Geotechnical Investigation
Clawson Subdivision Roadway
Eden, Utah

September 8, 2020

Prepared by:

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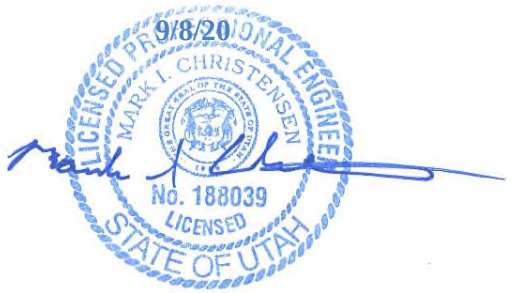
Geotechnical Investigation
Clawson Subdivision Roadway
Rivers Edge Road
Eden, Utah
CG Project No.: 137-007

Prepared by:



Mark I. Christensen, P.E.
Principal

Christensen Geotechnical
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September 8, 2020

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ATTACHED PLATES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF WORK

This report presents the results of a geotechnical investigation that was performed for a roadway within the proposed Clawson Subdivision which is to be located at the south end of Rivers Edge Road in Eden, Utah. The general location of the project is indicated on the Project Vicinity Map, Plate 1. In general, the purposes of this investigation were to evaluate the subsurface conditions and the nature and engineering properties of the subsurface soils, and to provide recommendations for general site grading and for the design and construction of pavements. This investigation included subsurface exploration, representative soil sampling, field and laboratory testing, engineering analysis, and preparation of this report.

The work performed for this report was authorized by Mr. Jason Peterson and was conducted in accordance with the Christensen Geotechnical proposal dated August 20, 2020.

1.2 PROJECT DESCRIPTION

Based on conversations with our client, we understand that the proposed roadway is to be an extension of Rivers Edge Road. The extension is to be approximately 150 feet long and is to be constructed at or near existing grade.

2.0 METHODS OF STUDY

2.1 FIELD INVESTIGATION

The subsurface conditions at the site were explored by excavating one test pit to a depth of 5 feet below the existing site grade. The approximate test pit location is shown on the Exploration Location Map, Plate 2. The subsurface conditions as encountered in the test pit were recorded at the time of excavation and are presented on the attached Test Pit Log, Plate 3. A key to the symbols and terms used on the Test Pit Log may be found on Plate 4.

The test pit excavation was accomplished with a mini tracked excavator. Due to the granular nature of the soils encountered, only disturbed soil samples were collected from the test pit sidewalls at the time of excavation. The disturbed samples were collected and placed in bags and buckets. The samples were visually classified in the field and portions of each sample were packaged and transported to our laboratory for testing. The classifications for the individual soil units are shown on the attached Test Pit Log.

2.2 LABORATORY TESTING

Of the soils collected during the field investigation, representative samples were selected for testing in the laboratory in order to evaluate the pertinent engineering properties. The laboratory testing included a moisture content determination, an Atterberg limits determination, and a gradation analysis. A summary of our laboratory testing is presented in the table below:

Table No. 1: Laboratory Test Results

TEST HOLE NO.	DEPTH (ft.)	NATURAL DRY DENSITY (pcf)	NATURAL MOISTURE (%)	ATTERBERG LIMITS		GRAIN SIZE DISTRIBUTION (%)			SOIL TYPE
				LIQUID LIMIT	PLASTICITY INDEX	GRAVEL (+ #4)	SAND	SILT/ CLAY (- #200)	
TP-1	2		2.4	NP	NP	60.7	37.8	1.5	GP

The results of our laboratory tests are also presented on the Test Pit Log, Plate 3, and more detailed laboratory results are presented on the Laboratory Testing Plate, Plate 5.

Samples will be retained in our laboratory for 30 days following the date of this report, at which time they will be disposed of unless a written request for additional holding time is received prior to the disposal date.

3.0 GENERAL SITE CONDITIONS

3.1 SURFACE CONDITIONS

At the time of our investigation, the subject site was undeveloped land. The property was nearly level and was covered with common grasses and weeds.

3.2 SUBSURFACE CONDITIONS

3.2.1 Soils

Based on the test pit completed for this investigation, the site is covered with approximately 1 foot of topsoil. The soils below the topsoil generally consisted of Poorly Graded GRAVEL with sand (GP) through the maximum depth explored (5 feet).

3.2.2 Groundwater

Groundwater was not encountered within our test pit at the time of excavation. It should be understood that groundwater is likely below its seasonal high and may fluctuate in response to seasonal changes, precipitation, and irrigation.

4.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

4.1 GENERAL CONCLUSIONS

Based on the results of our field and laboratory investigations, it is our opinion that the subject site is suitable for the proposed construction provided that the recommendations contained in this report are incorporated into the design and construction of the project.

4.2 EARTHWORK

4.2.1 General Site Preparation and Grading

Prior to site grading operations, all vegetation, topsoil, undocumented fill soils, and loose or disturbed soils should be stripped (removed) from the pavement areas. Following the stripping operations, the exposed soils should be proof rolled to a firm, unyielding condition. Site grading may then be conducted to bring the site to design grade.

4.2.2 Soft Soil Stabilization

Once exposed through excavation, all subgrade soils should be proof rolled with a relatively large, wheeled vehicle to a firm, unyielding condition. Localized soft areas encountered during the proof rolling operation should be removed and replaced with granular structural fill. If soft areas extend more than 18 inches deep, or where large areas are encountered, stabilization may be considered. The use of stabilization should be approved by the geotechnical engineer, but would likely consist of over-excavating the area by at least 18 inches and then placing a geofabric (such as Mirafi RS280i) at the bottom of the excavation. Over this, a stabilizing fill, consisting of angular coarse gravel with cobbles, would be placed to the design subgrade.

4.2.3 Temporary Construction Excavations

Based on OSHA requirements and the soil conditions encountered during our field investigation, we anticipate that temporary construction excavations at the site that have vertical walls that extend to depths of up to 5 feet may be occupied without shoring; however, where groundwater or fill soils are encountered, flatter slopes may be required. Excavations that extend to more than 5 feet in depth should be sloped or shored in accordance with OSHA regulations for a type C soil. The stability of construction excavations is the contractor’s responsibility. If the stability of an excavation becomes questionable, the excavation should be evaluated immediately by qualified personnel.

4.2.4 Structural Fill and Compaction

All fill placed for the support of pavements should consist of structural fill. The structural fill may consist of the native gravel soils once particles larger than 4 inches in diameter have been removed. Imported structural fill, if required, should consist of a relatively well-graded granular soil with a maximum particle size of 4 inches, with a maximum of 50 percent passing the No. 4 sieve and a maximum of 30 percent passing the No. 200 sieve. The liquid limit of the fines (material passing the No. 200 sieve) should not exceed 35 and the plasticity index should be less than 15. Additionally, all structural fill, whether native soils or imported material, should be free of topsoil, vegetation, frozen material, particles larger than 4 inches in diameter, and any other deleterious materials. Any imported materials should be approved by the geotechnical engineer prior to importing.

The structural fill should be placed in loose lifts that are a maximum of 8 inches thick. The moisture content should be within 3 percent of optimum and the fill should be compacted to at least 95 percent of the maximum density as determined by ASTM D 1557. Where fill heights exceed 5 feet, the level of compaction should be increased to 98 percent.

4.3 PAVEMENT DESIGN

The pavement section for roadway within the proposed development was assessed using the PAS computer program (prepared by the American Concrete Pavement Association) and an assumed CBR value of 10 percent. No traffic information was available at the time this report was prepared; Christensen Geotechnical has therefore assumed a traffic load for the roadways based on our experience with similar projects. We have assumed that traffic will consist of 100 passenger cars per day, 4 medium trucks per day and 1 heavy truck per day. We have further assumed no increase in traffic over the life of the pavement. Based on this information, we recommend a pavement section consisting of 3 inches of asphalt over 8 inches of untreated base. The asphalt should consist of a high-stability plant mix and should be compacted to at least 96 percent of the Marshall maximum density. The untreated base should meet the material requirements for Weber County and should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557.

5.0 LIMITATIONS

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

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

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

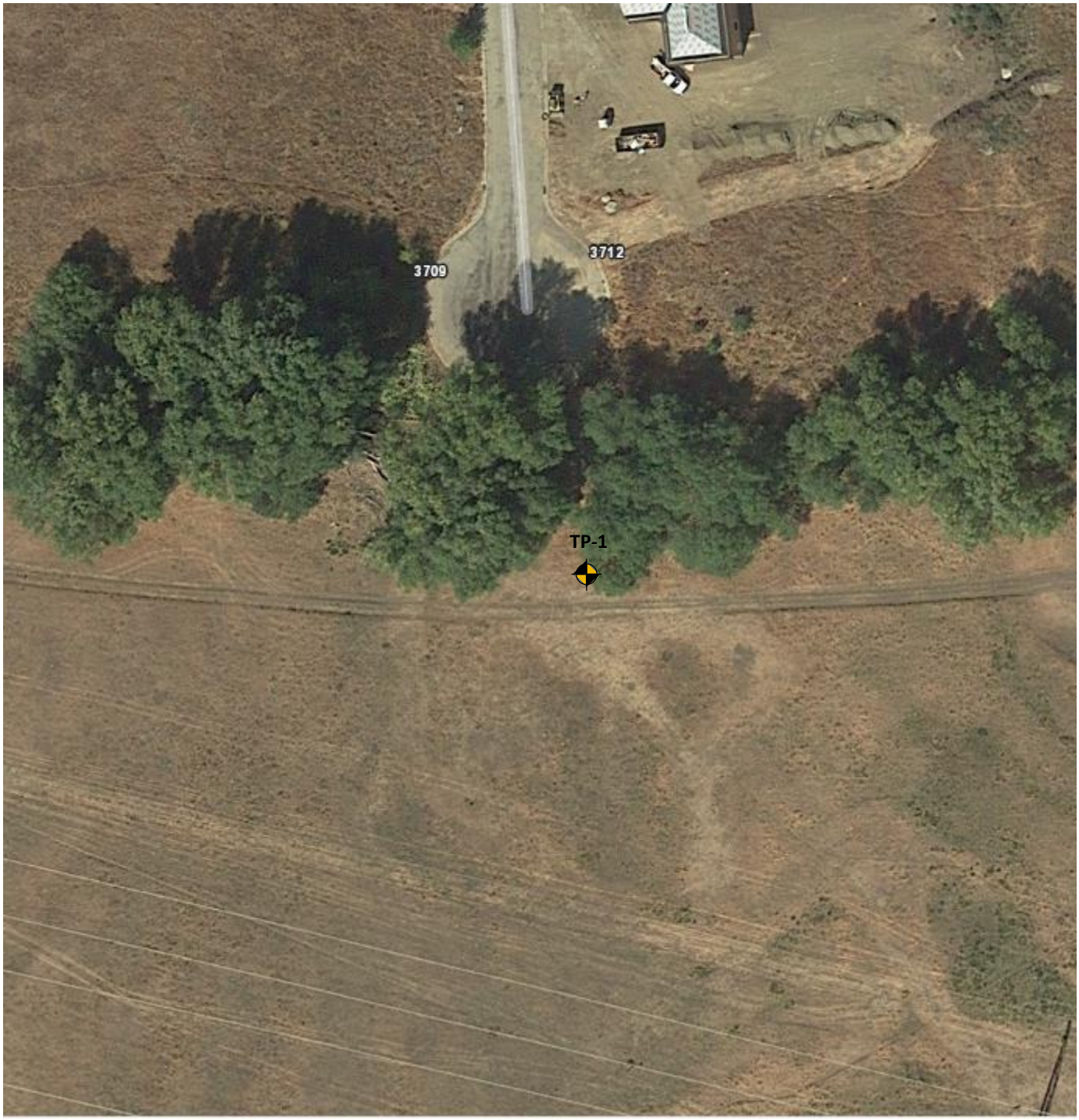
Base Photo: Utah AGRC

Drawing Not to Scale

N

Approximate Project Location

Christensen Geotechnical	Peterson Builders Clawson Subdivision Roadway Eden, Utah Project No. 137-007 **Vicinity Map**	Plate 1



Base Photo: Utah AGRC

Approximate Test Pit Location

Drawing Not to Scale

N

Christensen Geotechnical	Peterson Builders Clawson Subdivision Roadway Eden, Utah Project No. 137-007 **Exploration Location Map**	Plate 2

Date		
Started:	8/25/2020	
Completed:	8/25/2020	
Backfilled:	8/25/2020	

TEST PIT LOG

Logged By: M Christensen
Equipment: Trackhoe
Location: See Plate 2

Test Pit No.
TP-1
Sheet 1 of 1

Depth (feet)	Sample Type	Groundwater	Graphic Log	Group Symbol	Material Description	Dry Density (pcf)	Moisture Content (%)	Minus #200 (%)	Liquid Limit	Plasticity Index
					Topsoil; Silty GRAVEL with sand - moist, dark brown					
	☒				Poorly Graded GRAVEL with sand - medium dense, slightly moist, brown		2.4	1.5	NP	NP
5					Bottom of test pit at 5 feet					
10										
15										

☒ Bulk/Bag Sample
▥ Undisturbed Sample
▼ Stabllized Groundwater
▽ Groundwater At Time of Excavation

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Eden, Utah
Project No.: 137-007

Plate
3

RELATIVE DENSITY – COURSE GRAINED SOILS

Relative Density	SPT (blows/ft.)	3 In OD California Sampler (blows/ft.)	Relative Density (%)	Field Test
Very Loose	<4	<5	0 – 15	Easily penetrated with a ½ inch steel rod pushed by hand
Loose	4 – 10	5 – 15	15 – 35	Difficult to penetrate with a ½ inch steel rod pushed by hand
Medium Dense	10 – 30	15 – 40	35 – 65	Easily penetrated 1-foot with a steel rod driven by a 5 pound hammer
Dense	30 – 50	40 – 70	65 – 85	Difficult to penetrate 1-foot with a steel rod driven by a 5 pound hammer
Very Dese	>50	>70	85 - 100	Penetrate only a few inches with a steel rod driven by a 5 pound hammer

CONSISTENCY – FINE GRAINED SOILS

Consistency	SPT (blows/ft)	Torvane Undrained Shear Strength (tsf)	Pocket Penetrometer Undrained Shear Strength (tsf)	Field Test
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches with thumb
Soft	2 – 14	0.125 – 0.25	0.25 – 0.5	Easily penetrated one inch with thumb
Medium Stiff	4 – 8	0.25 – 0.5	0.5 – 1.0	Penetrated over ½ inch by thumb with moderate effort. Molded by strong finger pressure
Stiff	8 – 15	0.5 – 1.0	1.0 – 2.0	Indented ½ inch by thumb with great effort
Very Stiff	15 – 30	1.0 – 2.0	2.0 – 4.0	Readily indented with thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty with thumbnail

CEMENTATION

Weakly	Crumbles or breaks with handling or little finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

MOISTURE

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually below water table

GRAIN SIZE

Description		Sieve Size	Grain Size (in)	Approximate Size
Boulders		>12”	>12”	Larger than basketball
Cobbles		3” – 12”	3” – 12”	Fist to basketball
Gravel	Coarse	3/4” - 3”	3/4” - 3”	Thumb to fist
	Fine	#4 – 3”	0.19 – 0.75	Pea to thumb
Sand	Coarse	#10 - #4	0.079 – 0.19	Rock salt to pea
	Medium	#40 - #10	0.017 – 0.079	Sugar to rock salt
	Fine	#200 - #40	0.0029 – 0.017	Flour to sugar
Silt/Clay		<#200	<0.0029	Flour sized or smaller

STRATAFICATION

Occasional	One or less per foot of thickness
Frequent	More than one per foot of thickness

MODIFIERS

Trace	<5%
Some	5-12%
With	>12%

STRATIFICATION

Seam	1/16 to 1/2 inch
Layer	1/2 to 12 inch

NOTES

1. The logs are subject to the limitations and conclusions presented in the report.
2. Lines separating strata represent approximate boundaries only. Actual transitions may be gradual.
3. Logs represent the soil conditions at the points explored at the time of our investigation.
4. Soils classifications shown on logs are based on visual methods . Actual designations (based on laboratory testing)may vary.

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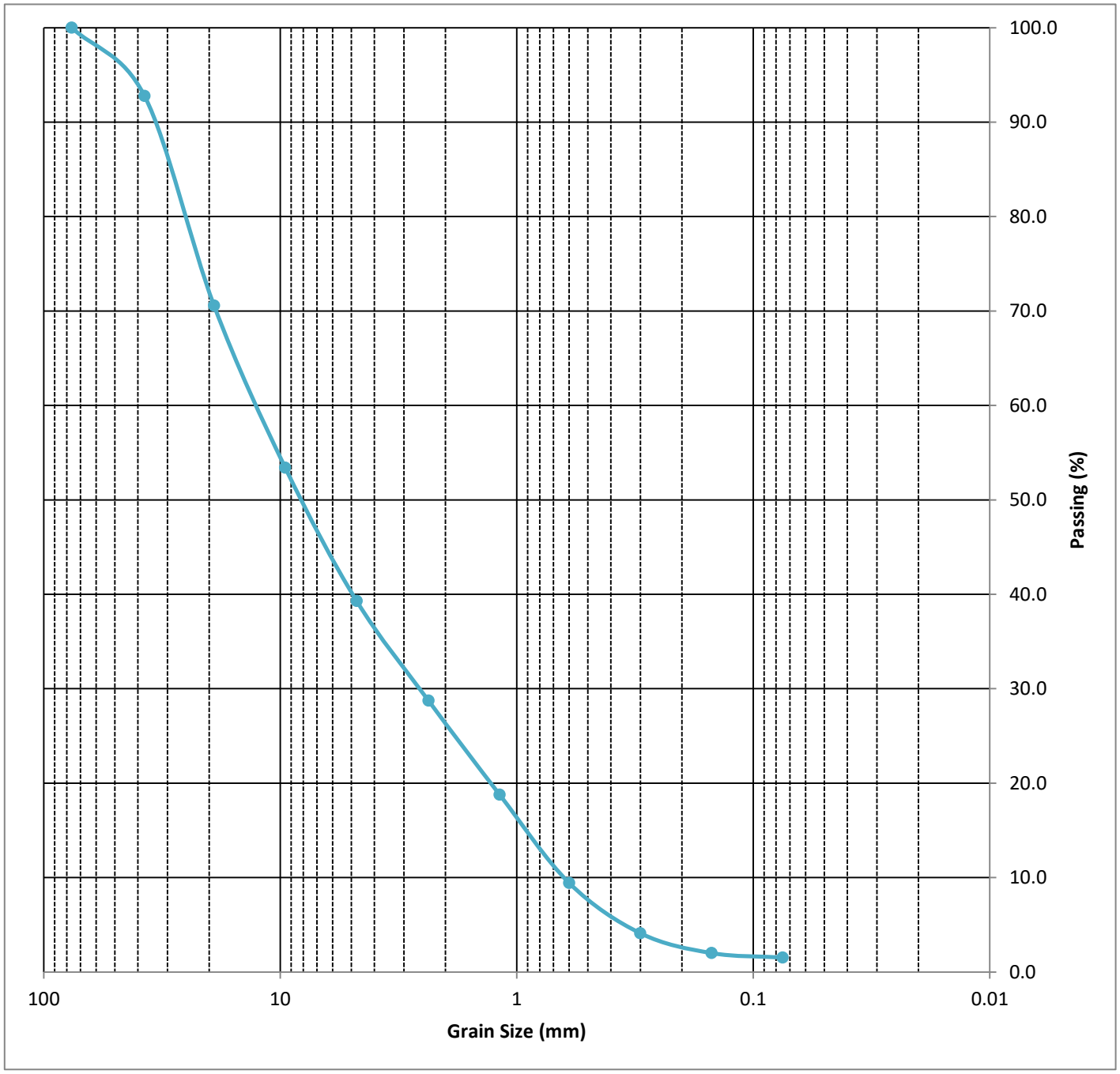
Soil Terms Key

Plate 4

Grain Size Distribution



Location	Depth		Classification	% Gravel	% Sand	% Silt and Clay
TP-1	2	●	Poorly Graded GRAVEL with sand	60.7	37.8	1.5

Christensen Geotechnical	Peterson Builders Clawson Subdivision Roadway Eden, Utah Project No.: 137-007	Plate 5