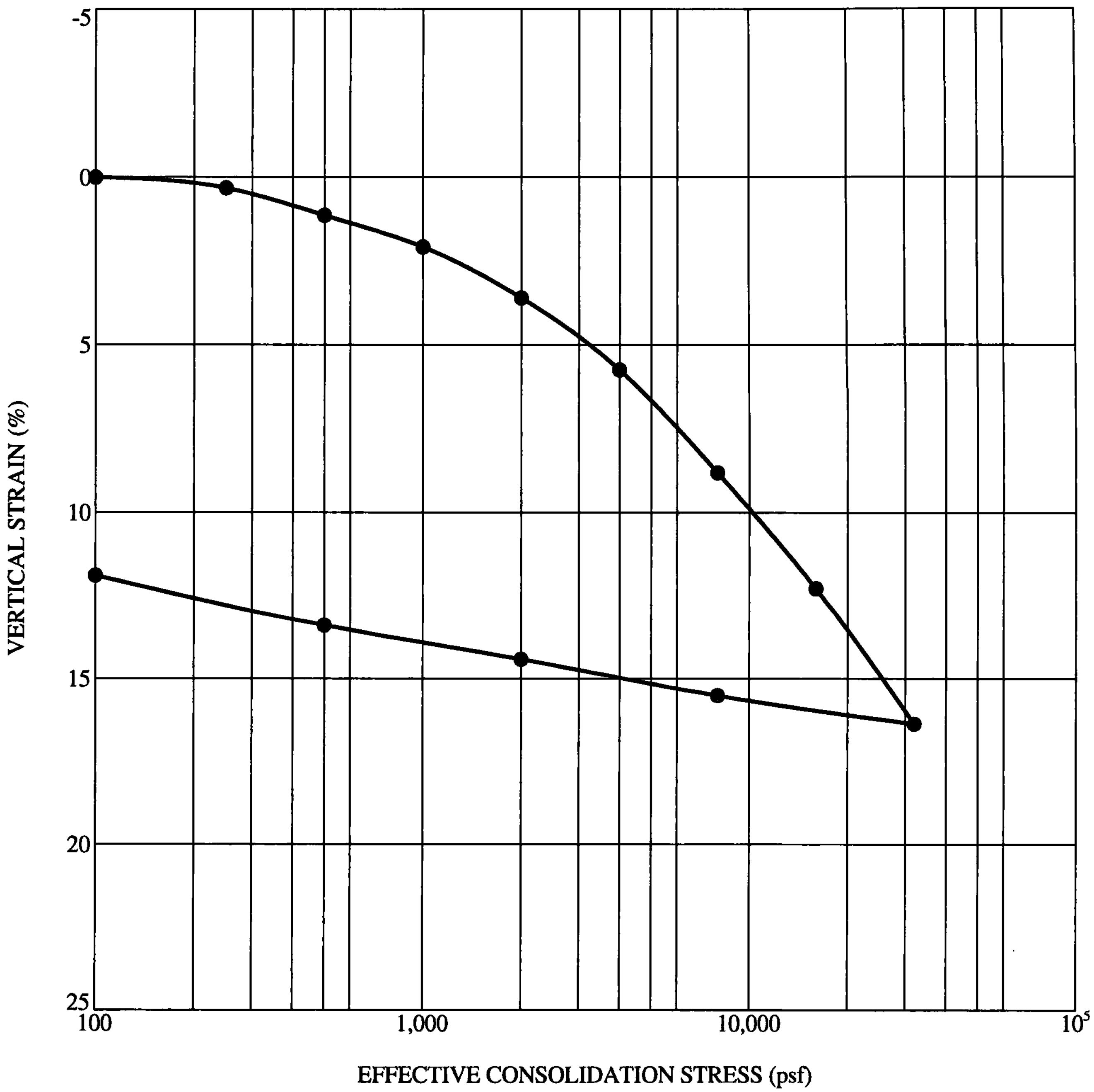
1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 13

C_CONSOL EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR
●	**V-TP-2**	**3.0**	**Lean CLAY with sand**	**81**	**35**	**0.125**	**0.018**	**9.8**

GeoStrata

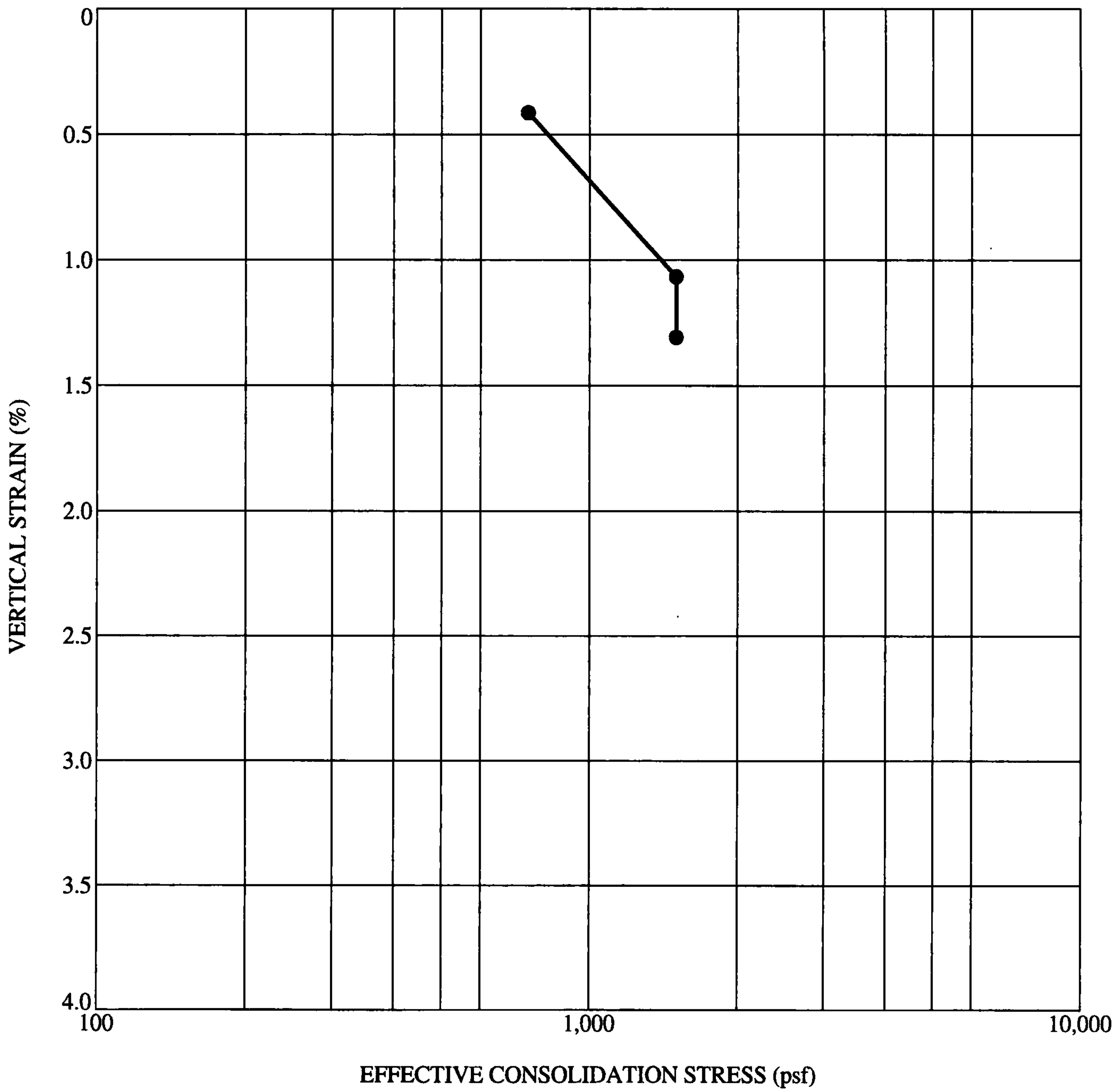
1-D CONSOLIDATION TEST - ASTM D 2435

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 14

C_CONSOL EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



Sample Location		Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR	Inundation Load (psf)	Swell (%)	Collapse (%)
●	**TP-09**	**4.0**	**Silt with sand**	**109**	**16**				**1500**		**0.24**

GeoStrata

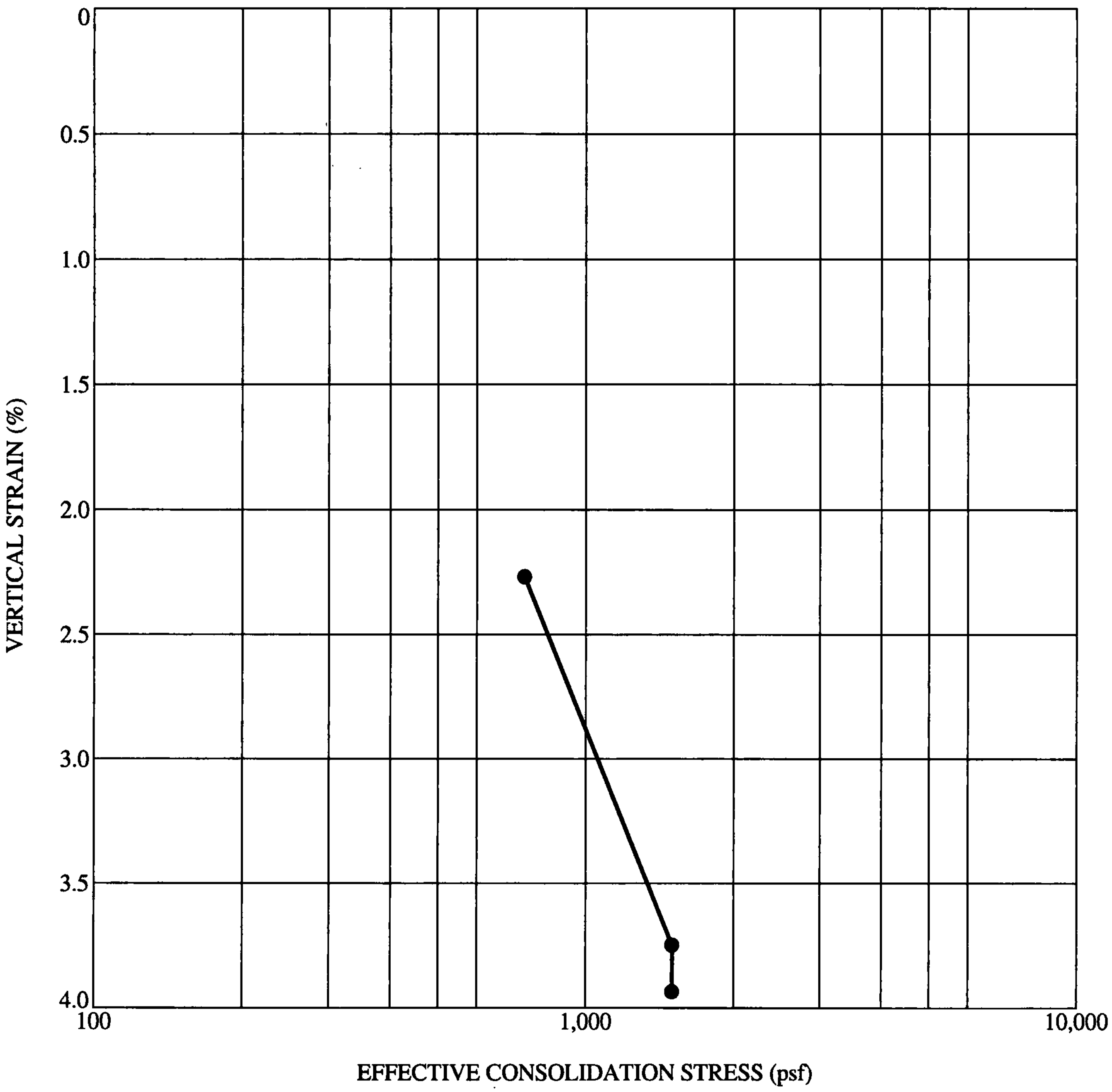
1-D CONSOLIDATION/SWELL/COLLAPSE TEST

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 15

C_CONSOL SWELL/COLLAPSE EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



Sample Location		Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR	Inundation Load (psf)	Swell (%)	Collapse (%)
●	**V-B-1**	**5.0**	**Lean CLAY**	**98**	**28**				**1500**		**0.19**

GeoStrata

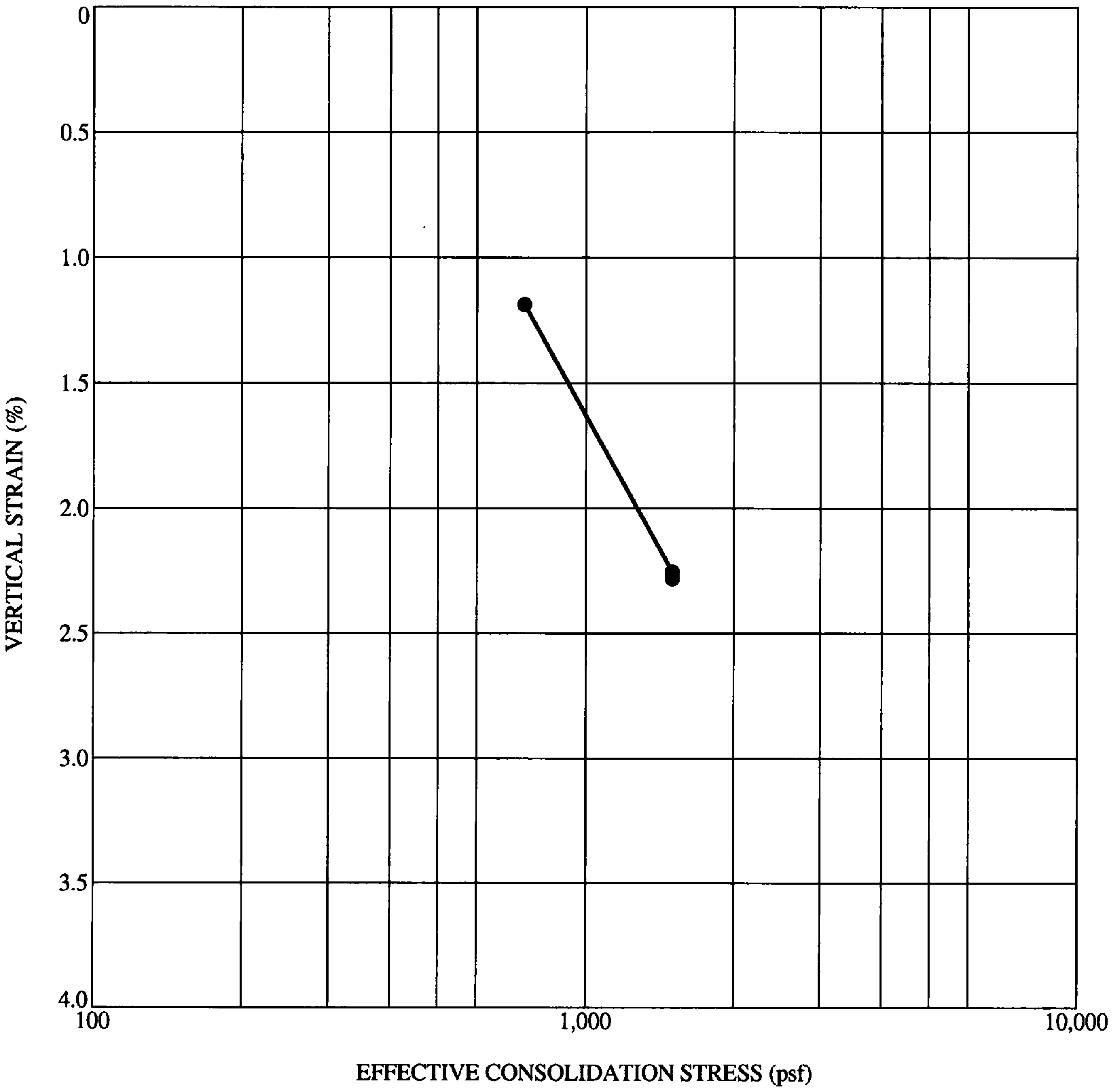
1-D CONSOLIDATION/SWELL/COLLAPSE TEST

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate

C - 16

C_CONSOL SWELL/COLLAPSE EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20



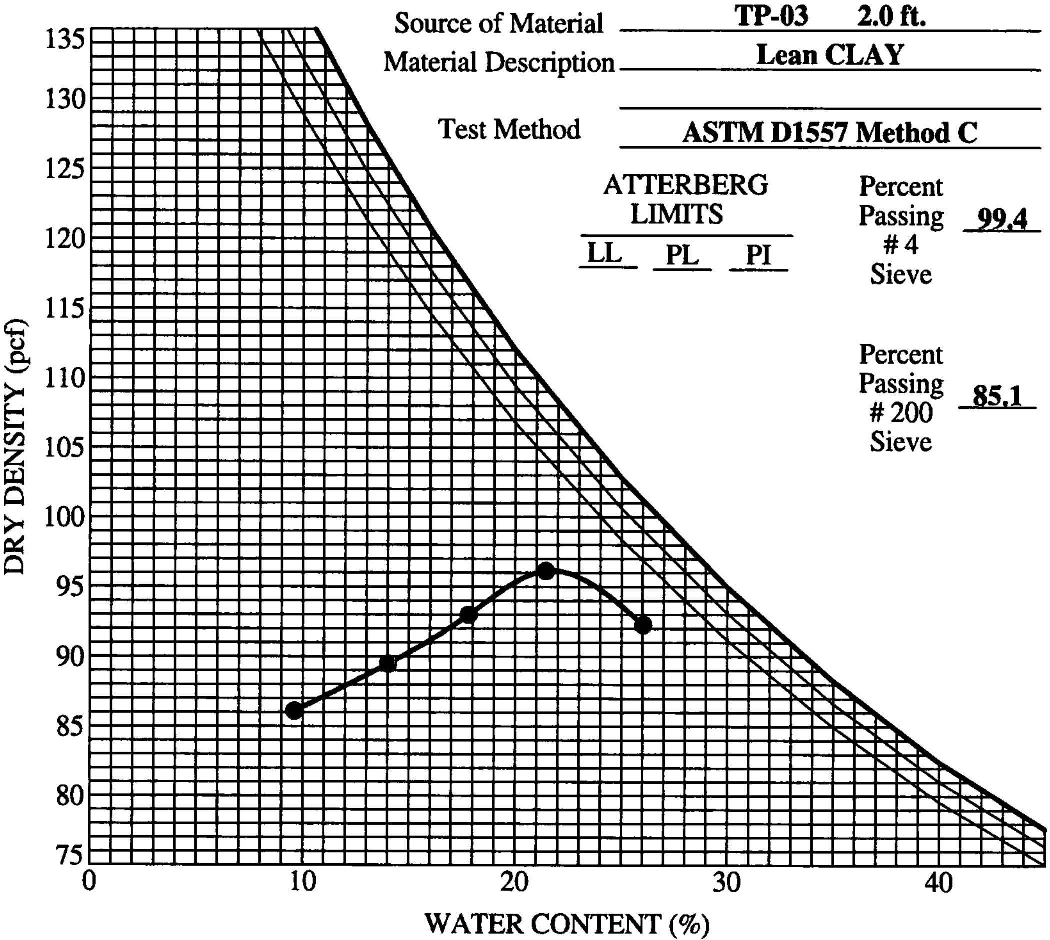
	Sample Location	Depth (ft)	Classification	γ_d (pcf)	MC (%)	C'_c	C'_r	OCR	Inundation Load (psf)	Swell (%)	Collapse (%)
●	**V-TP-3**	**2.5**	**Lean CLAY**	**91**	**25**				**1500**		**0.03**

GeoStrata

1-D CONSOLIDATION/SWELL/COLLAPSE TEST

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
C - 17



Source of Material: **TP-03 2.0 ft.**

Material Description: **Lean CLAY**

Test Method: **ASTM D1557 Method C**

ATTERBERG LIMITS

LL	PL	PI

Percent Passing # 4 Sieve: 99.4

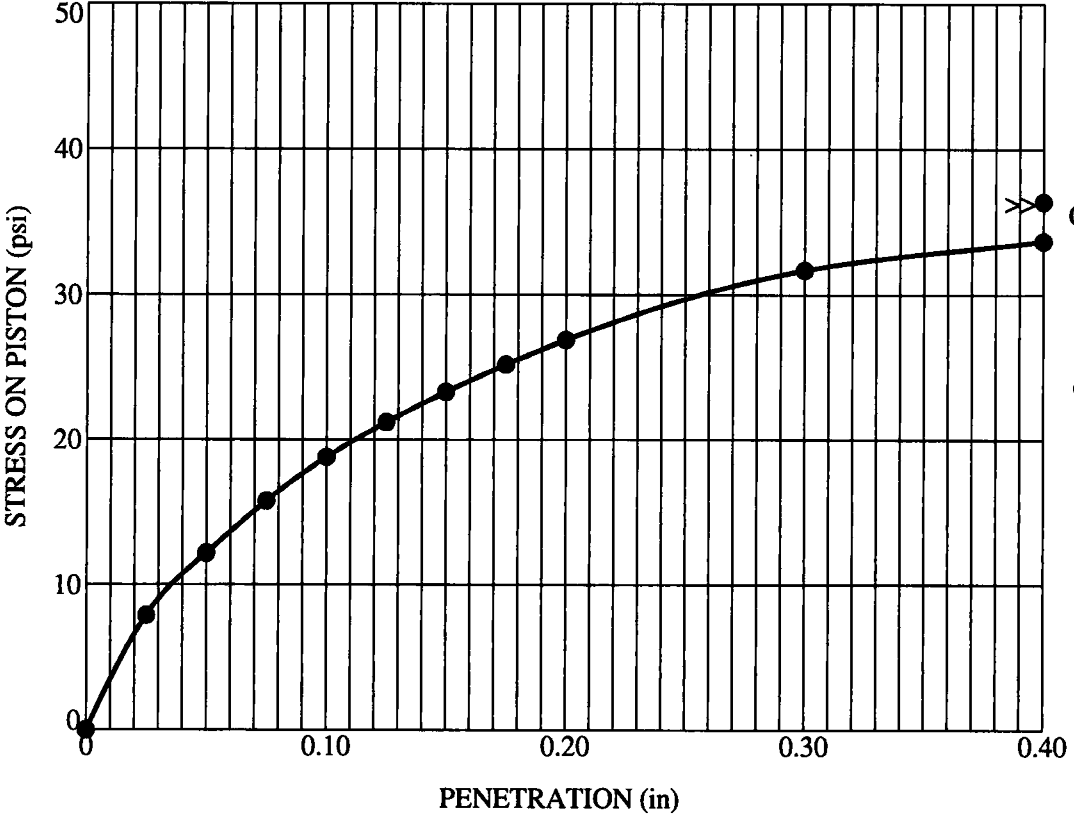
Percent Passing # 200 Sieve: 85.1

TEST RESULTS

Maximum Dry Density	**96.1**	(pcf)
Optimum Water Content	**21.1**	(%)
Percent Rock		(%)
Corrected Maximum Dry Density		(pcf)
Corrected Optimum Water Content		(%)

Curves of 100% Saturation for Specific Gravity Equal to:

2.60, 2.70, 2.80



Dry Density	**96.1**	(pcf)
Relative Compaction	**96**	(%)
Surcharge	**51**	(psf)
% Standard CBR	**1.90**	
Swell	**0.81**	(%)

C_COMPACTION SPLIT EXPLORATION LOGS.GPJ GEOSTRATA.GDT 4/15/20

GeoStrata

COMPACTION AND CBR TEST

Neighborly Ventures
American Fork 10-Acres
American Fork, Utah
Project Number: 1524-001

Plate
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APPENDIX D

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GBA GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

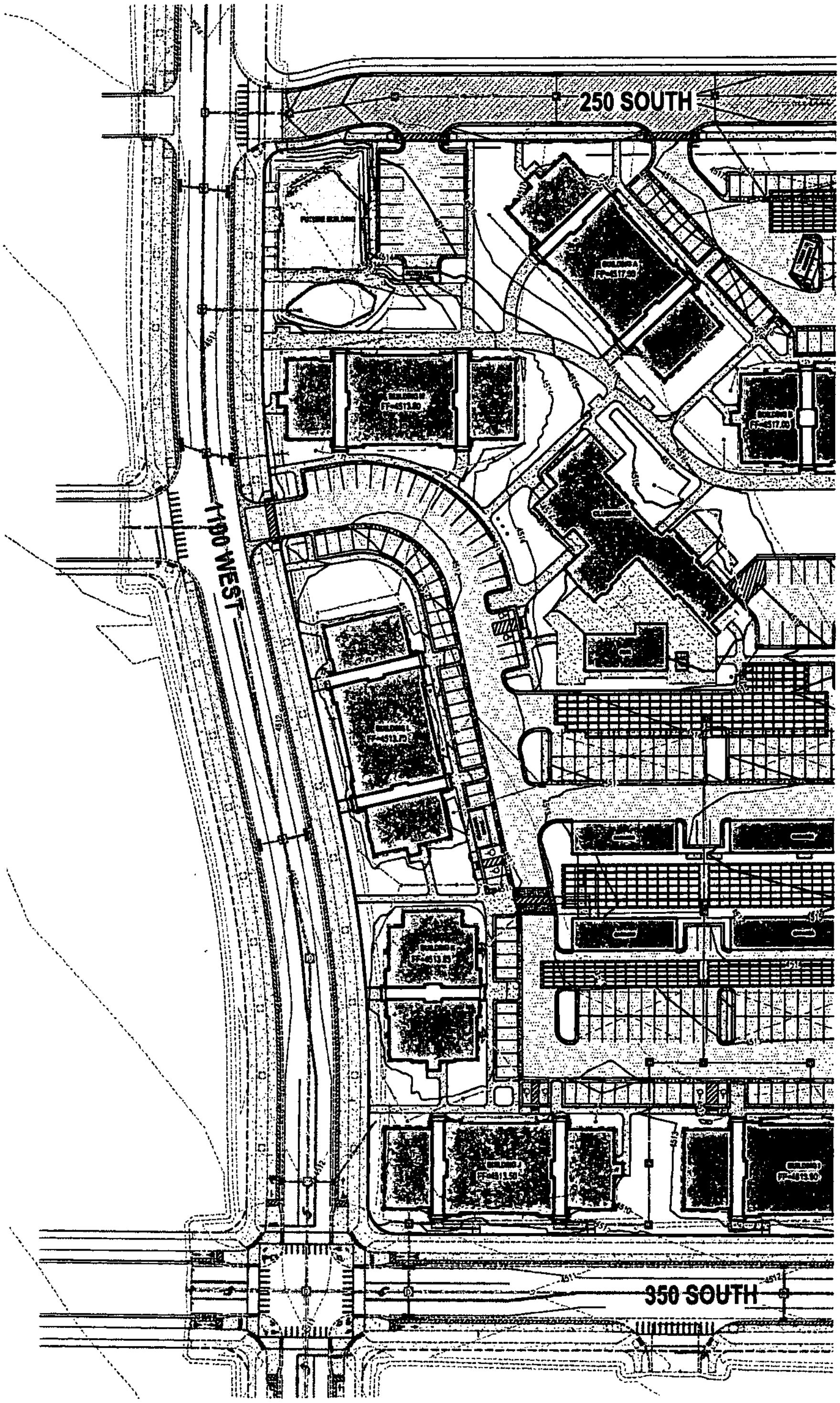
Know what's below. Call before you dig.

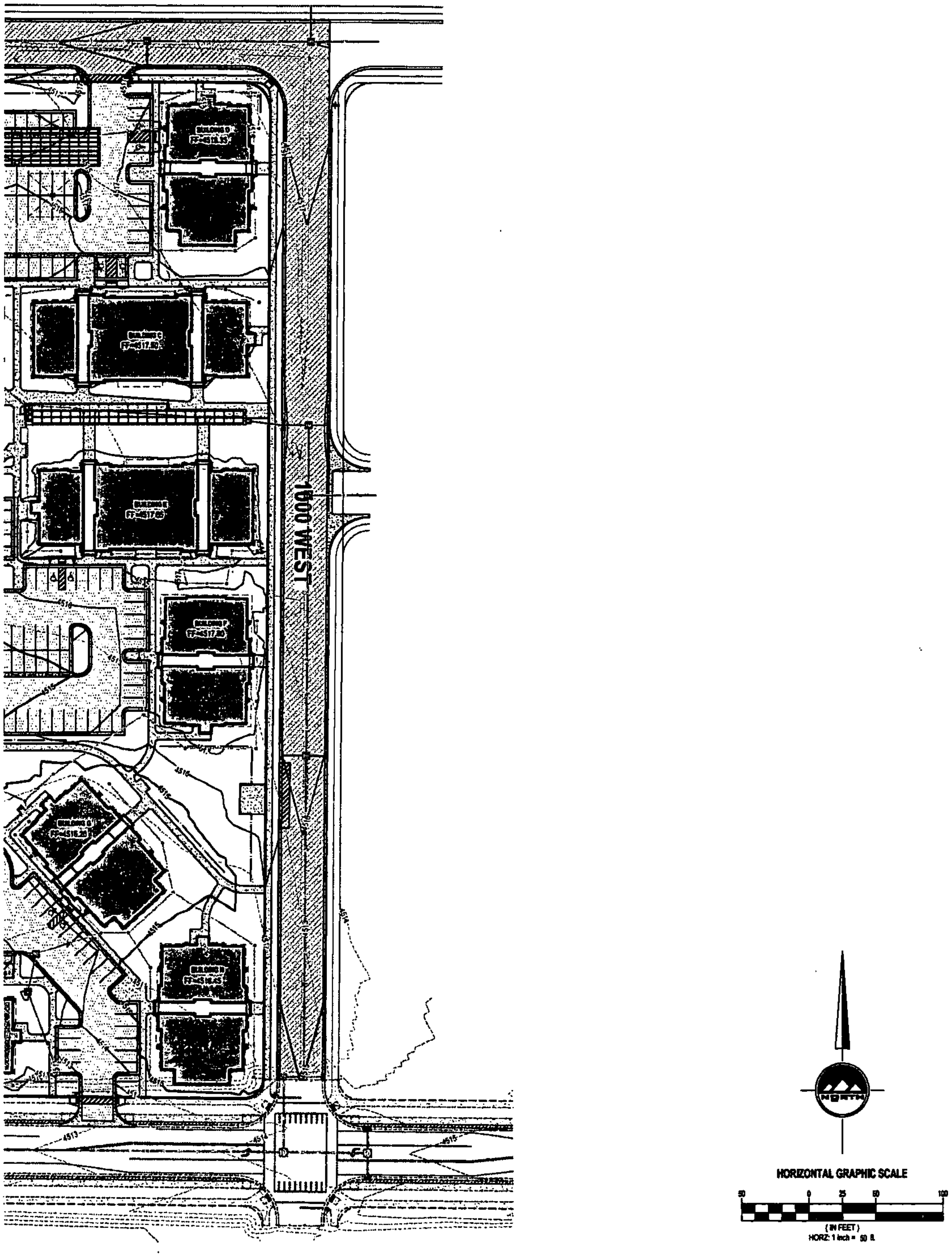
CALL BLUESTAKES
@ 811 AT LEAST 48 HOURS
PRIOR TO THE
COMMENCEMENT OF ANY
CONSTRUCTION.

BENCHMARK

NW CORNER OF SECTION 22.
TOWNSHIP 5 SOUTH, RANGE 1 EAST
SALT LAKE BASE AND MERIDIAN

ELEV = 4524.26'





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Phone: 435.865.1453

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FOR:
NEIGHBORLY VENTURES
2925 RIVER RD S., STE. 100
SALEM, OREGON, 97302

CONTACT:
RICHARD BERGER
PHONE: 503-584-4593

KELTON APARTMENTS

301 SOUTH 1100 WEST
AMERICAN FORK, UTAH

FOR REVIEW ONLY

NO.	DATE	REVISION	BY
1	[illegible]	CITY & UTILITY COMMENTS	E.F.
2			
3			
4			
5			
6			
7			
8			

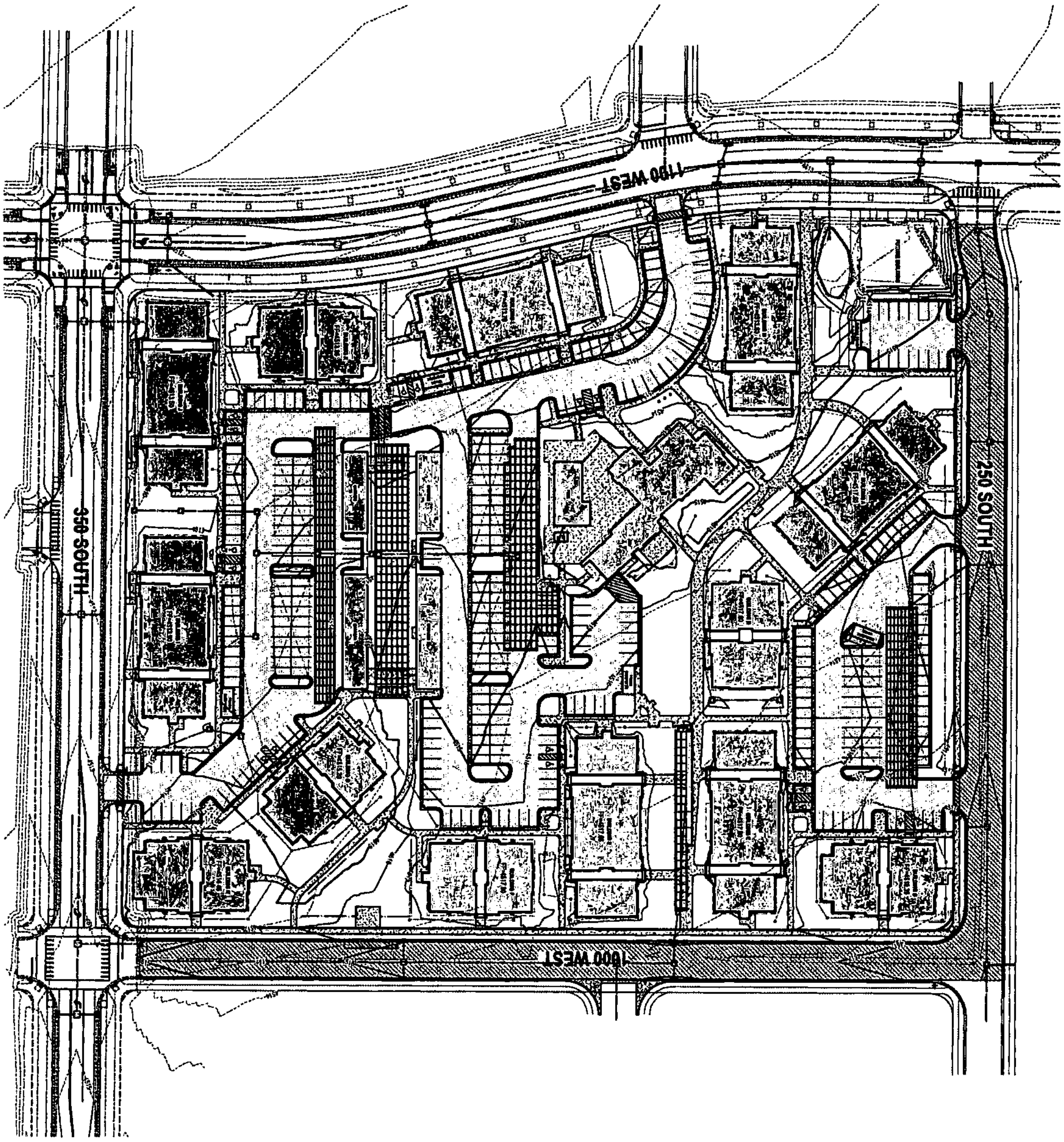
OVERALL GRADING PLAN

PROJECT NUMBER 8799H	PRINT DATE 10/XX/2020
DRAWN BY E.FISHER	CHECKED BY J.FORD
PROJECT MANAGER J.FORD	

C-200

811
CALL BLUESTAKES @ 811 AT LEAST 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION

BENCHMARK
NW CORNER OF SECTION 22, TOWNSHIP 5 SOUTH, RANGE 1 EAST SALT LAKE BASE AND MERIDIAN
ELEV = 4624.25



HORIZONTAL GRAPHIC SCALE
0 25 50 100
(IN FEET)
1 inch = 50 ft.

KELTON APARTMENTS

301 SOUTH 1100 WEST
AMERICAN FORK, UTAH

ENSIGN
THE STANDARD IN ENGINEERING

SALT LAKE CITY
45 W. 10000 S., Suite 500
Sandy, UT 84070
Phone: 801.255.0529

LAYTON
Phone: 801.547.1100

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CEDAR CITY
Phone: 435.865.1453

RICHFIELD
Phone: 435.896.2983

WWW.ENSIGNENG.COM

FOR:
NEIGHBORLY VENTURES
2025 RIVER RD S, STE. 100
SALEM, OREGON 97302

CONTACT:
RICHARD BENDER
PHONE: 503-581-4393

FOR REVIEW ONLY

OVERALL GRADING PLAN

C-200