GEOTECHNICAL INVESTIGATION

NEW INDUSTRIAL LIVE/WORK STRUCTURE

5260 North Sawyer Avenue
Garden City, ID

PREPARED FOR:

Diana Witt
No Park Units LLC
311 Village Drive, PMB 3144
Donnelly, ID 83615

PREPARED BY:

Atlas Technical Consultants, LLC
2791 South Victory View Way
Boise, ID 83709

April 13, 2023
B230372g

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Subject: **Geotechnical Investigation**
New Industrial Live/Work Structure
5260 North Sawyer Avenue
Garden City, ID

Dear Diana Witt:

In compliance with your instructions, Atlas has conducted a soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on March 20, 2023. Data have been analyzed to evaluate pertinent geotechnical conditions. Results of this investigation, together with our recommendations, are to be found in the following report. We have provided a PDF copy for your review and distribution.

Often, questions arise concerning soil conditions because of design and construction details that occur on a project. Atlas would be pleased to continue our role as geotechnical engineers during project implementation.

If you have any questions, please call us at (208) 376-4748.

Respectfully submitted,

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Staff Engineer

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Staff Geologist

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Senior Geotechnical Engineer

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1. INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design of structures as defined in the 2018 International Building Code (IBC). Information in support of groundwater and stormwater issues pertinent to the practice of Civil Engineering is included. Observations and recommendations relevant to the earthwork phase of the project are also presented. Revisions in plans or drawings for the proposed structure from those enumerated in this report should be brought to the attention of the soils engineer to determine whether changes in the provided recommendations are required. Deviations from noted subsurface conditions, if encountered during construction, should also be brought to the attention of the soils engineer.

1.1 Project Description

The proposed development is in the City of Garden City, Ada County, ID, and occupies a portion of the N½NW¼ of Section 31, Township 4 North, Range 2 East, Boise Meridian. The site to be developed is approximately 0.57 acre. Site maps included in the **Appendix** show the project location.

This project will consist of construction of a 3-unit light industrial structure with a building footprint of approximately 8,550 square-feet. Each unit will include a 2nd-story apartment that is approximately 600 square-feet in size. Retaining walls are not anticipated as part of the project. The western and southern portions of the project site will be developed with pavement. Drainage is expected to be directed to onsite infiltration facilities. Location of the infiltration facilities are unknown at this time. Atlas has not been informed of the proposed grading plan.

1.2 Scope of Investigation

Our scope of work was completed in general accordance with our proposal dated and authorized on April 3, 2023. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between No Park Units LLC and Atlas.

Atlas' scope of services included the following:

- Subsurface exploration via test pits.
- Field and laboratory testing of materials encountered and collected.
- Preparation of this report, which includes project description, site conditions, and our engineering analysis and evaluation for the project.

2. SITE DESCRIPTION

2.1 Regional Geology

The project site is located within the western Snake River Plain of southwestern Idaho and eastern Oregon. The plain is a northwest trending rift basin, about 45 miles wide and 200 miles long, that developed about 14 million years ago (Ma) and has since been occupied sporadically by large inland lakes. Geologic materials found within and along the plain's margins reflect volcanic and fluvial/lacustrine sedimentary processes that have led to an accumulation of approximately 1 to 2 km of interbedded volcanic and sedimentary deposits within the plain. Along the margins of the plain, streams that drained the highlands to the north and south provided coarse to fine-grained sediments eroded from granitic and volcanic rocks, respectively. About 2 million years ago the last of the lakes was drained and since that time fluvial erosion and deposition has dominated the evolution of the landscape. The project site is underlain by "Alluvium of Boise River" as mapped by Othberg and Stanford (1993). These Holocene (10,000 years ago to present) age deposits accumulated as the result of stream processes on low-lying river beds, flood plains and alluvial fans. Deposits are composed of sandy cobble gravel upstream grading to sandy pebble gravel downstream and typically contain no pedogenic clay. Gravel deposits underlie the flood plain of the Boise River to depths of 23-35 feet and overlie a surface cut by the river into earlier Tertiary basin-fill sediments.

2.2 General Site Characteristics

The following details regarding site conditions are based on visual observations and review of available geologic and topographic maps and imagery:

- **Current Site Conditions:** The site is approximately 0.57 acre. The site consists of a gravel surfaced lot with an asphalt paved access road on the northwest side of the site. The site is currently used as semi-trailer storage. Commercial structures are present to the west, south, and southeast of the site. A vacant lot is present northeast of the site. A horse track is present to the north of the site
- **Vegetation:** Vegetation on the site consists primarily of landscape trees and shrubs in the northeast corner of the site and along the southeast boundary.
- **Topography:** The site is relatively flat and level.
- **Drainage:** Stormwater drainage for the site is achieved by both sheet runoff and percolation through surficial soils. Runoff predominates for the paved areas while percolation prevails across gravel areas. The site is situated so that it is unlikely that it will receive any drainage from off-site sources.

3. SEISMIC SITE EVALUATION

3.1 Geoseismic Setting

Soils on site are classed as Site Class D in accordance with Chapter 20 of the American Society of Civil Engineers (ASCE) publication ASCE/SEI 7-16. Structures constructed on this site should be designed per IBC requirements for such a seismic classification. Our investigation revealed low hazard potential resulting from potential earthquake motions including: slope instability, liquefaction, and surface rupture caused by faulting or lateral spreading.

3.2 Seismic Design Parameter Values

The ASCE 7-16 seismic design parameter values have been provided below.

Table 1 – Seismic Design Values

Seismic Design Parameter	Design Value
Site Class	D "Default"
Site Modified Peak Ground Acceleration, PGA_M	0.207
S_S	0.306 (g)
S_1	0.110 (g)
F_a	1.555
F_v	2.380
S_{MS}	0.476
S_{M1}	0.261
S_{DS}	0.318
S_{D1}	0.174

4. SOILS EXPLORATION

4.1 Exploration and Sampling Procedures

Field exploration conducted to determine engineering characteristics of subsurface materials included a reconnaissance of the project site and investigation by test pit. Test pit sites were located in the field by means of a Global Positioning System (GPS) device and are reportedly accurate to within ten feet. Upon completion of investigation, each test pit was backfilled with loose excavated materials. Re-excavation and compaction of these test pit areas are required prior to construction.

Samples obtained have been visually classified in the field, identified according to test pit number and depth, placed in sealed containers, and transported to our laboratory for additional testing. Subsurface materials have been described in detail on logs provided in the **Appendix**. Results of field and laboratory tests are also presented in the **Appendix**. Atlas recommends that these logs **not** be used to estimate fill material quantities.

4.2 Laboratory Testing Program

Along with our field investigation, a supplemental laboratory testing program was conducted to determine additional pertinent engineering characteristics of subsurface materials. Laboratory tests were conducted in accordance with current specifications. The laboratory testing program for this report included:

- Atterberg Limits Testing – ASTM D4318
- Grain Size Analysis – ASTM C117/C136

4.3 Soil and Sediment Profile

The profile below represents a generalized interpretation for the project site. Note that on site soils strata, encountered between test pit locations, may vary from the individual soil profiles presented in the logs.

Table 2 – Typical Soil Profiles

Soil Horizons	Approximate Depths	Soil Types	Consistency/Relative Density
Fill Materials	0 to 3 feet	Poorly Graded Gravel with Sand, Silty Gravel with Sand, Silty Sand	Loose to Medium Dense
Intermediate Soils[1]	3 to 5 feet	Silty Sand	Loose to Medium Dense
Deeper Soils	3 to 8 feet	Poorly Graded Gravel with Sand	Loose to Dense

[1]Native silty sands were not encountered in test pit 2.

During excavation, sloughing of test pit sidewalls was observed. However, moisture contents will also affect wall competency with saturated soils having a tendency to readily slough when under load and unsupported.

4.4 Volatile Organic Scan

Soils obtained during on-site activities were not assessed for volatile organic compounds by portable photoionization detector. Samples obtained during our exploration activities exhibited no apparent odors or discoloration typically associated with this type of contamination. Groundwater encountered did not exhibit obvious signs of contamination.

5. SITE HYDROLOGY

Existing surface drainage conditions are defined in the **General Site Characteristics** section. Information provided in this section is limited to observations made at the time of the investigation. Either regional or local ordinances may require information beyond the scope of this report.

5.1 Groundwater

During this field investigation, groundwater was encountered in test pit 1 at a depth of 6.0 feet bgs. Atlas has previously performed 6 geotechnical investigations within 0.30 mile of the project site. Information from these investigations has been provided in the table below.

Table 3 – Groundwater Data

Date	Approximate Distance from Site (mile)	Direction from Site	Groundwater Depth (feet bgs)
May 2019	0.07	West	6.1 to 6.2
August 2016	0.08	Northeast	6.2
October 2021	0.09	Northeast	5.1 to 6.2
September 2017	0.24	Southwest	7.8
March 2015	0.25	North	7.2
August 2013	0.29	Northwest	6.0

Based on evidence of this investigation and background knowledge of the area, Atlas has determined that the typical seasonal high groundwater should remain greater than approximately 4.5 feet bgs. This depth can be confirmed through long-term groundwater monitoring. If desired, Atlas is available to perform this monitoring from the piezometer installed in test pit 1.

5.2 Soil Infiltration Rates

Soil permeability, which is a measure of the ability of a soil to transmit a fluid, was not tested in the field. Given the absence of direct measurements, for this report an estimation of infiltration is presented using generally recognized values. Typical infiltration rates comprising the generalized soil profile for this study have been provided in the table below.

Table 4 – Generalized Soil Infiltration Rates

Soil Type	Typical Infiltration Rate (inches per hour)
Silty Sand	4 to 8*
Poorly Graded Gravel with Sand	>12*

***Infiltration into and/or within close proximity to groundwater may reduce infiltration rates to near zero.**

Seasonal high groundwater is expected to impact drainage. When this occurs, vertical drainage of stormwater will be limited. This condition has been accounted for in the recommended infiltration rate below.

It is recommended that infiltration facilities constructed on the site be extended into native poorly graded gravel with sand sediments. Excavation depths of approximately 3.2 to 4.8 feet bgs should be anticipated to expose these poorly graded gravels with sand sediments. An infiltration rate of 4 inches per hour should be used in design. Actual infiltration rates should be confirmed at the time of construction. Atlas recommends that all infiltration facilities be constructed in accordance with the local municipality requirements.

6. FOUNDATION AND SLAB DISCUSSION AND RECOMMENDATIONS

Various foundation types have been considered for support of the proposed structure. Two requirements must be met in the design of foundations. First, the applied bearing stress must be less than the ultimate bearing capacity of foundation soils to maintain stability. Second, total and differential settlement must not exceed an amount that will produce an adverse behavior of the superstructure. Allowable settlement is usually exceeded before bearing capacity considerations become important; thus, allowable bearing pressure is normally controlled by settlement considerations.

6.1 Foundation Loading Information

Loads of up to 4,000 pounds per lineal foot for wall footings, and column loads of up to 50,000 pounds were assumed for settlement calculations. Total settlement should be limited to approximately 1 inch and differential settlement should be limited to approximately ½ inch, provided the following design and construction recommendations are observed.

6.2 Foundation Design Recommendations

Considering subsurface conditions and the proposed construction, it is recommended that the structure be founded upon conventional spread footings and continuous wall footings. Based on data obtained from the site and test results from various laboratory tests performed, Atlas recommends the following guidelines for the net allowable soil bearing capacity:

Table 5 – Soil Bearing Capacity

Footing Depth	ASTM D1557 Subgrade Compaction	Net Allowable Soil Bearing Capacity
Footings must bear on competent, undisturbed, native silty sand sediments, poorly graded gravel with sand sediments, or compacted structural fill. Existing fill materials must be completely removed from below foundation elements.[1] Excavation depths of roughly 3.2 feet bgs should be anticipated to expose proper bearing soils.[2]	Not Required for Native Soil 95% for Structural Fill	2,000 lbs/ft^2

[1]It will be required for Atlas personnel to verify the bearing soil suitability for each structure at the time of construction.

The following sliding frictional coefficient values should be used: 1) 0.35 for footings bearing on native silty sand sediments and 2) 0.45 for footings bearing on native poorly graded gravel with sand sediments or granular structural fill. A passive lateral earth pressure of 344 pounds per square foot per foot (psf/ft) should be used for silty sand sediments. For native poorly graded gravel with sand sediments or compacted sandy gravel fill, a passive lateral earth pressure of 496 psf/ft should be used.

Footings should be proportioned to meet either the stated soil bearing capacity or the 2018 IBC minimum requirements. Objectionable soil types encountered at the bottom of footing excavations should be removed and replaced with structural fill. Excessively loose or soft areas that are encountered in the footings subgrade will require over-excavation and backfilling with structural fill. To minimize the effects of slight differential movement that may occur because of variations in the character of supporting soils and seasonal moisture content, Atlas recommends continuous footings be suitably reinforced to make them as rigid as possible. For frost protection, the bottom of external footings should be 30 inches below finished grade. Foundations must be backfilled in accordance with the **Backfill of Walls** section. Based on the soil types encountered onsite and the character of the proposed construction, foundation drains are not needed.

6.3 Floor Slab-on-Grade

Uncontrolled fill was encountered in portions of the site. Atlas recommends that these fill materials be removed to a depth of at least 1½ feet below existing grade. If fill materials remain after excavation, the exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The excavated fill materials can be replaced in accordance with the **Fill Placement and Compaction** section provided that all organic material and debris is completely removed. Once final grades have been determined, Atlas is available to provide additional recommendations.

Organic, loose, or obviously compressive materials must be removed prior to placement of concrete floors or floor-supporting fill. In addition, the remaining subgrade should be treated in accordance with guidelines presented in the **Earthwork** section. Areas of excessive yielding should be excavated and backfilled with structural fill. Fill used to increase the elevation of the floor slab should meet requirements detailed in the **Structural Fill** section. Fill materials must be compacted to a minimum 95 percent of the maximum dry density as determined by ASTM D1557.

A free-draining granular mat should be provided below slabs-on-grade to provide drainage and a uniform and stable bearing surface. This should be a minimum of 4 inches in thickness and properly compacted. The mat should consist of a sand and gravel mixture, complying with Idaho Standards for Public Works Construction (ISPWC) specifications for ¾-inch (Type 1) crushed aggregate. The granular mat should be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D1557. A moisture-retarder should be placed beneath floor slabs to minimize potential ground moisture effects on moisture-sensitive floor coverings. The moisture-retarder should be at least 15-mil in thickness and have a permeance of less than 0.01 US perms as determined by ASTM E96. Placement of the moisture-retarder will require special consideration with regard to effects on the slab-on-grade and should adhere to recommendations outlined in the ACI 302.1R and ASTM E1745 publications. Upon request, Atlas can provide further consultation regarding installation.

7. PAVEMENT DISCUSSION AND RECOMMENDATIONS

7.1 Pavement Design Parameters

Project specific traffic loading information has not been provided. Based on the character of the proposed construction, Atlas has assumed a traffic loading of 45,000 equivalent single axle loads (ESALs) for light duty pavement areas and 140,000 ESALs for heavy duty pavement areas. Light duty pavement should be used for parking lots and heavy duty pavement is to be used for access routes and loading/unloading areas. Atlas can provide a project specific pavement design upon request. Based on experience with soils in the region, a subgrade California Bearing Ratio (CBR) value of 6 has been assumed for near-surface fill materials and native silty sand sediments on site.

The recommended pavement sections provided below are based on a 20-year design life. To achieve this design life a routine maintenance program that includes crack sealing on a regular basis and possible seal coating will be required. The following are minimum thickness requirements for assured pavement function. Depending on site conditions, additional work, e.g. soil preparation, may be required to support construction equipment.

7.2 Flexible Pavement Sections

The American Association of State Highway and Transportation Officials (AASHTO) design method has been used to calculate the following pavement sections. Atlas recommends that materials used in the construction of asphaltic concrete pavements meet requirements of the ISPWC Standard Specification for Highway Construction. Construction of the pavement section should be in accordance with these specifications.

Table 6 – AASHTO Flexible Pavement Specifications

Pavement Section Component	Light Duty	Heavy Duty
Asphaltic Concrete	2.5 Inches	3.0 Inches
Crushed Aggregate Base	4.0 Inches	4.0 Inches
Structural Subbase	6.0 Inches	8.0 Inches
Compacted Subgrade[1]	See **Pavement Subgrade Preparation** Section	See **Pavement Subgrade Preparation** Section

[1]It will be required for Atlas personnel to verify subgrade competency at the time of construction.

- Asphaltic Concrete: Asphalt mix design shall meet the requirements of ISPWC Section 810. Materials shall be placed in accordance with ISPWC Standard Specifications for Highway Construction.
- Aggregate Base: Material complying with ISPWC Standards for Type 1 Crushed Aggregate Materials.
- Structural Subbase: Material complying with ISPWC Section 801 for 3-inch or 6-inch Uncrushed Aggregate Materials. The maximum material diameter cannot exceed $^2/_3$ the component thickness.

7.3 Pavement Subgrade Preparation

Uncontrolled fill was encountered in portions of the site. Atlas recommends that these fill materials be removed to a depth of at least 1½ feet below existing grade. If fill materials remain after excavation, the exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D698 for flexible pavements. The excavated fill materials can be replaced in accordance with the **Fill Placement and Compaction** section provided that all organic material and debris is completely removed. However, the existing fill materials are not suitable for use as either the base or subbase components of the recommended pavement section. Once final grades have been determined, Atlas is available to provide additional recommendations.

7.4 Common Pavement Section Construction Issues

The subgrade upon which above pavement sections are to be constructed must be properly stripped, compacted (if indicated), inspected, and proof-rolled. Proof rolling of subgrade soils should be accomplished using a heavy rubber-tired, fully loaded, tandem-axle dump truck or equivalent. Verification of subgrade competence by Atlas personnel at the time of construction is required. Fill materials on the site must demonstrate the indicated compaction prior to placing material in support of the pavement section. Atlas anticipated that pavement areas will be subjected to heavy traffic. Pumping or soft areas must be removed and replaced with structural fill.

Fill material and aggregates, as well as compacted native subgrade soils, in support of the pavement section must be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D698 for flexible pavements and by ASTM D1557 for rigid pavements. If a material placed as a pavement section component cannot be tested by usual compaction testing methods, then compaction of that material must be approved by observed proof rolling. Minor deflections from proof rolling for flexible pavements are allowable. Deflections from proof rolling of rigid pavement support courses should not be visually detectable.

8. CONSTRUCTION CONSIDERATIONS

8.1 Earthwork

Excessively organic soils, deleterious materials, or disturbed soils generally undergo high volume changes when subjected to loads, which is detrimental to subgrade behavior in the area of pavements, floor slabs, structural fills, and foundations. Mature trees, brush, and thick grasses with associated root systems were noted at the time of our investigation. It is recommended that organic or disturbed soils, if encountered, be removed to depths of 1 foot (minimum), and wasted or stockpiled for later use. Stripping depths should be adjusted in the field to assure that the entire root zone or disturbed zone or topsoil are removed prior to placement and compaction of structural fill materials. Exact removal depths should be determined during grading operations by Atlas personnel, and should be based upon subgrade soil type, composition, and firmness or soil stability. If underground storage tanks, underground utilities, wells, or septic systems are discovered during construction activities, they must be decommissioned then removed or abandoned in accordance with governing Federal, State, and local agencies. Excavations developed as the result of such removal must be backfilled with structural fill materials as defined in the **Structural Fill** section.

Atlas should oversee subgrade conditions (i.e., moisture content) as well as placement and compaction of new fill (if required) after native soils are excavated to design grade. Recommendations for structural fill presented in this report can be used to minimize volume changes and differential settlements that are detrimental to the behavior of footings, pavements, and floor slabs. Sufficient density tests should be performed to properly monitor compaction.

8.2 Grading

Positive grades must be maintained surrounding structures and pavements, including exterior slabs. The interface of plant bedding materials and underlying soils should be graded to provide drainage away from site elements. Otherwise, bedding materials may direct water to underlying fine-grained soils, which increases the potential for localized heave. Excessive watering of landscaping should be avoided.

8.3 Dry Weather

If construction is to be conducted during dry seasonal conditions, many problems associated with soft soils may be avoided. However, some rutting of subgrade soils may be induced by shallow groundwater conditions related to springtime runoff or irrigation activities during late summer through early fall. Problems may also arise because of lack of moisture in native and fill soils at time of placement. This will require the addition of water to achieve near-optimum moisture levels. Low-cohesion soils exposed in excavations may become friable, increasing chances of sloughing or caving. Measures to control excessive dust should be considered as part of the overall health and safety management plan.

8.4 Wet Weather

If construction is to be conducted during wet seasonal conditions (commonly from mid-November through May), problems associated with soft soils must be considered as part of the construction plan. During this time of year, fine-grained soils such as silts and clays will become unstable with increased moisture content, and eventually deform or rut. Additionally, constant low temperatures reduce the possibility of drying soils to near optimum conditions.

8.5 Frozen Subgrade Soils

Prior to placement of structural fill materials or foundation elements, frozen subgrade soils must either be allowed to thaw or be stripped to depths that expose non-frozen soils and wasted or stockpiled for later use. Stockpiled materials must be allowed to thaw and return to near-optimal conditions prior to use as structural fill.

8.6 Structural Fill

The following table defines the types of fill material that is suitable for use on the project. Refer to the **Fill Placement and Compaction** section for recommended placement locations for each fill type listed below.

Table 7 – Fill Material Criteria

Fill Type	Material	Lift Thickness*
Granular Structural Fill	ISPWC Section 801 for 1-inch, 3-inch, or 6-inch Uncrushed Aggregate and ISPWC Section 802 Aggregate Base	12 inches
Aggregate Base Material	ISPWC Section 802 for Type 1 Crushed Aggregate Base	12 inches
Subbase Material	ISPWC Section 801 for 3-inch or 6-inch Uncrushed Aggregate	12 inches
Suitable Soil	Onsite/imported SM, GM, and GP soils that are free of organics and debris	6 inches

*** Initial loose thickness, prior to compaction.**

8.7 Fill Placement and Compaction

Requirements for fill material type and compaction effort are dependent on the planned use of the material. The following table specifies material type and compaction requirements based on the placement location of the fill material.

Table 8 – Fill Placement and Compaction Requirements

Fill Location	Material Type	Compaction
Foundations	Granular Structural Fill	95% of ASTM D1557
Interior Slab-on-Grade	Granular Structural Fill or Suitable Soil	95% of ASTM D1557
Top 4 Inches of Interior and Exterior Slab-on-Grade	Aggregate Base Material	95% of ASTM D1557
Below Pavement Subgrade and Exterior Flatwork Areas	Granular Structural Fill or Suitable Soil	95% of ASTM D698 or 92% of ASTM D1557
Foundation and Retaining Wall Backfill	Granular Structural Fill or Suitable Soil	95% of ASTM D1557
Utility Trench Backfill	Granular Structural Fill or Suitable Soil	Per ISPWC Section 306
Landscape Areas	Granular Structural Fill or Suitable Soil	92% of ASTM D698 or 90% of ASTM D1557

Prior to placement of structural fill materials, surfaces must be prepared as outlined in the **Earthwork** section. Structural fill material must be placed in horizontal lifts not exceeding 6-inches in thickness for fine-grained soils and 12-inches in thickness for granular structural fill, aggregate base material, and subbase material. All fill material must be moisture-conditioned to achieve optimum moisture content prior to compaction. During placement all fill materials must be monitored and tested to confirm compaction requirements have been achieved, as specified above, prior to placement of subsequent lifts. In addition, compacted surfaces must be in a firm and unyielding condition. Atlas personnel should be onsite to verify suitability of subgrade soil conditions, identify whether further work is necessary, and perform in-place moisture density testing.

Sufficient density tests should be performed to properly monitor compaction. At a minimum, Atlas recommends one test per lift as follows:

- Structures – 1 test every 5,000 square feet
- Pavement and Exterior Flatwork Areas – 1 test every 10,000 square feet
- Foundation and Retaining Wall Backfill – 1 test every 500 square feet
- Utility Trench Backfill – 1 test every 100 linear feet
- Landscape Areas – 1 test every 15,000 square feet

Silty soils require very high moisture contents for compaction, require a long time to dry out if natural moisture contents are too high, and may also be susceptible to frost heave under certain conditions. Therefore, these materials can be quite difficult to work with as moisture content, lift thickness, and compactive effort becomes difficult to control. If silty soil is used for structural fill, lift thicknesses should not exceed 6 inches (loose), and fill material moisture must be closely monitored at both the working elevation and the elevations of materials already placed. Following placement, the exposed surface must be protected from degradation resulting from construction traffic or subsequent construction. It is anticipated that fine-grained soils will not be suitable for reuse during the wet season.

Use of silty soils (GM, SM, and ML) as structural fill below footings is prohibited. For structural fill below footings, areas of compacted backfill must extend outside the perimeter of the footings for a distance equal to the thickness of fill between the bottom of foundation and underlying soils, or 5 feet, whichever is less.

If material contains more than 40 percent but less than 50 percent oversize (greater than ¾-inch) particles, compaction of fill must be confirmed per ISPWC Section 202.3.8.D.3. Material should contain sufficient fines to fill void spaces and must not contain more than 50 percent oversize particles.

8.8 Backfill of Walls

Backfill materials must conform to the requirements of structural fill, as defined in this report. For wall heights greater than 2.5 feet, the maximum material size should not exceed 4 inches in diameter. Placing oversized material against rigid surfaces interferes with proper compaction and can induce excessive point loads on walls. Backfill shall not commence until the wall has gained sufficient strength to resist placement and compaction forces. Further, retaining walls above 2.5 feet in height shall be backfilled in a manner that will limit the potential for damage from compaction methods and/or equipment. It is recommended that only small hand-operated compaction equipment be used for compaction of backfill within a horizontal distance equal to the height of the wall, measured from the back face of the wall.

Backfill should be compacted in accordance with the specifications for structural fill, except in those areas where it is determined that future settlement is not a concern, such as planter areas. In nonstructural areas, backfill must be compacted to a firm and unyielding condition. Atlas recommends in these areas that the top 12 inches must consist of a low permeability (clay or silt) soil to limit surface water infiltration.

Proper grading away from structures is critical. The surface must be graded away from the structure. In addition, Atlas recommends that roof drains carry stormwater at least 10 feet away from the structure.

8.9 Excavations

Shallow excavations that do not exceed 4 feet in depth may be constructed with side slopes approaching vertical. Below this depth, it is recommended that slopes be constructed in accordance with Occupational Safety and Health Administration (OSHA) regulations, Section 1926, Subpart P. Based on these regulations, on-site soils are classified as type "C" soil, and as such, excavations within these soils should be constructed at a maximum slope of 1½ feet horizontal to 1 foot vertical (1½:1) for excavations up to 20 feet in height. Excavations in excess of 20 feet will require additional analysis. Note that these slope angles are considered stable for short-term conditions only, and will not be stable for long-term conditions.

During the subsurface exploration, test pit sidewalls generally exhibited little indication of collapse; however, sloughing of fill materials and native granular sediments from test pit sidewalls was observed, particularly after penetration of the water table. For deep excavations, native granular sediments cannot be expected to remain in position. These materials are prone to failure and may collapse, thereby undermining upper soil layers. This is especially true when excavations approach depths near the water table. Care must be taken to ensure that excavations are properly backfilled in accordance with procedures outlined in this report.

8.10 Groundwater Control

Groundwater was encountered during the investigation but is anticipated to be below the depth of most construction. Excavations below the water table will require a dewatering program. Dewatering will be required prior to placement of fill materials. Placement of concrete can be accomplished through water using a tremie. It may be possible to discharge dewatering effluent to remote portions of the site, to a sump, or to a pit. This will essentially recycle effluent, thus eliminating the need to enter into agreements with local drainage authorities. Should the scope of the proposed project change, Atlas should be contacted to provide more detailed groundwater control measures.

Special precautions may be required for control of surface runoff and subsurface seepage. It is recommended that runoff be directed away from open excavations. Silty soils may become soft and pump if subjected to excessive traffic during time of surface runoff. Ponded water in construction areas should be drained through methods such as trenching, sloping, crowning grades, nightly smooth drum rolling, or installing a French drain system. Additionally, temporary or permanent driveway sections should be constructed if extended wet weather is forecasted.

9. GENERAL COMMENTS

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed structures, the site is adequate for the planned construction. When plans and specifications are complete, and if significant changes are made in the character or location of the proposed structures, consultation with Atlas must be arranged as supplementary recommendations may be required. Suitability of subgrade soils and compaction of structural fill materials must be verified by Atlas personnel prior to placement of structural elements. Additionally, monitoring and testing should be performed to verify that suitable materials are used for structural fill and that proper placement and compaction techniques are utilized.

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APPENDIX I WARRANTY AND LIMITING CONDITIONS

Atlas warrants that findings and conclusions contained herein have been formulated in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology only for the site and project described in this report. These engineering methods have been developed to provide the client with information regarding apparent or potential engineering conditions relating to the site within the scope cited above and are necessarily limited to conditions observed at the time of the site visit and research. Field observations and research reported herein are considered sufficient in detail and scope to form a reasonable basis for the purposes cited above.

Exclusive Use

This report was prepared for exclusive use of the property owner(s), at the time of the report, and their retained design consultants ("Client"). Conclusions and recommendations presented in this report are based on the agreed-upon scope of work outlined in this report together with the Contract for Professional Services between the Client and Atlas Technical Consultants ("Consultant"). Use or misuse of this report, or reliance upon findings hereof, by parties other than the Client is at their own risk. Neither Client nor Consultant make representation of warranty to such other parties as to accuracy or completeness of this report or suitability of its use by such other parties for purposes whatsoever, known or unknown, to Client nor Consultant. Neither Client nor Consultant shall have liability to indemnify or hold harmless third parties for losses incurred by actual or purported use or misuse of this report. No other warranties are implied or expressed.

Report Recommendations are Limited and Subject to Misinterpretation

There is a distinct possibility that conditions may exist that could not be identified within the scope of the investigation or that were not apparent during our site investigation. Findings of this report are limited to data collected from noted explorations advanced and do not account for unidentified fill zones, unsuitable soil types or conditions, and variability in soil moisture and groundwater conditions. To avoid possible misinterpretations of findings, conclusions, and implications of this report, Atlas should be retained to explain the report contents to other design professionals as well as construction professionals.

Since actual subsurface conditions on the site can only be verified by earthwork, note that construction recommendations are based on general assumptions from selective observations and selective field exploratory sampling. Upon commencement of construction, such conditions may be identified that require corrective actions, and these required corrective actions may impact the project budget. Therefore, construction recommendations in this report should be considered preliminary, and Atlas should be retained to observe actual subsurface conditions during earthwork construction activities to provide additional construction recommendations as needed.

Since geotechnical reports are subject to misinterpretation, **do not** separate the soil logs from the report. Rather, provide a copy of, or authorize for their use, the complete report to other design professionals or contractors. Locations of exploratory sites referenced within this report should be considered approximate locations only. For more accurate locations, services of a professional land surveyor are recommended.

This report is also limited to information available at the time it was prepared. In the event additional information is provided to Atlas following publication of our report, it will be forwarded to the client for evaluation in the form received.

Environmental Concerns

Comments in this report concerning either onsite conditions or observations, including soil appearances and odors, are provided as general information. These comments are not intended to describe, quantify, or evaluate environmental concerns or situations. Since personnel, skills, procedures, standards, and equipment differ, a geotechnical investigation report is not intended to substitute for a geoenvironmental investigation or a Phase II/III Environmental Site Assessment. If environmental services are needed, Atlas can provide, via a separate contract, those personnel who are trained to investigate and delineate soil and water contamination.

Vicinity Map

Figure 1

MAP NOTES:

- Delorme Street Atlas
- Not to Scale

LEGEND

Approximate Site Location (red dot)

New Industrial Live/Work Structure

5260 North Sawyer Avenue
Garden City, ID

Modified from DeLorme by: CCW
March 24, 2023
Drawing: B230372g

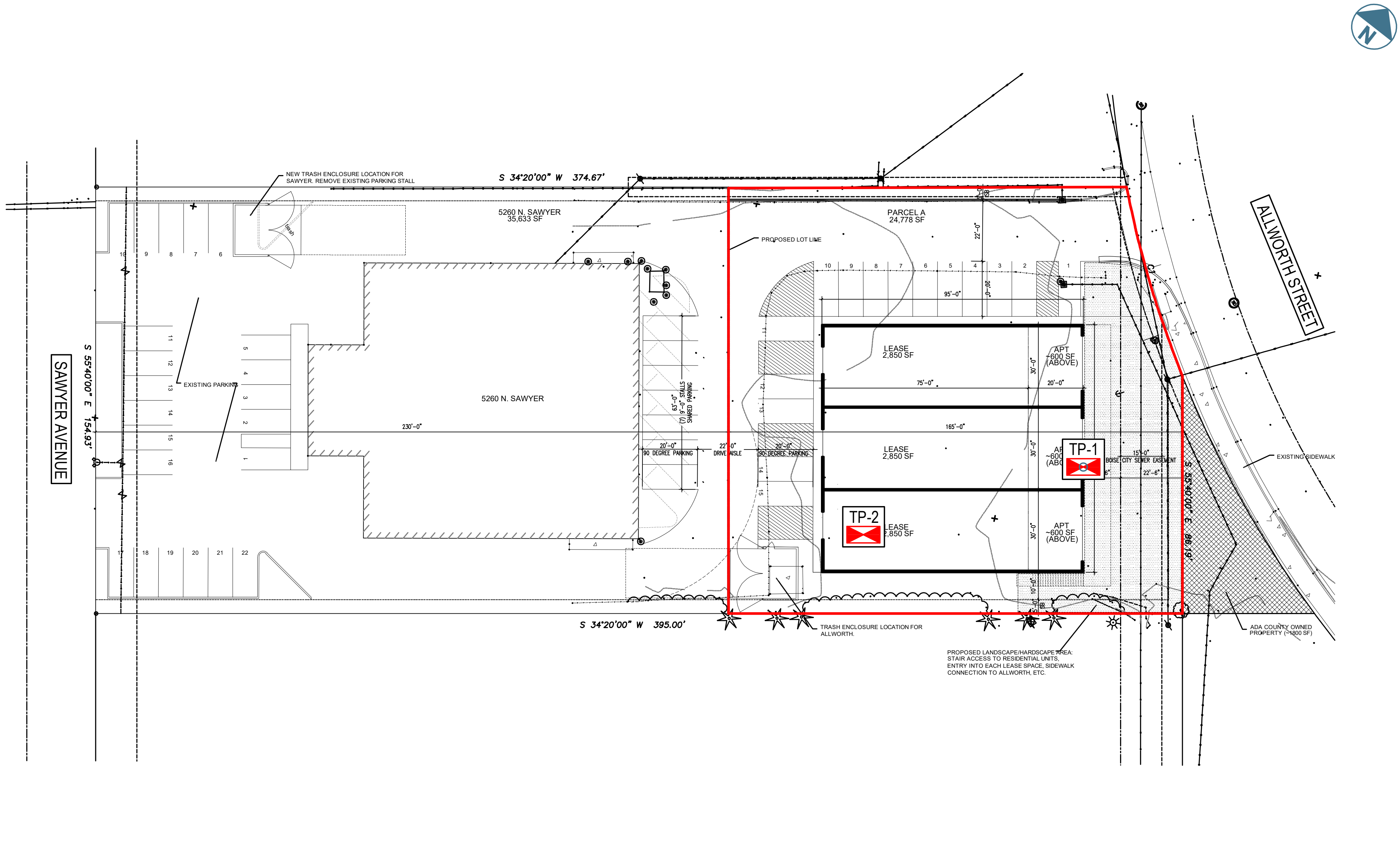
ATLAS

2791 S. Victory View Way
Boise, ID 83709

Phone: (208) 376-4748
Fax: (208) 322-6515
Web: oneatlas.com

Site Map

Figure 2



NOTES:

- Not to Scale

LEGEND

Approximate Site Boundary

Approximate Atlas Test Pit Location with Piezometer

Approximate Atlas Test Pit Location

New Industrial Live/Work Structure
5260 North Sawyer Avenue
Garden City, ID

Modified by: CCW
March 24, 2023
Drawing: B230372g

ATLAS
2791 S. Victory View Way
Boise, ID 83709
Phone: (208) 376-4748
Fax: (208) 322-6515
Web: oneatlas.com

APPENDIX IV GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-1
Date Advanced: March 20, 2023
Excavated by: Turn of the Century Homes
Logged by: Max Kasberger, PE

Latitude: 43.646876
Longitude: -116.268581
Depth to Water Table: 6.0 feet bgs
Total Depth: 8.2 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-0.5	Poorly Graded Gravel with Sand Fill (GP-FILL): Light brown, slightly moist, medium dense, with fine to coarse-grained sand and fine gravel.				
0.5-3.2	Silty Gravel with Sand Fill (GM-FILL): Dark brown, slightly moist to moist, loose to medium dense, with fine to medium-grained sand, fine to coarse gravel, and 6-inch minus cobbles.				
3.2-4.8	Silty Sand (SM): Brown, slightly moist, loose to medium dense, with fine to medium-grained sand.	GS	3.2-3.8		A
4.8-8.2	Poorly Graded Gravel with Sand (GP): Light brown, slightly moist to saturated, loose to dense, with fine to coarse-grained sand, fine to coarse-gravel, and 8-inch minus cobbles.				

Notes: See Site Map for test pit location.
Sidewall caving encountered throughout the test pit.
Piezometer installed to a depth of 8.2 feet bgs.

Lab Test ID	Moisture (%)	LL	PI	Sieve Analysis (% Passing)				
				#4	#10	#40	#100	#200
A	12.7	NP	NP	91	87	72	44	26.2

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-2
Date Advanced: March 20, 2023
Excavated by: Turn of the Century Homes
Logged by: Max Kasberger, PE

Latitude: 43.646672
Longitude: -116.268774
Depth to Water Table: Not Encountered
Total Depth: 6.4 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-0.5	Poorly Graded Gravel with Sand Fill (GP-FILL): Light brown, slightly moist, medium dense, with fine to coarse-grained sand and fine gravel.				
0.5-2.0	Silty Sand Fill (SM-FILL): Dark brown, slightly moist to moist, loose to medium dense, with fine to coarse-grained sand.				
2.0-3.2	Poorly Graded Gravel with Sand Fill (GP-FILL): Dark brown to black, slightly moist, loose to medium dense, with fine to coarse-grained sand and fine to coarse gravel.				
3.2-6.4	Poorly Graded Gravel with Sand (GP): Light brown, slightly moist to wet, loose to medium dense, with fine to coarse-grained sand, fine to coarse gravel, and 7-inch minus cobbles.				

Notes: See Site Map for test pit location.
Sidewall caving encountered throughout the test pit, causing refusal at 6.4 feet bgs.

APPENDIX V GEOTECHNICAL GENERAL NOTES

Unified Soil Classification System			
Major Divisions		**Symbol**	**Soil Descriptions**
Coarse-Grained Soils < 50% passes No.200 sieve	Gravel & Gravelly Soils < 50% coarse	GW	Well-graded gravels; gravel/sand mixtures with little or no fines
		GP	Poorly-graded gravels; gravel/sand mixtures with little or no fines
		GM	Silty gravels; poorly-graded gravel/sand/silt mixtures
		GC	Clayey gravels; poorly-graded gravel/sand/clay mixtures
	Sand & Sandy Soils > 50% coarse fraction	SW	Well-graded sands; gravelly sands with little or no fines
		SP	Poorly-graded sands; gravelly sands with little or no fines
		SM	Silty sands; poorly-graded sand/gravel/silt mixtures
		SC	Clayey sands; poorly-graded sand/gravel/clay mixtures
Fine-Grained Soils > 50% passes No.200 sieve	Silts & Clays LL < 50	ML	Inorganic silts; sandy, gravelly or clayey silts
		CL	Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays
		OL	Organic, low-plasticity clays and silts
	Silts & Clays LL > 50	MH	Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
		CH	Fat clays; high-plasticity, inorganic clays
		OH	Organic, medium to high-plasticity clays and silts
Highly Organic Soils		PT	Peat, humus, hydric soils with high organic content

Relative Density and Consistency Classification	
Coarse-Grained Soils	**SPT Blow Counts (N)**
Very Loose:	< 4
Loose:	4-10
Medium Dense:	10-30
Dense:	30-50
Very Dense:	> 50
Fine-Grained Soils	**SPT Blow Counts (N)**
Very Soft:	< 2
Soft:	2-4
Medium Stiff:	4-8
Stiff:	8-15
Very Stiff:	15-30
Hard:	> 30

Moisture Content and Cementation Classification	
Description	**Field Test**
Dry	Absence of moisture, dry to touch
Slightly Moist	Damp, but no visible moisture
Moist	Visible moisture
Wet	Visible free water
Saturated	Soil is usually below water table
Description	**Field Test**
Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

Particle Size	
Boulders:	> 12 in.
Cobbles:	12 to 3 in.
Gravel:	3 in. to 5 mm
Coarse-Grained Sand:	5 to 0.6 mm
Medium-Grained Sand:	0.6 to 0.2 mm
Fine-Grained Sand:	0.2 to 0.075 mm
Silts:	0.075 to 0.005 mm
Clays:	< 0.005 mm

Acronym List	
GS	grab sample
LL	Liquid Limit
M	moisture content
NP	non-plastic
PI	Plasticity Index
Q_p	penetrometer value, unconfined compressive strength, tsf
V	vane value, ultimate shearing strength, tsf

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 <u>not</u> 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 <u>not</u> be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> 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 <u>not</u> rely on an executive summary. Do <u>not</u> 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.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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