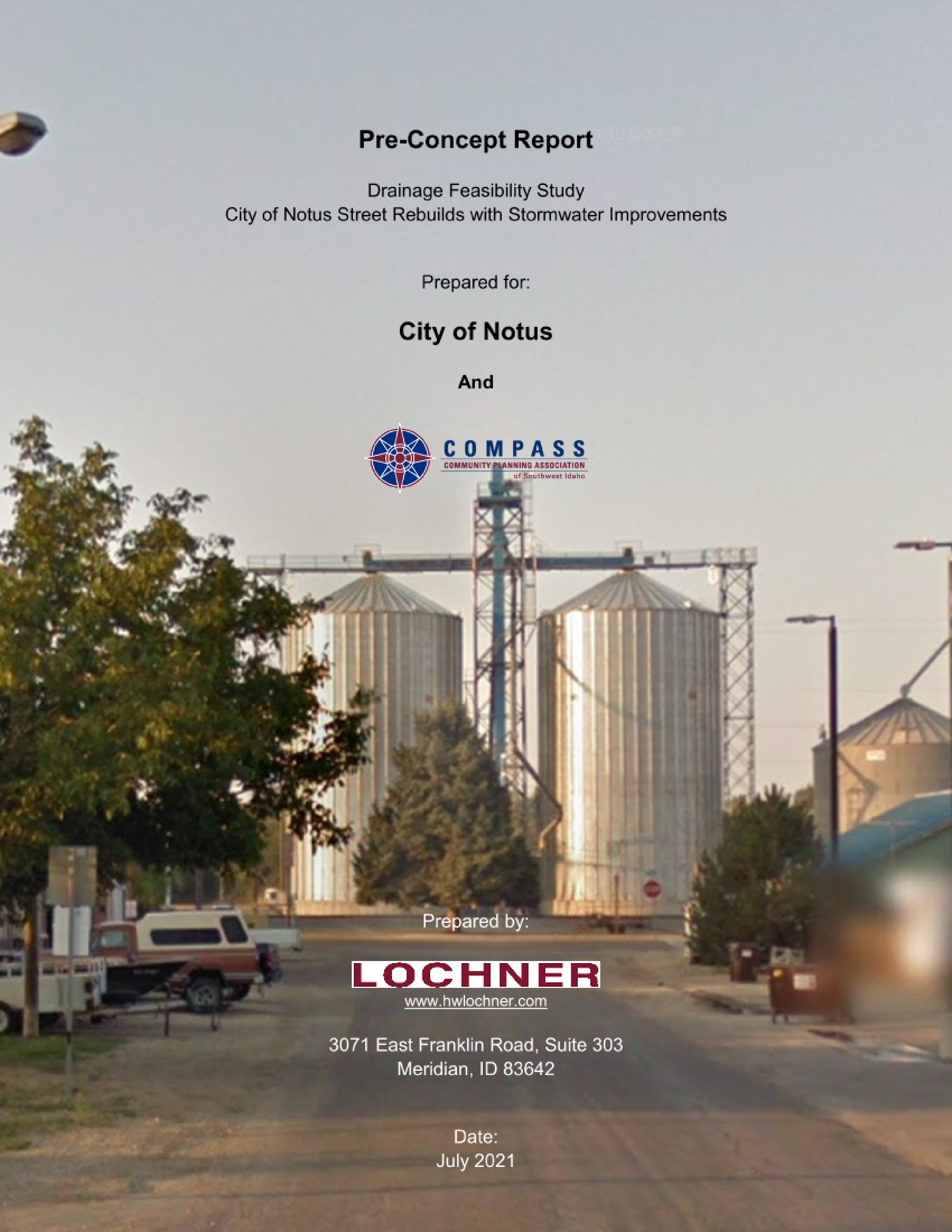


Pre-Concept Report

Drainage Feasibility Study
City of Notus Street Rebuilds with Stormwater Improvements

Prepared for:

City of Notus

And

COMPASS
COMMUNITY PLANNING ASSOCIATION
of Southwest Idaho

Prepared by:

LOCHNER
www.hwlochner.com

3071 East Franklin Road, Suite 303
Meridian, ID 83642

Date:
July 2021

Contents

1.0 Introduction

The Community Planning Association of Southwest Idaho (COMPASS) retained HW Lochner to conduct a drainage feasibility study for future stormwater improvements to three separate roadways in Notus, Idaho. The roadways studied include Notus Road, 1st Street, and 2nd Street within the city limits. Figure 1 provides a vicinity map of the project area. Lochner is working with COMPASS, and the City of Notus who is the sponsor, for this potential federal-aid project to reconstruct Notus Road.

A study was previously performed for COMPASS and the city of Notus to look at the potential to reconstruct Notus Road, 1st Street and 2nd Street, including addressing stormwater needs, as a lack of stormwater facilities has been the primary cause of these three roadways failing. This earlier study also developed construction costs for each roadway reconstruction.

The focus of this current study is to determine whether the drainage improvements identified in the first study are constructable given the site conditions present. Specifically, this study will verify 1) whether subsurface storage and infiltration is a possible drainage alternative, and 2) whether discharging water to the storm sewer system in US-20/26, owned by the Idaho Transportation Department, is a possibility.

2.0 Project Description

The City of Notus is located in Canyon County, Idaho and is a small agricultural community of approximately 600 residents. Figure 2 shows the project limits for all three roadways studied for future roadway and drainage improvements. The City of Notus and COMPASS initiated this project to develop a concept that would reconstruct three identified failing roadways within downtown Notus and preserve the existing transportation systems and infrastructure. The project would address failing pavements from water ponding along the edge of pavement, widen narrow roadway widths, and add an appropriate pedestrian facility for residents, in particular children walking to and from school.

This effort is the result of an approved request made by the City of Notus through COMPASS' Project Development program, which is funded with federal planning funds provided by the Federal Highway Administration (FHWA).

Figure 1. Vicinity Map

Figure 2 Project Limits

3.0 Infiltration Potential

Much of the city of Notus drains towards US-20/26 and enters the storm system constructed by the Idaho Department of Transportation (ITD). However, some streets such as Gary Avenue and Fargo Avenue run parallel to US-20/26 and do not have a direct connection to US-20/26. Storm water on these streets has been observed to pond along the roadway edge and slowly infiltrate over several hours or days. It is not feasible to attempt to develop storm systems to connect these streets to the US-20/26 storm system. Also, the storm system in US-20/26 does not have the capacity to receive all the storm water draining from every street with the project study area. Therefore, options to collect and store water within the city proper must be explored. Given there are no locations within the city to develop storm water retention/detention ponds without purchasing right-of-way, subsurface storage and treatment within the right-of-way is the best option.

To determine the feasibility of this option, several locations within the project limits were identified to perform infiltration tests. Figure 3 highlights these locations.

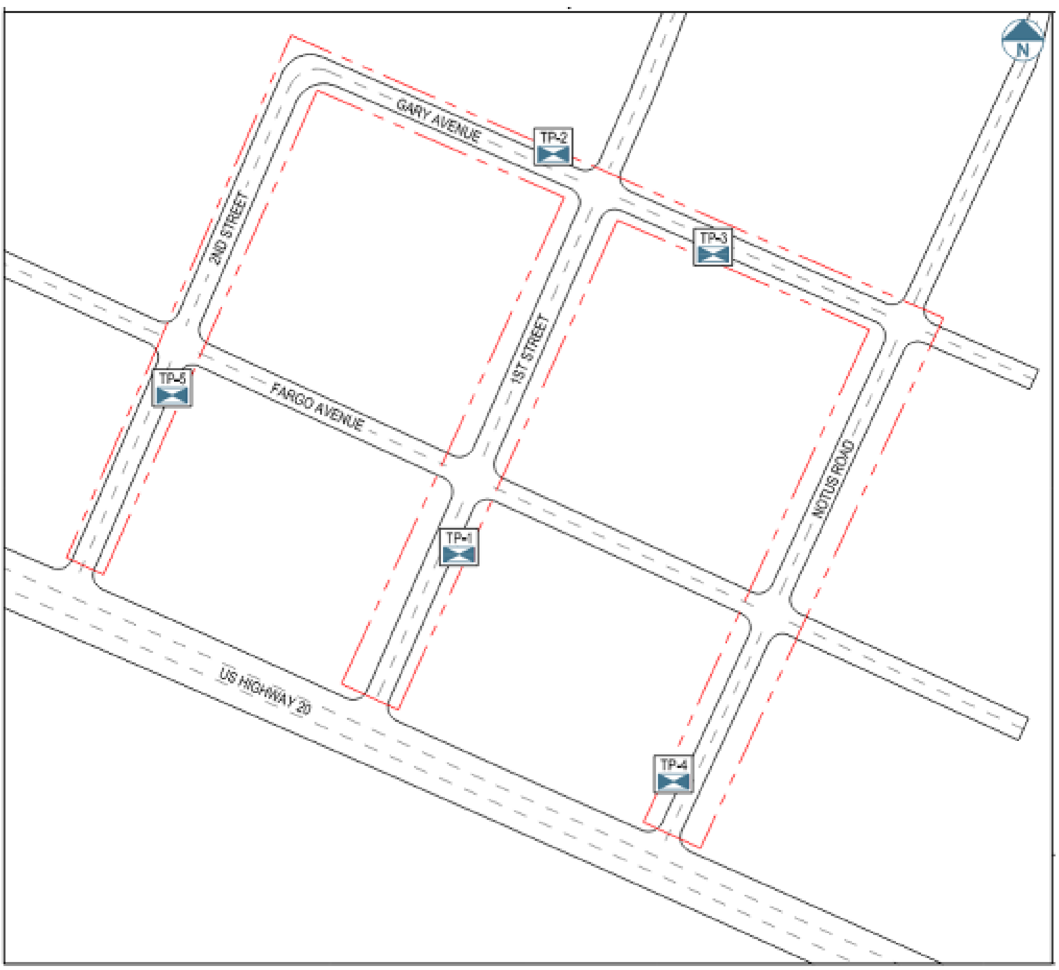


Figure 3 Infiltration Test Locations

Lochner retained Atlas to perform the infiltration testing for the project site. Fieldwork was completed on November 12th and 13th of 2020. The scope of this investigation included review of geologic literature and existing available geotechnical studies of the area, visual site reconnaissance of the immediate site, subsurface exploration of the site, field testing of materials collected, and engineering analysis and evaluation of drainage materials. Appendix A includes the report Atlas wrote describing the field investigation and detailed results. Table 1 below summarizes the results of the infiltration tests.

Test Location	Test Depth (ft)	Soil Type	Test Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)
TP-1	9.2	Sandy Silt	3.84	1.92
TP-2	11.0	Sandy Silt	2.00	1.00
TP-3	7.7	Sandy Silt	1.80	0.90
TP-4	11.9	Sandy Silt	1.44	0.72
TP-5	11.1	Silty Sand	0.72	0.36

Table 1 – Infiltration Test Results

Factors of safety (see Appendix A) have been applied to the infiltration rates achieved during testing to obtain the design infiltration rates listed above. The reason for applying a factor of safety and using decreased infiltration rates is to account for long term saturation of the soils and the potential for less permeable soils to settle into the bottom of the infiltration facilities.

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed roadway projects, the site is adequate for the placement of subsurface drainage facilities that rely on infiltration to disperse water.

4.0 US 20/26 Storm Sewer Facilities

At the conclusion of the previous study, a meeting was held to present the project findings. Aaron Bauges of ITD was present. Aaron responded on behalf of ITD, that they are willing to accept future storm water to their system if their system has the capacity to accept the water and that the quantity of storm water does not exceed that which they are receiving from the City now.

The second portion of this investigation began with a review of as-built plans provided by ITD and a field visit to inspect the ITD system in US-20/26. This was conducted on May 14, 2021. The investigation found that there are two separate storm systems in US-20/26 within the Notus City Limits. There is a high point in US-20/26 between 1st Street and Notus Street that separates these two systems. As-builts will not be included in the Appendices as they were very difficult to read and discern construction elements.

West of this high point, water is collected in catch basins in the curb and gutter and a trunkline runs westward along the south side of US-20/26, which discharges water to the roadside ditch west of town. This ditch discharges water directly to the Conway Drain, which then drains to the Boise River.

East of the high point in US-20/26, water is collected in catch basins in the curb and gutter and a trunkline runs eastward along the south side of US-20/26, which discharges water to the roadside ditch east of town. This ditch discharges to the Boise River east of town.

Storm water treatment is provided in both systems via the vegetated ditches conveying water to the river. Both trunklines are free of debris and appear in good shape. These piped systems could only be observed from the system manholes. In the future, these systems could be inspected with a video camera to better determine their actual condition. Both systems consist entirely of concrete pipe. The outfall ditches appear to have the ability to carry a significant amount of flow, far beyond what the current drainage area can contribute. The trunklines also appear to have the capacity to carry additional storm water, however, as actual invert elevations and slopes are not available for this study, a detailed analysis cannot be completed at this time to determine their actual capacity. This will have to wait until the future design project for surveyors to collect invert and slope information. Once this is known, the proposed storm sewer design for Notus Road, and possibly 1st and 2nd Street, can proceed.

5.0 Conclusion

As determined in the first part of this study, the proposed design will be able to incorporate infiltration facilities to detain the portion of the flows that the US-20/26 system cannot handle. What will be additionally beneficial is that a future Notus Street storm system will discharge storm water to the easterly trunkline and the 1st and 2nd Street systems will be able to discharge to the westerly trunkline. This will help limit water to any one single system, splitting it between the two systems, limiting the amount of water each future system will need to detain on site.

The conclusion of this drainage study is that the proposed drainage concept developed in the first study is feasible. The future roadway projects will be able to utilize a combination of on-site storage/infiltration facilities and piped storm systems connecting to the ITD-owned storm system in US-20/26 to capture and treat all storm water for the proposed three roadway improvement projects. Future design of storm systems that connect to ITD facilities will require coordination for approval beyond the initial communications with Aaron Bauges of ITD mentioned in this study.

Appendix A: GEOTECHNICAL INVESTIGATION REPORT

LIMITED GEOTECHNICAL INVESTIGATION

CITY OF NOTUS, DRAINAGE UPGRADES

Various Roadways

Notus, ID

PREPARED FOR:

Mr. Rob Cleere
H.W. Lochner, Inc.
3071 East Franklin Road, Suite 303
Meridian, ID 83642

PREPARED BY:

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

November 24, 2020
B201721g

ATLAS

2791 South Victory View Way
Boise, ID 83709
(208) 376-4748 | oneatlas.com

November 24, 2020

Atlas No. B201721g

Mr. Rob Cleere
H.W. Lochner, Inc.
3071 East Franklin Road, Suite 303
Meridian, ID 83642

Subject: Limited Geotechnical Investigation
City of Notus, Drainage Upgrades
Various Roadways
Notus, ID

Dear Mr. Cleere:

In compliance with your instructions, Atlas has conducted a limited soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on November 12 and 13, 2020. 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,

PROFESSIONAL ENGINEER
LICENSED
18300
11-24-2020
STATE OF IDAHO
JACOB SCHLADOR

Jacob Schlador, PE
Geotechnical Engineer

Monica Saculles, PE
Senior Geotechnical Engineer

CONTENTS

TABLES

APPENDICES

1. INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design of infiltration facilities. 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 infiltration facilities 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 central portion of the City of Notus, Canyon County, ID, and occupies a portion of the SW¼NE¼ & NW¼SE¼ of Section 34, Township 5 North, Range 4 West, Boise Meridian. This project will consist of upgrades to drainage facilities along various roadways within the City of Notus. Atlas was informed that infiltration facilities would extend a minimum of 7 feet below existing ground surface. Atlas scope of work has been limited to providing drainage recommendations.

1.2 Authorization

Authorization to perform this exploration and analysis was given in the form of a written authorization to proceed from Mr. Rob Cleere of H.W. Lochner, Inc. to Jacob Schlador of Atlas Technical Consultants (Atlas), on October 15, 2020. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between H.W. Lochner, Inc. and Atlas. Our scope of services for the proposed development has been provided in our proposal dated September 17, 2020 and repeated below.

1.3 Scope of Investigation

The scope of this investigation included review of geologic literature and existing available geotechnical studies of the area, visual site reconnaissance of the immediate site, subsurface exploration of the site, field testing of materials collected, and engineering analysis and evaluation of drainage materials. Our scope of work did not include foundation design recommendations, pavement recommendations, or earthwork recommendations.

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. Pleistocene Lake Bonneville occupied much of northeast Utah until about 14,000 years ago when it drained in a catastrophic flood that modified much of the landscape near the Snake River of southwestern Idaho. The project site is underlain by "Clay of Bonneville Flood Slack Water" as mapped by Othberg and Stanford (1993). Fine grained sediments deposited in the slackwater of this flood include a 3 to 6 foot thick unit of light tan silty clay found upstream of Parma, Idaho.

2.2 General Site Characteristics

The project site consists of various roadways throughout the central portion of the City of Notus. The roadways throughout the project site were relatively flat and level and consisted of asphaltic concrete. The project site was surrounded by existing residential and commercial developments on all sides. No vegetation was noted on the project site at the time of our investigation. However, various landscaping bushes, small trees, and grasses were noted adjacent to the project site.

Regional drainage is south and west toward the Boise River. Stormwater drainage for the site is achieved by both sheet runoff and percolation through surficial soils. Runoff predominates for the hardscape areas while percolation prevails across the landscaping areas/non-hardscape areas. The site is situated so that it is unlikely that it will receive any drainage from off-site sources. Stormwater drainage collection and retention systems were not noted within the various roadways across the site.

3. SOILS EXPLORATION

3.1 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. Atlas was provided a map showing ten potential test pit locations. Based on the presence of utilities and accessibility, Atlas selected five locations for test pits. 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 of overlying structures.

In addition, samples were obtained from representative soil strata encountered. Samples obtained have been visually classified in the field by professional staff, identified according to test pit number and depth, placed in sealed containers, and transported to our laboratory. 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.

3.2 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, which can be found in the **Appendix**.

At ground surface throughout the site were silt-sand-gravel fill mixtures. These fills were typically brown to light brown, dry to slightly moist, loose to dense, and contained fine to coarse-grained sand and fine to coarse gravel. Underlying these fill materials were silt with sand soils. Silts with sand were brown to light brown, dry to moist, soft to very stiff, and contained fine-grained sand. At depth throughout the site were sandy silt or silty sand soils. Sandy silts/silty sands were brown to light brown, dry to slightly moist, stiff to hard/medium dense to dense, and contained fine to medium-grained sand. Lenses of poorly graded sand sediments were encountered within test pits 1, 2, and 3. In test pits 4 and 5 were moderate induration and calcium carbonate cementation.

During excavation, test pit sidewalls were generally stable. However, moisture contents will affect wall competency with saturated soils having a tendency to readily slough when under load and unsupported.

4. 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.

4.1 Groundwater

During this field investigation, groundwater was not encountered in test pits advanced to a maximum depth of 11.9 feet bgs. Soil moistures in the test pits were generally dry to moist throughout. In the vicinity of the project site, groundwater levels are controlled in large part by residential and agricultural irrigation activity and leakage from nearby canals. Maximum groundwater elevations likely occur during the later portion of the irrigation season.

During a previous investigation performed in July 2015 within 0.68 mile to the north of the project site, groundwater was encountered within numerous test pits at depths ranging from 14.1 to 16.0 feet bgs. Furthermore, according to Idaho Department of Water Resources (IDWR) well logs within approximately ½-mile of the project site, groundwater was measured at depths ranging between 16 and 22 feet bgs.

Based on evidence of this investigation and background knowledge of the area, Atlas estimates groundwater depths to remain greater than approximately 14 feet bgs throughout the year.

4.2 Soil Infiltration Rates

Soil permeability, which is a measure of the ability of a soil to transmit a fluid, was tested in the field. For this report, an estimation of infiltration is also presented using generally recognized values for each soil type and gradation. Of soils comprising the generalized soil profile for this study, silt soils generally offer little permeability, with typical hydraulic infiltration rates of less than 2 inches per hour. Sandy silt soils will commonly exhibit infiltration rates from 2 to 4 inches per hour and silty sand sediments usually display rates of 4 to 8 inches per hour; though calcium carbonate cementation and induration may reduce these values to near zero.

4.3 Infiltration Testing

Infiltration testing was conducted using an open test pit method. Test pit areas will need to be re-excavated and compacted prior to construction of structures that will be sensitive to settlement. Test locations were presoaked prior to testing. Pre-soaking increases soil moistures, which allows the tested soils to reach a saturated condition more readily during testing. Saturation of the tested soils is desirable in order to isolate the vertical component of infiltration by inhibiting horizontal seepage during testing.

Testing was conducted on November 13, 2020. Details and results of testing are as follows:

Table 1 – Infiltration Test Results

Test Location	Test Depth (feet bgs)	Soil Type	Stabilized Infiltration Rate (inches/hour)	Design Infiltration Rate (inches per hour)
TP-1	9.2	Sandy Silt	3.84	1.92
TP-2	11.0	Sandy Silt	2.00	1.00
TP-3	7.7	Sandy Silt	1.80	0.90
TP-4	11.9	Sandy Silt	1.44	0.72
TP-5	11.1	Silty Sand	0.72	0.36

Appropriate factors of safety have been applied to the stabilized infiltration rates achieved during testing to obtain the design infiltration rates listed above. The reason for the decreased infiltration rate is to account for long term saturation of the soils and the potential for less permeable soils to settle into the bottom of the infiltration facilities. Atlas recommends that all infiltration facilities be constructed in accordance with the local municipality requirements.

5. GENERAL COMMENTS

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed development, 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 facilities, 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.

6. REFERENCES

American Society for Testing and Materials (ASTM) (2017). Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System): ASTM D2487. West Conshohocken, PA: ASTM.

Idaho Department of Water Resources. [Online] Well Construction & Drilling, Find a Well Mapping Tool. <http://www.idwr.idaho.gov/wells/find-a-well.html> (2020).

International Building Code Council (2015). International Building Code, 2015. Country Club Hills, IL: Author.

Othberg, K. L. and Stanford, L. A., Idaho Geologic Society (1993). Geologic Map of the Boise Valley and Adjoining Area, Western Snake River Plain, Idaho. (scale 1:100,000). Boise, ID: Joslyn and Morris.

State of Idaho Department of Environmental Quality (October 2019). Technical Guidance Manual For Individual and Subsurface Sewage Disposal Systems. Boise, ID: Author.

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 Materials Testing and Inspection ("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 or 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

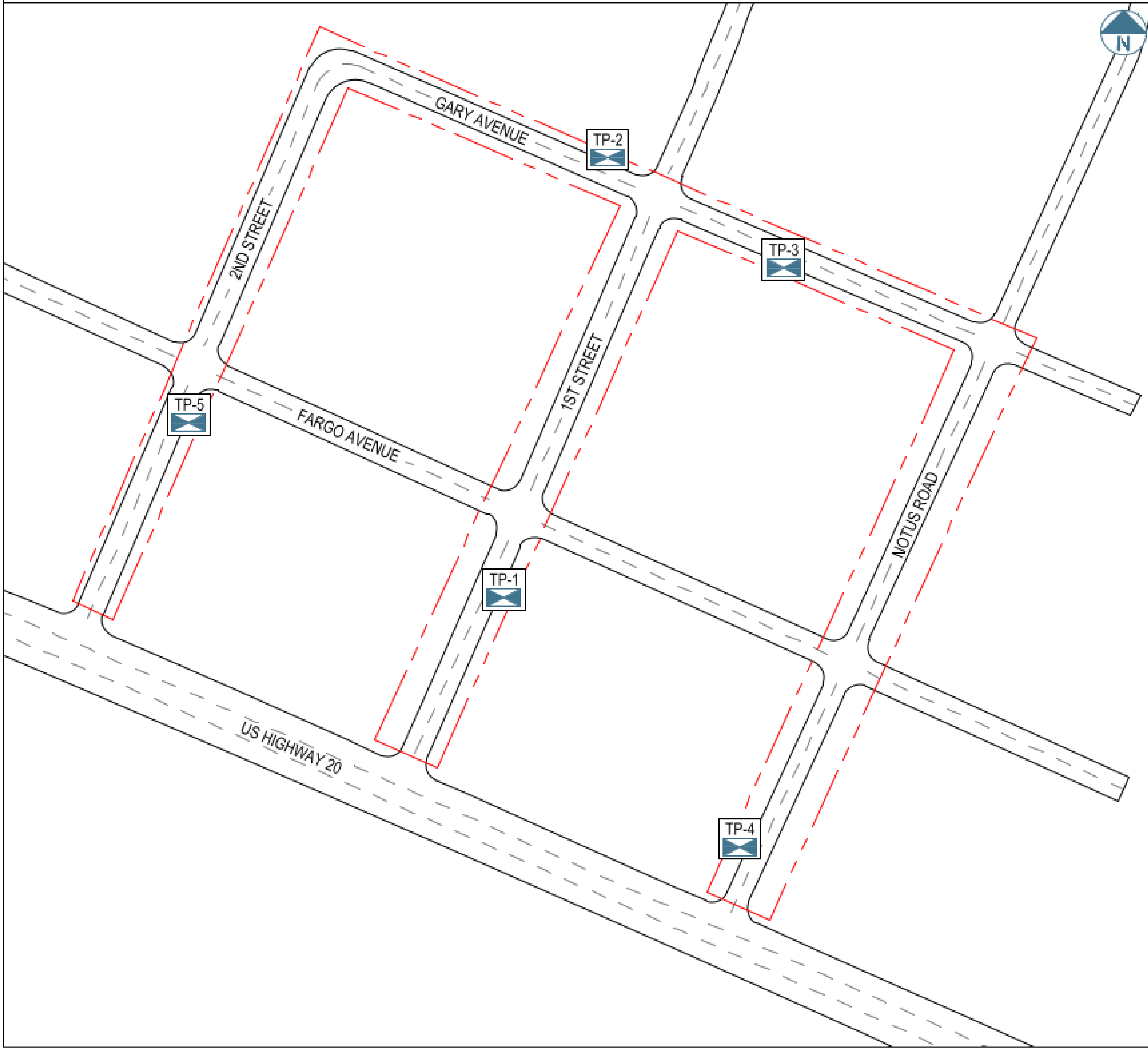
City of Notus Drainage Upgrades
Various Roadways
Notus, ID

Modified from DeLorme by: JBS
November 16, 2020
Drawing: B201721g

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 Project Boundary

Approximate Atlas Test Pit Location

City of Notus Drainage Upgrades
Various Roadways
Notus, ID

Drawn by: JBS
November 16, 2020
Drawing: B201721g

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: November 12, 2020
Excavated by: Turn of the Century Homes
Logged by: Jacob Schlador, PE

Latitude: 43.72564
Longitude: -116.80037
Depth to Water Table: Not Encountered
Total Depth: 9.2 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-0.25	Asphaltic Concrete: 3 inches thick.				
0.25-1.4	Silty Gravel with Sand Fill (GM-FILL): Brown to light brown, dry, medium dense, with fine to coarse-grained sand and fine to coarse gravel.				
1.4-7.7	Silt with Sand (ML): Brown to light brown, dry to slightly moist, medium stiff to very stiff, with fine-grained sand.				
7.7-9.2	Sandy Silt (ML): Brown to light brown, dry to slightly moist, stiff to very stiff, with fine to medium-grained sand. --Sand lens noted at 8.0 to 8.5 feet bgs.				

Notes: See Site Map for test pit location.
Infiltration testing conducted at a depth of 9.2 feet bgs.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-2
Date Advanced: November 12, 2020
Excavated by: Turn of the Century Homes
Logged by: Jacob Schlador, PE

Latitude: 43.72702
Longitude: -116.79991
Depth to Water Table: Not Encountered
Total Depth: 11.0 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-1.0	Silty Gravel with Sand Fill (GM-FILL): Brown to light brown, dry to slightly moist, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel.				
1.0-6.8	Silt with Sand (ML): Brown, dry to slightly moist, stiff to very stiff, with fine-grained sand.				
6.8-11.0	Sandy Silt (ML): Light brown, slightly moist, stiff to very stiff, with fine to medium-grained sand. --Sand lens encountered at 9.0 to 9.5 feet bgs.				

Notes: See Site Map for test pit location.
Infiltration testing conducted at a depth of 11.0 feet bgs.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-3
Date Advanced: November 12, 2020
Excavated by: Turn of the Century Homes
Logged by: Jacob Schlador, PE

Latitude: 43.72671
Longitude: -116.79922
Depth to Water Table: Not Encountered
Total Depth: 7.7 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-1.2	Silty Gravel with Sand Fill (GM-FILL): Brown to light brown, dry to slightly moist, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel.				
1.2-3.2	Silt with Sand (ML): Brown, dry to slightly moist, medium stiff to stiff, with fine-grained sand.			1.0-1.5	
3.2-7.7	Sandy Silt (ML): Brown to light brown, dry, stiff to very stiff, with fine to medium-grained sand. --Sand lens encountered from 6.0 to 6.5 feet bgs.				

Notes: See Site Map for test pit location.
Infiltration testing conducted at a depth of 7.7 feet bgs.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-4
Date Advanced: November 12, 2020
Excavated by: Turn of the Century Homes
Logged by: Jacob Schlador, PE

Latitude: 43.72501
Longitude: -116.79938
Depth to Water Table: Not Encountered
Total Depth: 11.9 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-1.2	Poorly Graded Gravel with Silt and Sand Fill (GP-GM-FILL): Brown to light brown, dry, loose to medium dense, with fine to coarse-grained sand and fine to coarse gravel.				
1.2-6.8	Silt with Sand (ML): Brown, dry to slightly moist, medium stiff to very stiff, with fine-grained sand.			1.0-2.5	
6.8-11.9	Sandy Silt (ML): Brown to light brown, slightly moist, very stiff to hard, with fine to medium-grained sand. --Moderate induration encountered from 11.0 to 11.9 feet bgs.				

Notes: See Site Map for test pit location.
Infiltration testing conducted at a depth of 11.9 feet bgs.

GEOTECHNICAL INVESTIGATION TEST PIT LOG

Test Pit Log #: TP-5
Date Advanced: November 12, 2020
Excavated by: Turn of the Century Homes
Logged by: Jacob Schlador, PE

Latitude: 43.72670
Longitude: -116.80278
Depth to Water Table: Not Encountered
Total Depth: 11.1 feet bgs

Depth (feet bgs)	Field Description and USCS Soil and Sediment Classification	Sample Type	Sample Depth (feet bgs)	Qp	Lab Test ID
0.0-2.0	Poorly Graded Gravel with Silt and Sand Fill (GP-GM-FILL): Light brown, dry, medium dense to dense, with fine to coarse-grained sand and fine to coarse gravel.				
2.0-6.5	Silt with Sand (ML): Brown, dry to moist, soft to stiff, with fine-grained sand.			0.5-1.0	
6.5-11.1	Silty Sand (SM): Brown to light brown, dry to slightly moist, medium dense to very dense, with fine to coarse-grained sand. --Moderate calcium carbonate cementation encountered from 7.4 to 11.1 feet bgs.				

Notes: See Site Map for test pit location.
Infiltration testing conducted at a depth of 11.1 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 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.***

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