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Reno, NV 89511

February 27, 2020  
Project No: 2556

Mr. William H. Hoffman, P.E.  
**Poggemeyer Design Group**  
1575 Delucchi Lane, Suite 110  
Reno, Nevada 89502

**RE: DRAFT Preliminary Geotechnical Memorandum  
Truckee Meadows Fire Department (TMFD) Washoe Valley Consolidation Parcel Review  
Washoe City, Washoe County, Nevada**

Dear Mr. Hoffman,

Construction Materials Engineers, Inc (CME) is pleased to submit the preliminary results of our initial phased preliminary geotechnical/percolation investigation for the proposed Truckee Meadows Fire Department Washoe Valley Consolidation parcel review. The subject property is located in Washoe City near the north end of Washoe Valley.

## 1.0 SCOPE OF WORK

Since the project is in the preliminary planning phases, a phased scope of work will be completed as follows:

### Current Phase

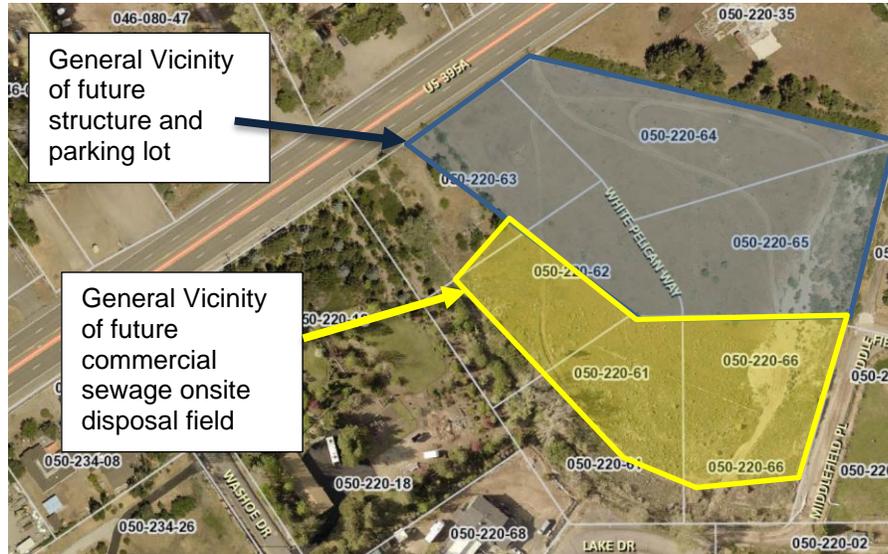
- **Phase 1 (Preliminary Geotechnical Memorandum):** This letter presents the results of our phase 1 investigation. Phase 1 work consists of identify potential geologic hazards (faults, liquefaction potential, shallow groundwater, potential for compressible/expansive soils) and provides a list of general construction concerns (percolation rate, excavation difficulties, soil instabilities, dewatering, remedial earthwork). This letter should be reviewed by the client and owner to determine the precursors associated with the economic feasibility of the project and if a Phase 2 investigation shall be conducted.

### Future Phases

- **Phase 2 (Preliminary Geotechnical Investigation Report):** Phase 2 will be the preliminary geotechnical investigation to provide preliminary geotechnical design recommendations. This phase of work will be completed following the initial client/design team review of the Preliminary Geotechnical Memorandum (Phase 1).
- **Phase 3 (Design Level Geotechnical Investigation):** Phase 3 is the final geotechnical investigation. This scope of work will be determined once the proposed structure layout and design elements of the project have been developed. Additional subsurface exploration, laboratory testing, and percolation testing may be required for this scope of work.

## 2.0 PROJECT DESCRIPTION

The project is currently in the conceptual phases and parcel acquisition is not 100 percent complete. Currently Poggemeyer Design Group is assisting Washoe County in performing due diligence activities to determine if the following Washoe County Assessor Parcel Numbers (APN's) can be economically developed as a Fire Station: APN's 050-220-61, -62, -63, -64, -65, and -66. An aerial image showing the approximate limits of the subject site is included as Figure 1 (Preliminary Site Plan).



**Figure 1: Preliminary Site Plan (N.T.S.)**

Based on conversations with Poggemeyer Design Group and Washoe County, subsurface conditions at the current parcel site are unknown and potential geotechnical design and/or construction constraints need to be developed to determine if purchase of the properties will facilitate the need of the Truckee Meadows Fire Departments request for future development as a Fire Station.

## 3.0 SITE CONDITONS

The subject property is located toward the north end of Washoe Valley along the base of the eastern flank of the Carson Range. The property is bounded by US 395A to the northwest, Steamboat Creek to the southwest, and residential properties along the remaining property boundaries.

The property is currently undeveloped and the majority of the site consists of a large open field with low-lying grasses and sparsely located bushes. Medium to large trees are sparsely located along the perimeters of the property. The property gentle slopes in a predominant northwesterly to southeasterly direction with a gradient of 1 to 2 percent. Based on the Washoe County Quick Map, the total elevation differential across the site is about 10 feet.

Access to the site from US 395A is via West Washoe Drive connecting into Lake Drive.

## 4.0 SUBSURFACE EXPLORATION

The property was explored using both test pit excavations (predominately to assess the viability of an onsite sewage disposal field) and vertical test borings (to assess a deeper soil profile and liquefaction potential at the site). A description of each exploration method performed is included as Sections 4.1 (Test Pits) and 4.2 (Vertical Test Borings). A Field Exploration Location Map is presented as Plate A-1.

Elevations shown on the exploration logs were obtained via Google Earth and should be considered approximate. The exploration locations included in this report should be considered accurate only to the degree implied by the methods used.

### 4.1 TEST PITS

Four test pits were excavated to depths of 7 to 10 feet bgs in February 2020. The test pits were excavated using a rubber tire, John Deere 310SG backhoe, equipped with a 24-inch wide bucket.

Following completion of the excavation, the test pit was backfilled with the excavated spoils. Test pit backfill was loosely placed and not compacted to the standards typically required for properly placed structural fill<sup>1</sup>.

### 4.2 VERTICAL TEST BORINGS

The proposed site was explored in February 2020 by drilling two test borings to a depth of 15 and 40 feet below the existing ground surface. The borings were drilled using a truck-mounted Gefco SS15 soil sampling drill rig with 6-inch-outside-diameter (O.D.), 3-1/4-inch-inside-diameter (I.D.) continuous-flight augers to a depth of 5 feet where the exploration methodology switched to mud rotary drilling methods consisting of advancing a 3 1/8-inch mud rotary bit with a water/bentonite drilling fluid. The rotary bit decreases sample disturbance at the bottom of the borehole and the drilling fluid prevents sloughing of the borehole sidewalls.

The native soils were sampled in-place every 2 to 5 feet using a standard 2-inch OD split-spoon sampler driven by a standard 140-pound drive hammer with a 30-inch stroke. The number of blows to drive the sampler the final 12 inches of an 18-inch penetration into undisturbed soil is an indication of the density and consistency of the material (Standard Penetration Test (SPT) - ASTM D 1586).

Due to the relatively small diameter of the sampler, the maximum particle size that could be recovered was approximately 1 1/4 inches. Soil classifications presented on the boring logs may not, therefore, adequately represent the actual quantity or presence of gravels, cobbles, or boulders. Additionally, any stratification lines on the logs represent the approximate boundary between soil types and the transition should be considered gradual.

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<sup>1</sup> **Warning:** Structures and or slabs constructed over loosely placed back-fill may experience significant settlement and/or differential settlement. Removal and recompaction of back-fill may be required prior to construction over these areas.

#### 4.3 MATERIAL CLASSIFICATION

Soils were examined and classified during exploration in general accordance with ASTM D 2488 (Description and Identification of Soils). During exploration, representative bulk samples were placed in sealed plastic bags and returned to our laboratory for testing. Upon completion of laboratory testing, additional soil classification and verification of the field classifications were subsequently performed in accordance with the Unified Soil Classification System (USCS), as presented in ASTM D 2487. Test Pit and Boring logs (Plate A-2) and a USCS chart (Plate A-3 - Graphic Soils Classification Chart) is presented in Appendix A.

#### 4.4 PERCOLATION TESTING

Percolation testing was performed within Test Pits TP-1, TP-2, and TP-3 at benched locations at the depths noted on the percolation test logs (included as Plates D-1).

Percolation test preparation included hand excavation of the test hole to a depth of about 14-inches and placing approximately 2-inches of gravel at the bottom to prevent scour. A perforated PVC liner approximately 4-inches in nominal diameter was placed in the center of the excavated percolation test hole.

Percolation testing was completed in general accordance with Chapter 444 of the Nevada Administration Code (NAC). Correction calculations were performed to adjust for the percolation test hole diameter and PVC liner. A summary of percolation test results is included as Table 1 (Percolation Test Information).

Table 1: Percolation Test Information						
Test ID	Test Pit Depth (ft)	Groundwater Depth (ft)	Percolation Test ID	Approximate Percolation Test Depth (ft)	Field Percolation Rate (min/in)	Corrected Percolation Rate (min/in) <sup>1</sup>
TP-1	10	7	P-1a	3	>120	
			P-1b	5		
TP-2	8.5	7	P-2a	3	10      21.2	
			P-2b	5		
TP-3	7	6	P-3a	2 ½	>120	
<b>NOTES:</b>						
1) Correction calculations were completed, refer to Plates A-2 (Percolation Test Results)						
2) NDEP Guidance Manual 1.0 notes that the soil percolation rate shall be faster than 120 min/in. Additionally, bottom of trenches and beds shall be at least 4 ft. above highest expected groundwater elevation.						

#### 5.0 LABORATORY TESTING

Representative samples of significant soil types will be tested in the laboratory as to index properties, such as moisture content, grain size distribution and plasticity. These index properties are indicative of mechanical behavior of the soils.

Soil chemistry testing on representative near surface soil sample(s) will also be performed to determine corrosion potential.

## 6.0 GEOLOGIC AND GENERAL SOIL CONDITIONS

Based on a review of the two regional published Geologic Maps:

- Geologic Map of the Washoe City Quadrangle, R.W Tabor and S. Ellen, 1975, the subject property is located in undifferentiated sand deposits (**Qsu**). These deposits consist of a combination of windblown sands, alluvial outwash, and slope wash.
- Geologic map of the Washoe City Quadrangle, Chad W. Carlson et al, 2019, the subject property is located in two different geologic units: Young alluvial-fan deposits (**Qfy**), located toward the north to central portions of the property, consisting of broad anastomosing fans emanating from channels along the western margins of Washoe valley. Toward the south end of the property, lacustrine deposits (**Ql**) are mapped consisting of a mixture of predominantly beach sand and eolian sands deposits interbedded with fan deposits. Figure 2 shows an excerpt of the geologic map.

In general, the geologic conditions are complex and influenced by the following four geomorphic processes:

- Alluvial fan deposits originating from the hillsides along the western margins of Washoe valley;
- Eolian (windblown) sands;
- Beach (shoreline) deposits originating from pluvial Washoe Lake having a high stand of 5080 feet, or about 20 feet above the existing ground surface;
- Floodplain and slope wash deposits originating from Steamboat Creek and braided stream deposits.

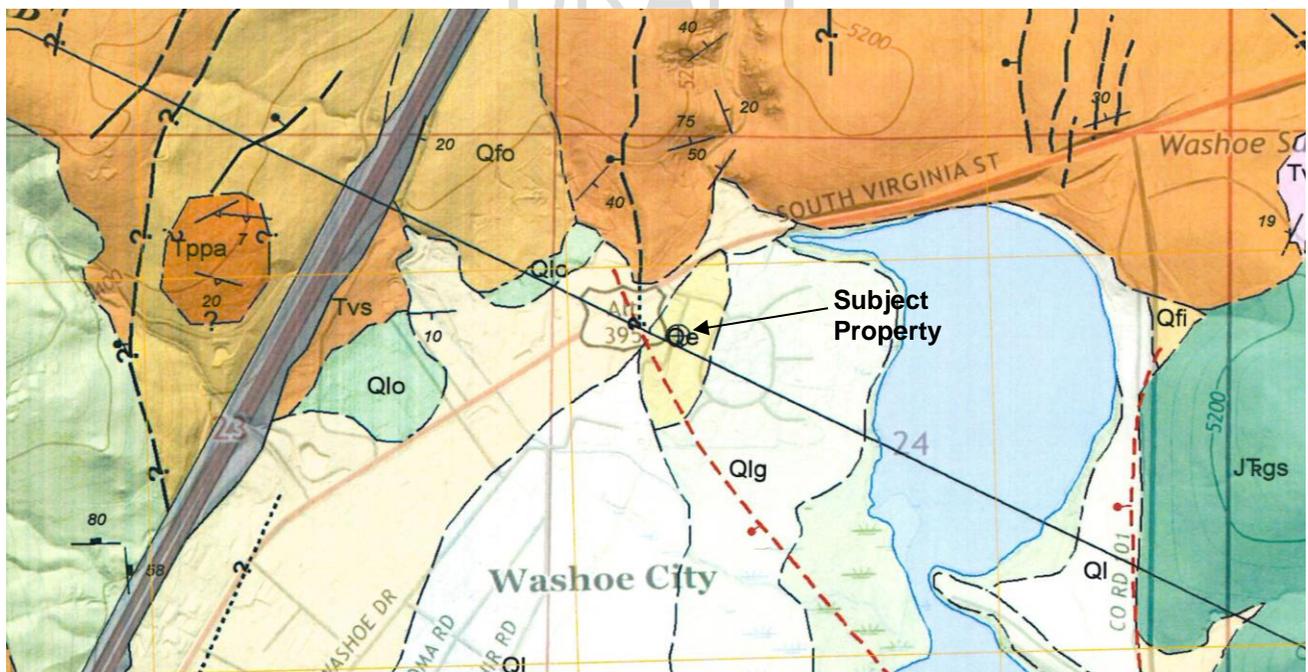


Figure 2: Excerpt of Geologic Map of Washoe Quadrangle

## 6.1 GEOLOGIC PROFILE ENCOUNTERED

The geologic profile is complex and reflects the multitude of geomorphic processes that have impacted this site. The uppermost soils encountered throughout this site are classified as either clayey sands (**SC**) or silty, clayey sands (**SC-SM**) exhibiting low plasticity characteristics. Below a depth of 4 to 5 feet, several different soil types were encountered depending on the location within the subject property. Toward the northwest portion of the property, near US 395, the soil profile contains increased clay fines, being predominantly clayey sands (**SC**) to the depth of exploration. Based on SPT blow counts, the relative density of this soil profile is loose to medium dense.

Toward the northeastern portion of property, the soil profile generally has an increased granular soil content with a denser relative density. Non-plastic silty sands (**SM**) were encountered from a depth of 4 to 11.5 feet exhibiting a medium dense relative density. Below 11.5 feet, clayey sands (**SC**) were encountered to the depth of exploration.

## 6.1 GROUNDWATER

Groundwater was encountered within the exploration locations ranging in depth from 6 to 7 ½ feet below existing grade.

DRAFT

## 7.0 SEISMICALLY RELATED GEOLOGIC HAZARDS

### 7.1 FAULTING

The Western United States is a region of moderate to intense seismicity related movement of the crustal masses (plate tectonics). The most active regions outside of Alaska are along the San Andreas Fault zone of western California and the Wasatch Front in Salt Lake City.



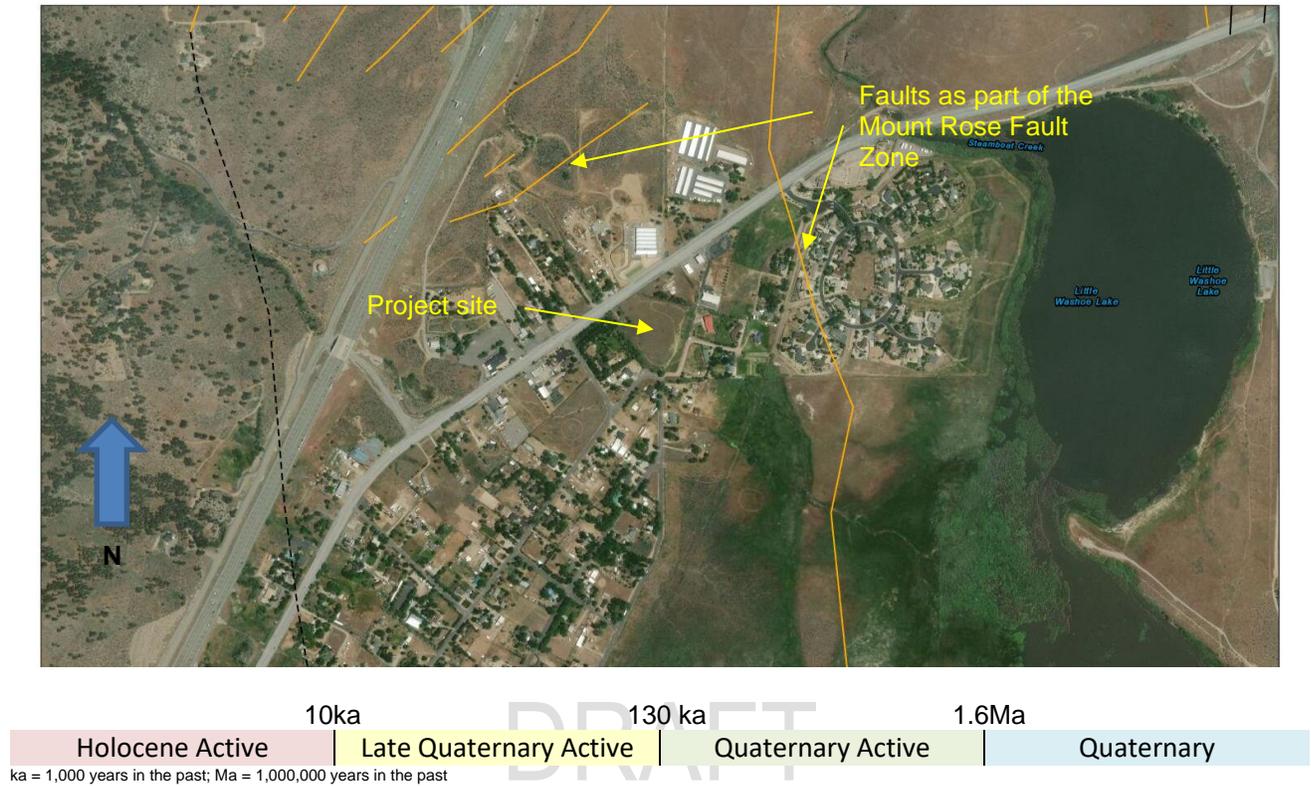
Figure 3: Overview Map Showing the Great Basin  
(N.T.S)

The Wasatch Front in Salt Lake City, Utah, forms the eastern boundary of the Basin and Range physiographic province, and the eastern form of the Sierra Nevada Mountains, which is the western margin of the province. The subject site is located northwest of the Pah Rah Range and east of the Sierra Nevada.

To determine the location of mapped earthquake faulting trending through or near the project site, a review of the following published information was completed:

- 1) USGS Website: *Earthquake Hazards Program Quaternary Faults in Google Earth* (refer to Figure 4);
- 2) The Nevada Bureau of Mines (NBMG) Interactive Fault Map (<https://gisweb.unr.edu/QuaternaryFaults/>).

U.S. Geological Survey Quaternary Faults



**Figure 4: Excerpt of the Fault Map and Activity Timeline**

Quaternary earthquake fault evaluation criterion has been formulated by a professional committee for the State of Nevada Seismic Safety Council, 2006. Faults that have shown movement more recently (e.g. Holocene Active) pose a more significant potential for surface rupture hazard. Faults with demonstrable movement in the past 1.6 million years are considered to be Late Quaternary-active faults or Quaternary faults.

No mapped faults traverse the proposed project site. However, the subject property is surrounded by mapped fault traces located less than ½ mile east and ½ mile north of the site. The latest fault ruptures that have been mapped along these faults is less than 15 Ka<sup>2</sup> and are considered Holocene Active. These faults are part of the Mount Rose Fault zone, which is a major fault structure that lies at the base of Carson Range extending from near Minden, Nevada to the North Reno Area.

## 7.2 LIQUEFACTION

Liquefaction is defined as a nearly complete loss of soil shear strength occurring during an earthquake, as cyclic shear stresses generate excessive pore water pressure between the soil grains. Soil liquefaction susceptibility depends on several factors including subsurface soil profile, ground water table, relative density, ground acceleration, and duration of shaking.

<sup>2</sup> Ka=1,000 years

Soil types most susceptible to liquefaction include loose to medium dense cohesionless sands, soft to stiff non-plastic to low plastic silts, or any combination of silt-sand mixtures lying below the groundwater table. Liquefaction is generally limited to depths of 50 feet or less below the existing ground surface.

Because of shallow groundwater conditions and presence of medium dense silty sands below the groundwater table, an analysis of soil liquefaction potential was completed in accordance with 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils; and subsequent updated recommendations by Idriss I.M. and Boulanger R.W. (2006). The primary updated recommendations include modifications to the empirical equations that determine the stress reduction coefficient ( $r_d$ ) and overburden correction factor ( $K_\delta$ ). Other revisions include the magnitude scaling factor (MSF) and cyclic resistance ratio (CRR). Each of these recommended changes were incorporated in our analysis. The primary factors to evaluate soil liquefaction potential are presented in Sections 7.2.1 to 7.2.9

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### **7.2.1 STRESS REDUCTION FACTOR ( $R_d$ )**

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The stress reduction factor coefficient is a parameter that describes the ratio of cyclic stresses of a flexible soil column to the cyclic stresses for a rigid soil column. The NCEER workshop guidelines are based on the stress reduction factor determined by an average curve for a range of earthquake ground motions and soil profiles as a function with depth. The coefficient has a maximum value of 1.0 and decreases with soil depth. The revised equation recommended by Idriss and Boulanger is a function of soil depth and earthquake magnitude instead of an average value.

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### **7.2.2 CYCLIC RESISTANCE RATIO (CRR)**

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The CRR is based on a relationship between the cyclic stress ratio causing liquefaction and  $(N_1)_{60}$  values for a  $M_w$  7.5 earthquake (Seed et al, 1982). Soils with fines content  $>5\%$  have an increased resistance to soil liquefaction. A graph was developed showing the relationship between the cyclic stress ratio and  $(N_1)_{60}$  values that show boundaries of non-liquefiable/liquefiable soils represented by percent fines curves. Since the NCEER workshop, several investigators including Cetin et al (2000) have re-examined and expanded the SPT case database. The original database included 125 cases of liquefaction/no-liquefaction from 19 earthquakes. Cetin included an additional 67 cases of liquefaction/no-liquefaction from 12 earthquakes. Several of the additional cases showed soil liquefaction within non-liquefiable zones that are shown on the graph produced by the NCEER workshop. Based on this information, the fines content curves were adjusted to reflect the new data sets. Idriss and Boulanger subsequently developed new empirical equations to determine CRR based on these revised curves.

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### **7.2.3 OVERBURDEN CORRECTION FACTOR ( $K_\Delta$ )**

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The overburden correction factor accounts for the effect of overburden stresses on CRR. This factor is a function of relative density and overburden pressure. The revised equation recommended by Idriss and Boulanger provides a direct correlation between corrected SPT blow counts and relative density. Idriss and Boulanger also recommend that  $K_\delta$  is  $\leq 1$ .

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### **7.2.4 PROBABLE MAGNITUDE OF THE DESIGN EARTHQUAKE**

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The dominant moment magnitude earthquake is from the Mount Rose Fault Zone with an earthquake moment magnitude ( $M_w$ ) of 6.85. Earthquake moment magnitude is based on an earthquake deaggregation analysis completed for the site (Unified Hazard Tool, 2014).

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### **7.2.5 ESTIMATE OF THE MAXIMUM HORIZONTAL GROUND ACCELERATION**

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As required by IBC (2018), the minimum horizontal ground acceleration (peak) to use for design should have a 2 percent probability of being exceeded for a 50-year period. This horizontal ground acceleration is 1.0g and was obtained from the Seismic Parameters provided in Section 8.0. This is an exceptional high ground acceleration value and reflects the site location in respect to the Mount Rose Fault Zone.

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### **7.2.6 GROUNDWATER LEVEL**

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Groundwater was encountered ranging from 6 to 7 ½ feet below the existing ground surface. Soil liquefaction analysis was completed based on a groundwater depth of 6 feet.

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### **7.2.7 SOIL PROFILE INDEX PROPERTIES**

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Soil profile index properties include particle sizing (percent by dry weight exceeding the #200 sieve) and plasticity index properties. Particle sizing is used to correct blow counts for soil liquefaction analysis, while plasticity index is used to determine if the soil is susceptible to liquefaction. Soils containing plastic fines will have a higher resistance to soil liquefaction than clean sands.

Boulanger (2006) recommends that liquefaction be reserved for soils that exhibit “sand-like” behavior and depending on plasticity properties the term “clay-like” behavior be used for soils not prone to soil liquefaction. The plastic index threshold boundary for fine-grained soil layers exhibiting “clay-like” soil behavior is a plastic index  $\geq 7$ . In Boring B-1, soils predominantly are classified as possessing “clay-like” soil behavior.

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### **7.2.8 FIELD BLOW COUNTS (SPT)**

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SPT blow counts are the standard in determining the subsurface soil profile and soil density for liquefaction analysis. SPT blow counts are based on  $(N_1)_{60}$  values, which represents the blow count corrected for effective overburden pressures at a hammer efficiency of 60 percent. The correction factor for overburden pressure ( $C_n$ ) is given in AASHTO (2010) as  $C_n = 0.77 \log_{10} (40 / \delta'_{vo})$ , where  $\delta'_{vo}$  is in ksf.

The hammer efficiency is assumed at 80 percent. Therefore, a correction factor of 1.33 was applied to the SPT blow count to normalize them to a hammer efficiency of 60 percent. Based on the recommendations from the NCEER workshop, a correction factor of 1.2 was also applied when using a sampler without liners.

Idriss and Boulanger recommend that when determining the overburden correction factor ( $K_\delta$ ), the maximum  $(N_1)_{60}$  value should be 37 because higher values are not compatible with their equation. Using this maximum  $(N_1)_{60}$  value will not increase the potential for soil liquefaction, as  $(N_1)_{60}$  values above 30 generally signify non-liquefiable soils.

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### **7.2.9 SOIL LIQUEFACTION RESULTS**

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Based on the calculated FOS values, the overall potential for soil liquefaction is low, mostly due to the clay content of the native soils. However, a potential for soil liquefaction exists in Boring B-1 at a depth between 15 to 18 feet bgs. This soil horizon contained sporadic 1 to 2-inch-thick lenses of poorly graded sand that may be susceptible to soil liquefaction. However, due to the limited thickness of these soil lenses and overburden pressures, the settlement due to soil liquefaction is considered negligible.

Soil liquefaction results are presented in Appendix C.

## 8.0 SEISMIC DESIGN PARAMETERS

Seismic design parameters are based on the provisions listed under the 2018 IBC. A default Site Class D can be used for the project design. Table 2 (Seismic Design Parameters (2018 IBC)) provides a summary of seismic design parameters for a Site Classification of D (Default). A copy of the Seismic Hazards Report is provided in Appendix C.

Approximate Latitude of Site	39.325293°
Approximate Longitude of Site	-119.808058°
Site Class Selected for this Site	D <sub>Default</sub>
Risk Category	IV
S <sub>s</sub> Spectral Response Acceleration at Short Period (0.2 sec.)	2.183
S <sub>1</sub> Spectral Response Acceleration at 1-second Period	0.769
F <sub>a</sub> Site amplification factor at Short Period (0.2 sec.)	1.0
F <sub>v</sub> Site amplification factor at 1-second Period	1.7
S <sub>DS</sub> Design Spectral Response Acceleration at Short Period (0.2 sec.)	1.455
S <sub>D1</sub> Design Spectral Response Acceleration at 1-second Period	0.872
S <sub>MS</sub> Site-modified spectral acceleration value at Short Period (0.2 sec.)	2.183
S <sub>M1</sub> Site-modified spectral acceleration value at 1-second Period	1.31
T <sub>L</sub> Long-period transition period in seconds	6
PGA MCE <sub>G</sub> peak ground acceleration	0.942
PGAM Site modified peak ground acceleration	1.037
<b>NOTES:</b>	
1. A default Site Classification D may be used if it is known that the site is not located within a Site Class E or F.	
2. Per ASCE 7-16 Section 11.4.3, F <sub>a</sub> shall not be less than 1.2.	
3. See requirements for Site Specific Ground Motions in Section 11.4.8 of ASCE 7.	
4. Reference <a href="https://seismicmaps.org/">https://seismicmaps.org/</a>	

## 9.0 DISCUSSION AND RECOMMENDATIONS

It is our opinion that the subject property is amenable to development with the following comments:

- The preferred building location is within the northeast portion of the site, as shown on the Field Exploration Location Map (Plate A-1). Based on our current exploration, this location overlies denser, more granular soils that would provide better support capabilities for the structure. Additional exploration to define this area will be completed with subsequent phases of this investigation.
- The potential for liquefaction at the site was assessed as part of this preliminary exploration is considered very low with calculated settlements of less than 0.1 inches.
- Based on the site topography, it is assumed that fill thicknesses will be 4 feet or less. Near surface soils are granular exhibiting low plasticity characteristics and can be used as structural fill.
- The groundwater table is high, ranging from 6 to 7.5 feet bgs. Because of the high groundwater table, cut areas limited in depth, especially in the building areas. Trenching for underground utilities may require dewatering and trench wall instabilities are a potential. Drain rock bedding will likely be required encapsulated with a geotextile.
- Deeper cut areas may experience unstable soils due to higher soil moisture contents. Soils may have to be removed and replaced with stabilizing fill and a geotextile.
- Based on the percolation test results, the most suitable location for the leach field is test pit TP-2. Special design considerations will need to be taken to comply with groundwater offsets. In addition, the upper 4 feet of the soil profile within the limits of Test Pit TP-2 will need to be removed and replaced with engineered fill. Additional percolation testing and design considerations will be provided in a later report.

Sincerely,

### CONSTRUCTION MATERIALS ENGINEERS, INC.



*Stella Hardy*  
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Geotechnical Project Manager  
[shardy@cmenv.com](mailto:shardy@cmenv.com)  
Direct: 775-737-7569

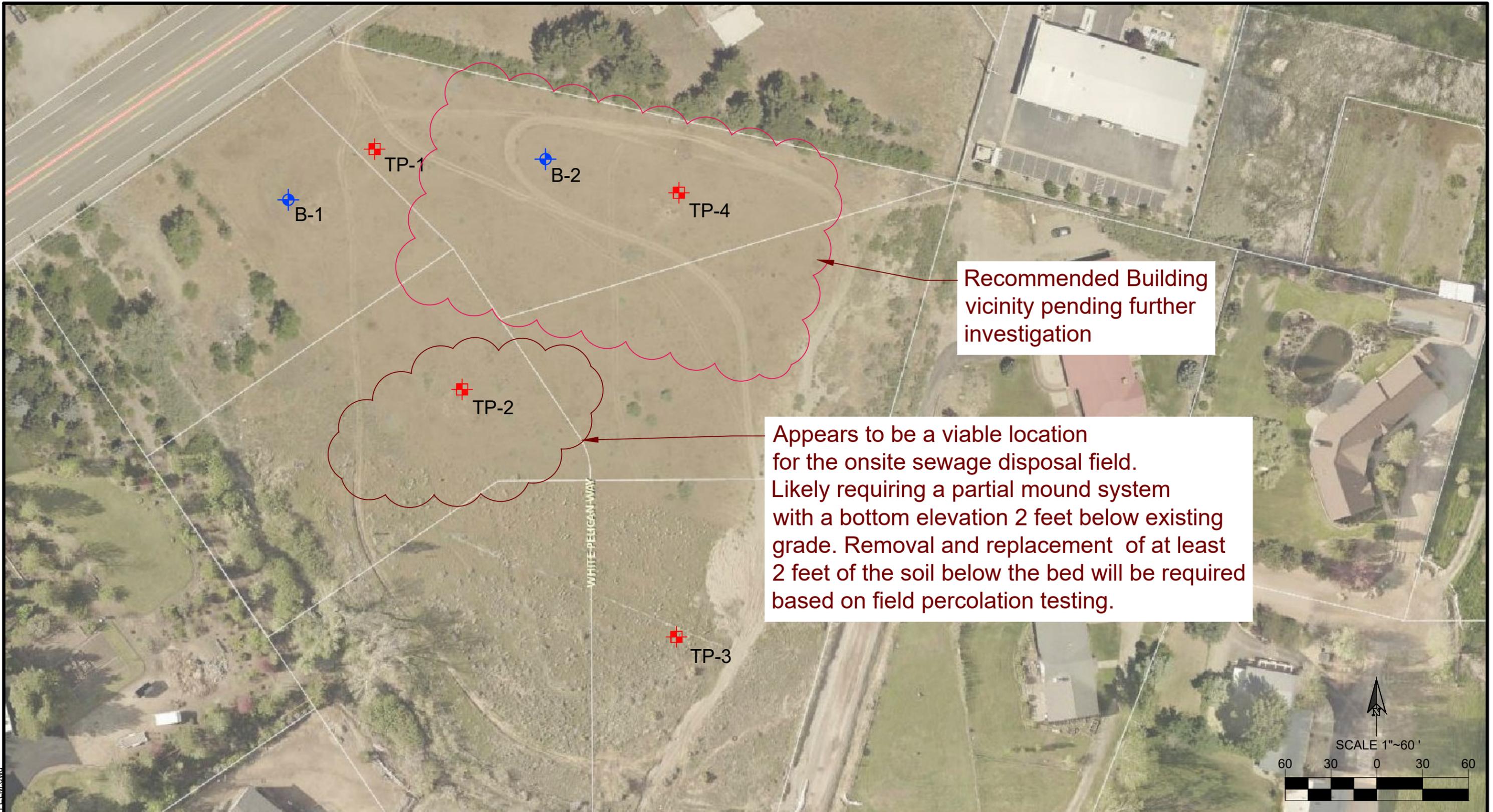
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#### Attachments:

Plate A-1	Exploration Location Map
Plate A-2	Exploration Logs (Test Pit and Boring)
Plate A-3	Soil Classification Chart
Plate B-1	Grainsize Analysis
Plate C-1	Liquefaction Analysis Summary
Plate D-1	Percolation Test Results

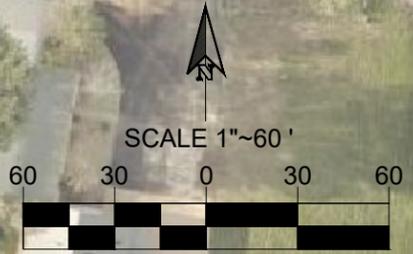


## **APPENDIX A**



Recommended Building vicinity pending further investigation

Appears to be a viable location for the onsite sewage disposal field. Likely requiring a partial mound system with a bottom elevation 2 feet below existing grade. Removal and replacement of at least 2 feet of the soil below the bed will be required based on field percolation testing.



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**CME CONSTRUCTION MATERIALS ENGINEERS INC.**

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Reno, NV 89511

POGGEMEYER DESIGN GROUP  
TMFD CONSOLIDATION  
EXPLORATION LOCATION MAP  
WASHOE VALLEY, NEVADA

PROJECT NO.: 2556

DATE: 2/24/2020

**LEGEND**

- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE BORING LOCATION

PLATE

**A-1**

# LOG OF TEST BORING NO. B-1

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION  
**PROJECT NO.** 2556 **DATE** 2/20/2020  
**CLIENT** POGGEMEYER **SURFACE ELEVATION** 5065 (FT)  
**LOGGED BY** ANH **ELEVATION METHOD** GOOGLE EARTH  
**LOCATION** NORTH WEST OF PROPERTY

**DRILLING CONTRACTOR** PC EXPLORATION  
**DRILL RIG** GEFCO SS15  
**BORING TYPE** HSA/MUD ROTARY  
**HAMMER TYPE** AUTOMATIC 140 lbs  
**BACKFILL METHOD** BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks				
5065	SL	MOIST		SC	0.0-24.0 CLAYEY SAND: mostly fine to medium sand; some medium plasticity fines; dark brown.	0																	
5062.5							S	1A	14	34	12												
5060																							
5057.5	MOIST			SC	NOTE: Switch to Mud Rotary drilling at 7.5 FT following sample 1C.	7.5		S	1C	3	10	18	31.9	33	16				17.2				
5055																							
5052.5																							
5050	WET			SC	NOTE: Color change to greenish brown.	12.5		S	1E	6	9	7	27.0	31	8				28.5				
					NOTE: Sporadic 1 to 2 inch thick lenses or poorly graded sand.	15				5													

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

PLATE NO.: A-2a

DEPTH	HOUR	DATE
7½	9:00 AM	2/20/20

A - Drill Cuttings B - Bulk Sample  
R - 3" O.D. 2.42" I.D. Ring Sample  
S - 2" O.D. 1.38" I.D. Sampler  
U - 3" O.D. 2.42" I.D. Tube Sample  
T - 3" O.D. Thin-Walled Shelby Tube

Elevation on boring log is approximate.  
All blow counts are uncorrected.  
NE = not encountered.



# LOG OF TEST BORING NO. B-1

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION  
**PROJECT NO.** 2556 **DATE** 2/20/2020  
**CLIENT** POGGEMEYER **SURFACE ELEVATION** 5065 (FT)  
**LOGGED BY** ANH **ELEVATION METHOD** GOOGLE EARTH  
**LOCATION** NORTH WEST OF PROPERTY

**DRILLING CONTRACTOR** PC EXPLORATION  
**DRILL RIG** GEFCO SS15  
**BORING TYPE** HSA/MUD ROTARY  
**HAMMER TYPE** AUTOMATIC 140 lbs  
**BACKFILL METHOD** BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks		
5047.5	WET			SC	NOTE: Increase fine sand content.	17.5		S	1F	6	12	18									
5045						20		S	1G	4	10	18	47.4	32	14			26.7			
5042.5				SC		22.5		S	1H	5	18	10									
5040				SC	24.0-28.0 CLAYEY SAND: mostly fine sand; some low plasticity fines; strong brown.	25		S	1I	9	33	10									
5037.5		WET					27.5		S	1J	14	33	10								
					SP-SC	28.0-33.0 POORLY GRADED SAND WITH CLAY: mostly fine to coarse sand; few low plasticity fines; brown.	30		S	1K	13	38	8								

**GROUNDWATER**

DEPTH	HOUR	DATE
7½	9:00 AM	2/20/20

**SAMPLE TYPE**

A - Drill Cuttings    B - Bulk Sample  
 R - 3" O.D. 2.42" I.D. Ring Sample  
 S - 2" O.D. 1.38" I.D. Sampler  
 U - 3" O.D. 2.42" I.D. Tube Sample  
 T - 3" O.D. Thin-Walled Shelby Tube

**NOTES**

Elevation on boring log is approximate.  
 All blow counts are uncorrected.  
 NE = not encountered.

**PLATE NO.:** A-2a



# LOG OF TEST BORING NO. B-1

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION  
**PROJECT NO.** 2556 **DATE** 2/20/2020 **DRILLING CONTRACTOR** PC EXPLORATION  
**CLIENT** POGGEMEYER **SURFACE ELEVATION** 5065 (FT) **DRILL RIG** GEFCO SS15  
**LOGGED BY** ANH **ELEVATION METHOD** GOOGLE EARTH **BORING TYPE** HSA/MUD ROTARY  
**LOCATION** NORTH WEST OF PROPERTY **HAMMER TYPE** AUTOMATIC 140 lbs  
**BACKFILL METHOD** BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks			
5032.5	WET				33.0-41.5 CLAYEY SAND; mostly fine to coarse sand; little low plasticity fines; brown.	32.5																
5030				SC		35	S	1L	15	19	35	12										
5027.5							37.5															
5025							40	S	1M	10	20	40	12									
5022.5					TERMINATED AT 41.5 BGS. FREE WATER ENCOUNTERED AT 7.5 FT.	42.5																
5020						45																

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

PLATE NO.: A-2a

DEPTH	HOUR	DATE
7½	9:00 AM	2/20/20

A - Drill Cuttings    B - Bulk Sample  
 R - 3" O.D. 2.42" I.D. Ring Sample  
 S - 2" O.D. 1.38" I.D. Sampler  
 U - 3" O.D. 2.42" I.D. Tube Sample  
 T - 3" O.D. Thin-Walled Shelby Tube

Elevation on boring log is approximate.  
 All blow counts are uncorrected.  
 NE = not encountered.



# LOG OF TEST BORING NO. B-2

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION  
**PROJECT NO.** 2556 **DATE** 2/20/2020  
**CLIENT** POGGEMEYER **SURFACE ELEVATION** 5062 (FT)  
**LOGGED BY** ANH **ELEVATION METHOD** GOOGLE EARTH  
**LOCATION** NORTH EAST OF PROPERTY

**DRILLING CONTRACTOR** PC EXPLORATION  
**DRILL RIG** GEFCO SS15  
**BORING TYPE** HSA/MUD ROTARY  
**HAMMER TYPE** AUTOMATIC 140 lbs  
**BACKFILL METHOD** BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks			
5062	SL LOW	SL LOW		SC	0.0-4.0 <u>CLAYEY SAND</u> : mostly fine to medium sand; some low to medium plasticity fines; dark brown.	0																
5059.5				2.5		S	2A	4	11	28	12											
	MOIST			SM	4.0-11.5 <u>SILTY SAND</u> : mostly fine to coarse sand; few nonplastic fines; brown.	5	S	2B	7	9	21	8										
5057				7.5		S	2C	7	11	22	10	12.3	NV	NP		14.6						
5054.5				10		S	2D	7	15	18	8	9										
5052	WET			SM	NOTE: Continuous sampling beginning at 7.5 FT BGS.		S	2E	12	28	18	13.4	NV	NP		13.5						
				12.5		S	2F	14	29	14	16	9										
						S	2G	14	35	14	6											
5049.5				15		S		21	11													
5047				SC	11.5-16.5 <u>CLAYEY SAND</u> : mostly fine to coarse sand; little low plasticity fines; brown.																	

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

**PLATE NO.: A-2b**

DEPTH	HOUR	DATE
8.5	1:00 PM	2/20/20

A - Drill Cuttings B - Bulk Sample  
R - 3" O.D. 2.42" I.D. Ring Sample  
S - 2" O.D. 1.38" I.D. Sampler  
U - 3" O.D. 2.42" I.D. Tube Sample  
T - 3" O.D. Thin-Walled Shelby Tube

Elevation on boring log is approximate.  
All blow counts are uncorrected.  
NE = not encountered.



# LOG OF TEST BORING NO. B-2

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION  
**PROJECT NO.** 2556 **DATE** 2/20/2020 **DRILLING CONTRACTOR** PC EXPLORATION  
**CLIENT** POGGEMEYER **SURFACE ELEVATION** 5062 (FT) **DRILL RIG** GEFCO SS15  
**LOGGED BY** ANH **ELEVATION METHOD** GOOGLE EARTH **BORING TYPE** HSA/MUD ROTARY  
**LOCATION** NORTH EAST OF PROPERTY **HAMMER TYPE** AUTOMATIC 140 lbs  
**BACKFILL METHOD** BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
5044.5					TERMINATED AT 16.5 BGS. FREE WATER ENCOUNTERED AT 8.5 FT.	17.5		S	2H	14	30	48							
5042						20				16									
5039.5						22.5													
5037						25													
5034.5						27.5													
5032						30													

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

**PLATE NO.:** A-2b

DEPTH	HOUR	DATE
8.5	1:00 PM	2/20/20

A - Drill Cuttings   B - Bulk Sample  
 R - 3" O.D. 2.42" I.D. Ring Sample  
 S - 2" O.D. 1.38" I.D. Sampler  
 U - 3" O.D. 2.42" I.D. Tube Sample  
 T - 3" O.D. Thin-Walled Shelby Tube

Elevation on boring log is approximate.  
 All blow counts are uncorrected.  
 NE = not encountered.



# LOG OF TEST PIT NO. TP-1

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION

**EQUIPMENT TYPE** DEERE 310SG

**PROJECT NO.** 2556

**DATE** 2/19/20

**BUCKET WIDTH** 24 INCHES

**CLIENT** POGGEMEYER

**SURFACE ELEVATION** 5064 (FT)

**SURFACE LENGTH** 8 (FT)

**LOGGED BY:** ANH

**ELEVATION METHOD** GOOGLE EARTH

**SURFACE WIDTH** 2 (FT)

**LOCATION** NORTH END OF PARCEL

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5062.5	SC	[Hatched Box]	MOIST	0.0-3.0 <b>CLAYEY SAND</b> : mostly fine to coarse sand; little medium plasticity fines; dark brown.	0	B	1A	27.1	27	11	11.8		
5060	SC		MOIST	3.0-10.0 <b>CLAYEY SAND</b> : mostly fine to coarse sand; some low plasticity fines; green to brown.	2.5	B	1B						
5057.5				NOTE: Seepage observed on sidewall @ 7.0 FT BGS.	7.5								
5052.5				TEST PIT TERMINATED AT 10 FEET BGS. FREE WATER ENCOUNTERED @ 10 FEET, SEEPAGE OBSERVED @ 7 FEET	10								
5050					12.5								
					15								

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

PLATE NO.: A-2c

DEPTH	HOUR	DATE
7'	8:30 AM	2/19/20

B - Bulk Sample

Elevation on test pit log is approximate.  
 NE = not encountered  
 bgs = Below Existing Ground Surface



# LOG OF TEST PIT NO. TP-2

<b>PROJECT</b> TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION	<b>EQUIPMENT TYPE</b> DEERE 310SG
<b>PROJECT NO.</b> 2556	<b>DATE</b> 2/19/20
<b>CLIENT</b> POGGEMEYER	<b>BUCKET WIDTH</b> 24 INCHES
<b>LOGGED BY:</b> ANH	<b>SURFACE ELEVATION</b> 5061 (FT)
<b>LOCATION</b> CENTER OF PARCEL	<b>SURFACE LENGTH</b> 7 (FT)
	<b>SURFACE WIDTH</b> 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC-SM SC-SM		MOIST	0.0-4.0 <u>SILTY, CLAYEY SAND</u> : mostly fine to medium sand; little low plasticity fines; dark brown.	0		B	2A	23.3	23	7	10.9	
5057.5													
5055	SP-SC		MOIST	3.0-8.5 <u>POORLY GRADED SAND WITH CLAY</u> : mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.	5		B	2B					
5052.5					NOTE: Water seepage from sidewalls and 7.0 FT BGS.								
5050				TEST PIT TERMINATED AT 8½ FEET BGS. FREE WATER ENCOUNTERED AT 8½ FEET, SEEPAGE OBSERVED AT 7 FEET	10								
5047.5					12.5								
					15								

**GROUNDWATER**

DEPTH	HOUR	DATE
7'	9:00 AM	2/19/20

**SAMPLE TYPE**

B - Bulk Sample

**NOTES**

Elevation on test pit log is approximate.  
 NE = not encountered  
 bgs = Below Existing Ground Surface

PLATE NO.: A-2d



# LOG OF TEST PIT NO. TP-3

**PROJECT** TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION      **EQUIPMENT TYPE** DEERE 310SG  
**PROJECT NO.** 2556      **DATE** 2/19/20      **BUCKET WIDTH** 24 INCHES  
**CLIENT** POGGEMEYER      **SURFACE ELEVATION** 5060 (FT)      **SURFACE LENGTH** 8 (FT)  
**LOGGED BY:** ANH      **ELEVATION METHOD** GOOGLE EARTH      **SURFACE WIDTH** 2 (FT)  
**LOCATION** SOUTHERN END OF PARCEL

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	% - 200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC		MOIST	0.0-3.0 <b>CLAYEY SAND</b> : mostly fine to medium sand; some medium plasticity fines; dark brown.	0	B	3A						
5057.5	SM		MOIST	3.0-7.0 <b>SILTY SAND</b> : mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.	2.5	B	3B						
5055				NOTE: Seepage observed along sidewall @ 6 FT BGS.	5								
5052.5				TEST PIT TERMINATED AT 7 FT BGS. FREE WATER ENCOUNTERED AT 7 FEET, SEEPAGE OBSERVED AT 6 FEET.	7.5								
5050					10								
5047.5					12.5								
5045					15								

**GROUNDWATER**

DEPTH	HOUR	DATE
6'	10:00 AM	2/19/20

**SAMPLE TYPE**

B - Bulk Sample

**NOTES**

Elevation on test pit log is approximate.  
 NE = not encountered  
 bgs = Below Existing Ground Surface

**PLATE NO.: A-2**



# LOG OF TEST PIT NO. TP-4

<b>PROJECT</b> TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION	<b>EQUIPMENT TYPE</b> DEERE 310SG
<b>PROJECT NO.</b> 2556	<b>DATE</b> 2/19/20
<b>CLIENT</b> POGGEMEYER	<b>BUCKET WIDTH</b> 24 INCHES
<b>LOGGED BY:</b> ANH	<b>SURFACE ELEVATION</b> 5061 (FT)
<b>LOCATION</b> EAST END OF PARCEL	<b>SURFACE LENGTH</b> 8 (FT)
	<b>ELEVATION METHOD</b> GOOGLE EARTH
	<b>SURFACE WIDTH</b> 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC	[Hatched Pattern]	MOIST	0.0-2.5 <u>CLAYEY SAND</u> : mostly fine to medium sand; some medium plasticity fines; dark brown.	0	X	B	2A					
5057.5	SC	[Hatched Pattern]	MOIST	2.5-5.0 <u>CLAYEY SAND</u> : mostly fine to medium sand; some low plasticity fines; dark brown.	2.5								
5055	SM	[Dotted Pattern]	MOIST	5.0-8.5 <u>SILTY SAND</u> : mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.	5	X	B	2B					
5052.5				NOTE: Seepage observed on sidewall @ 7 FT BGS.	7.5	▽							
5050				TEST PIT TERMINATED AT 8.0 FT BGS. FREE WATER ENCOUNTERED AT 8 FEET, SEEPAGE OBSERVED AT 7 FEET	10								
5047.5					12.5								
					15								

**GROUNDWATER**

**SAMPLE TYPE**

**NOTES**

PLATE NO.: A-2e

DEPTH	HOUR	DATE
7	8:30 AM	2/21/20

B - Bulk Sample

Elevation on test pit log is approximate.  
 NE = not encountered  
 bgs = Below Existing  
 Ground Surface



SOIL CLASSIFICATION CHART					
MAJOR DIVISIONS			SYMBOLS		TYPICAL CLASSIFICATION NAMES
			GRAPH	LETTER	
Course grained soils	Gravel and gravelly soils	Clean gravels		GW	Well-graded gravels, gravel-sand mixtures, few or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, few or no fines
		Gravels with fines		GM	Silty gravels, gravel-sand-silt mixtures
	Sand and sandy soils	Clean sands		SW	Well-graded sands, gravelly sands, few or no fines
				SP	Poorly-graded sands, gravelly sands, few or no fines
		Sands with fines		SM	Silty sands, sand-silt mixtures
Fine grained soils	Silt and clays	Liquid Limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts and organic silt-clays of low plasticity
	Liquid Limit greater than 50			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
				CH	Inorganic clays of medium to high plasticity
				OH	Organic clays of medium to high plasticity
			PT	Peat or other highly organic soils	

**NOTES:**  
1. Dual classifications may occur (e.g. SP-SM, CL-ML, GP-GC)

PARTICLE ANGULARITY	
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular, but have rounded edges
Subrounded	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

PARTICLE SHAPE	
Flat	Particles with width/thickness > 3
Elongated	Particles with length/width > 3
Flat and Elongated	Particles meet criteria for both flat and elongated

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

CEMENTATION	
Weak	Crumbles or breaks with handling or light finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PARTICLE SIZE, Ps	
Boulders	Ps > 12"
Cobbles	3" < Ps ≤ 12"
Gravel	coarse $\frac{3}{4}" < Ps \leq 3"$
	fine $\frac{1}{4}" < Ps \leq \frac{3}{4}"$
Sand	coarse $\frac{1}{16}" < Ps \leq \frac{1}{8}"$
	medium $\frac{1}{64}" < Ps \leq \frac{1}{16}"$
	fine $\frac{1}{300}" < Ps \leq \frac{1}{64}"$
Fines	Ps ≤ $\frac{1}{300}"$

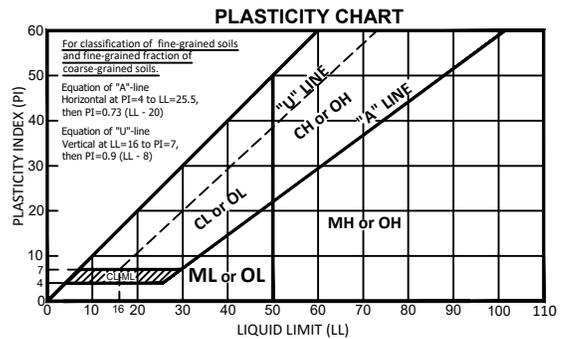
PERCENT OF SOIL, Pp	
Trace	Pp < 5%
Few	5 ≤ Pp ≤ 15%
Little	15 ≤ Pp ≤ 30%
Some	30 ≤ Pp ≤ 50%
Mostly	50 ≤ Pp ≤ 100%

**SOIL SAMPLE TYPES**

- B Bulk Sample
- S Standard Penetration Test (2.0" OD, 1.42" ID)
- U California Modified Sampler (3.0" OD, 2.42" ID)
- T Thin walled Shelby Tube (3.0" OD)
- R Rock Core

**GROUNDWATER SYMBOLS**

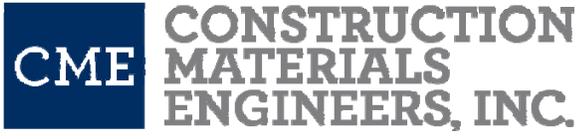
- Water level during drilling
- Water level after drilling



APPARENT DENSITY OF COHESIONLESS SOIL	
	SPT (1.4" ID) N <sub>60</sub>
Very Loose	< 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

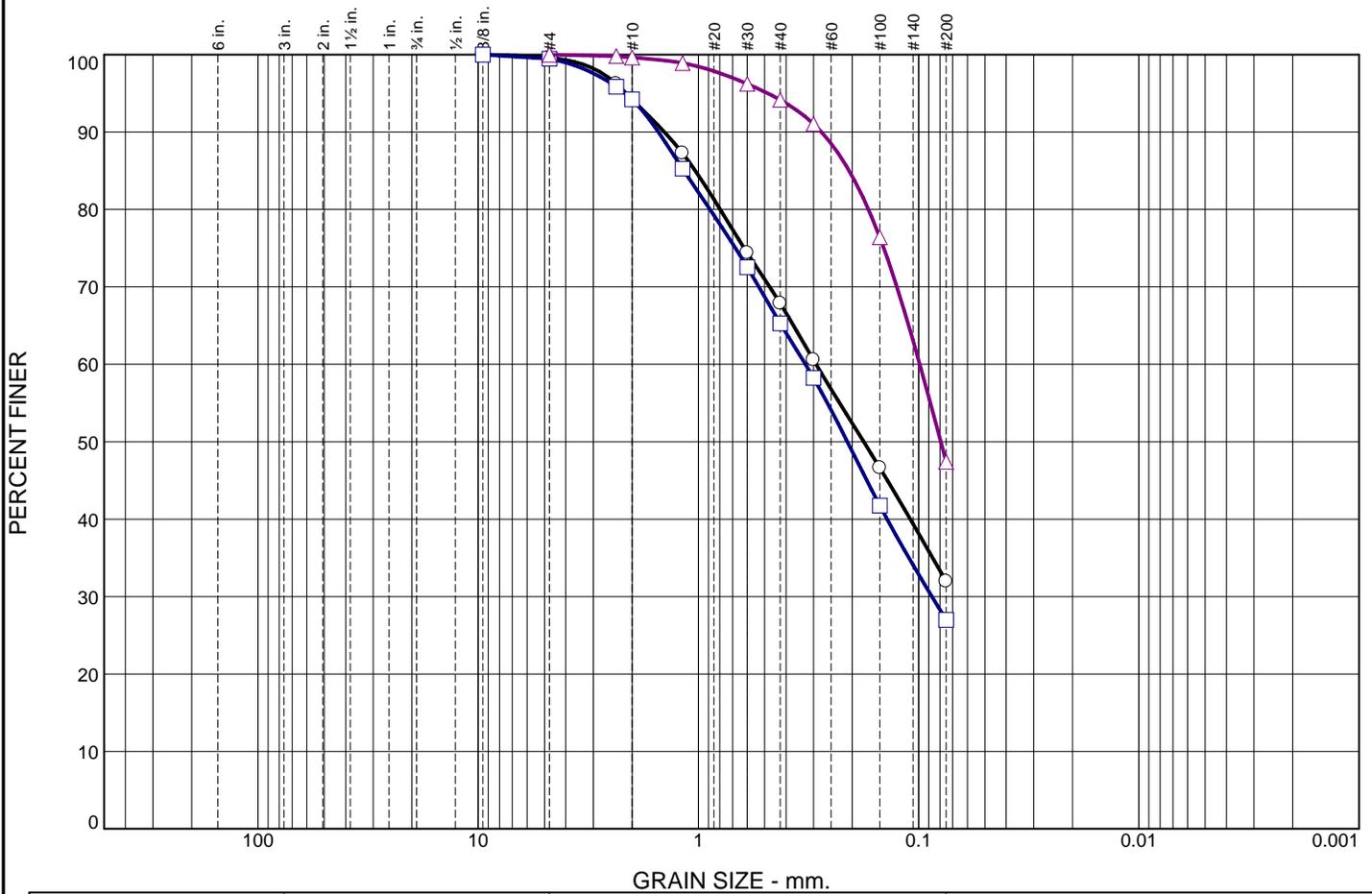
Based on 60% energy ratio (ER).  $N_{60} = N_{measured} * (ER/60)$   
California Modified Sampler can be corrected to SPT by multiplying by 0.62

CONSISTENCY OF COHESIVE SOIL			
	SPT (1.4" ID) N <sub>60</sub>	Unconfined Compressive Strength (psf)	Pocket Penetrometer (tsf)
Very Soft	0 - 1	< 500	< 0.25
Soft	2 - 4	500 - 1,000	0.25 - 0.5
Medium Stiff	5 - 8	1,000 - 2,000	0.5 - 1.0
Stiff	9 - 15	2,000 - 4,000	1.0 - 2.0
Very Stiff	16 - 30	4,000 - 8,000	2.0 - 4.0
Hard	31 - 60	8,000 - 16,000	> 4.0
Very Hard	> 60	> 16,000	



## **APPENDIX B**

# Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.4	5.4	26.3	36.0	31.9			
□	0.0	0.0	0.5	5.3	28.9	38.3	27.0			
△	0.0	0.0	0.0	0.4	5.5	46.7	47.4			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	33	17	1.0329	0.2920	0.1775					
□	31	23	1.1628	0.3263	0.2106	0.0870				
△	32	18	0.2066	0.0988	0.0793					

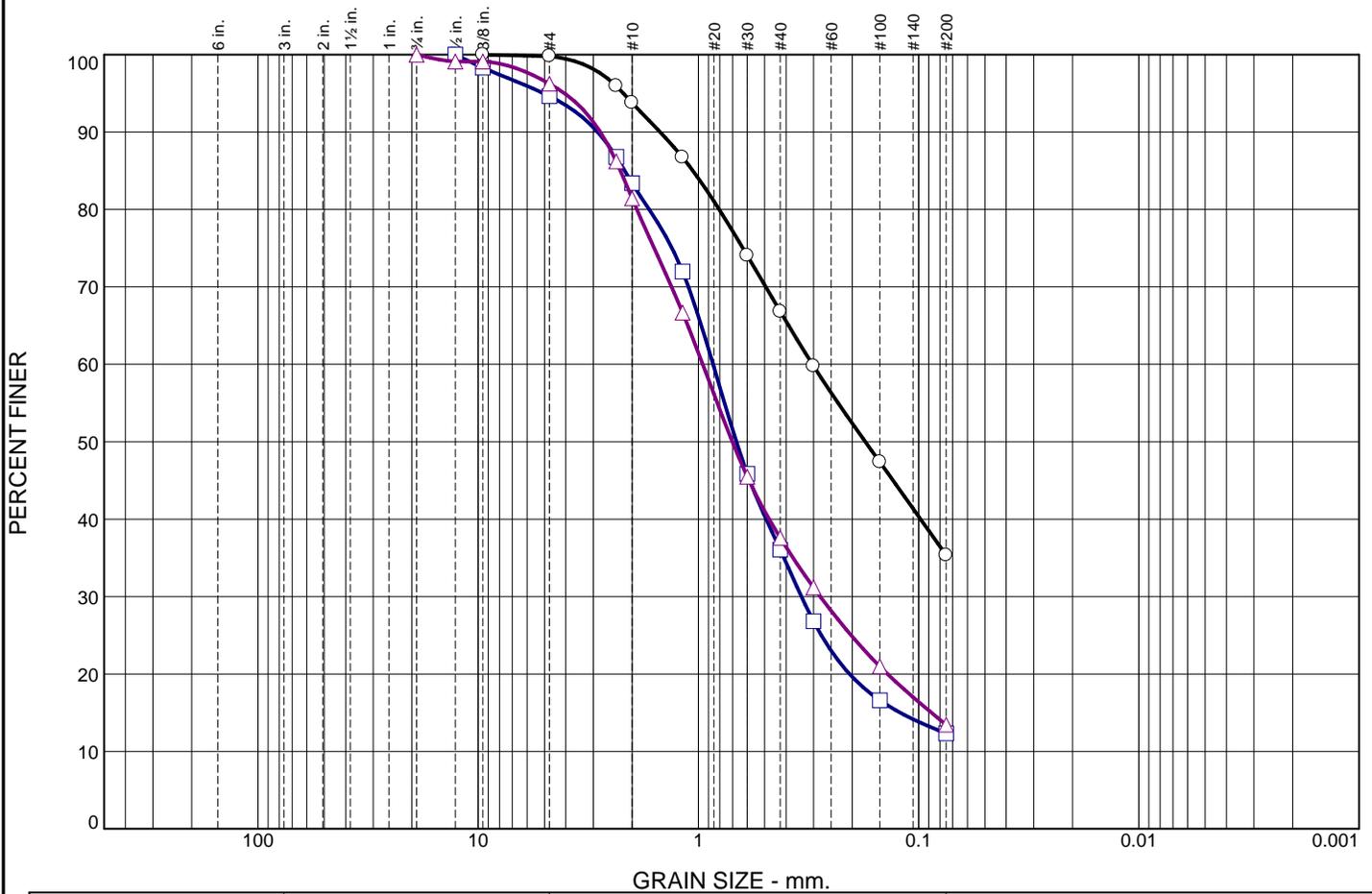
MATERIAL DESCRIPTION			TEST DATE	USCS	NM
○ Clayey Sand			2/25/20	SC	17.2
□ Clayey Sand			2/25/20	SC	28.5
△ Clayey Sand			2/25/20	SC	26.7

<b>Project No.</b> 2556 <b>Project:</b> TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION	<b>Client:</b> POGGEMEYER  <b>Source of Sample:</b> B-1 <b>Depth:</b> 7.5 <b>Sample Number:</b> 1C <b>Source of Sample:</b> B-1 <b>Depth:</b> 12.5 <b>Sample Number:</b> 1E <b>Source of Sample:</b> B-1 <b>Depth:</b> 17.5 <b>Sample Number:</b> 1G	<b>Remarks:</b>          <div style="text-align: right;"> <b>PLATE</b>      B-1a         </div>
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Tested By: MP      Checked By: AH



# Particle Size Distribution Report



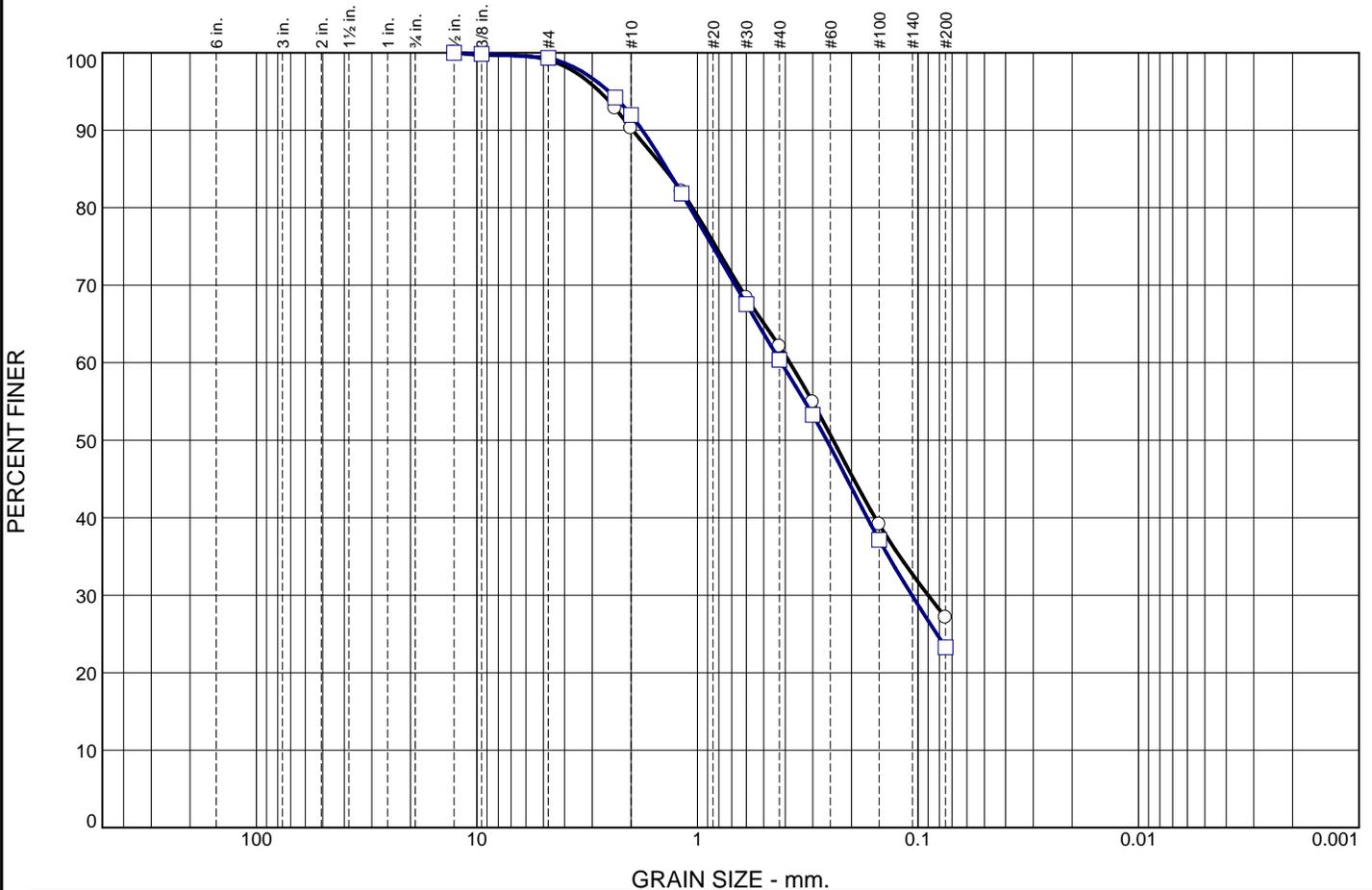
	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.2	6.0	27.0	31.5	35.3			
□	0.0	0.0	5.4	11.2	47.3	23.8	12.3			
△	0.0	0.0	3.8	14.8	43.8	24.2	13.4			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	36	19	1.0590	0.3033	0.1746					
□	NV	NP	2.1612	0.8578	0.6723	0.3404	0.1213			
△	NV	NP	2.2588	0.9558	0.7014	0.2797	0.0874			

MATERIAL DESCRIPTION			TEST DATE	USCS	NM
○ Clayey Sand			2/25/20	SC	22.9
□ Silty Sand			2/25/20	SM	14.6
△ Silty Sand			2/25/20	SM	13.5

<b>Project No.</b> 2556 <b>Client:</b> POGGEMEYER <b>Project:</b> TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION	<b>Remarks:</b>  
○ <b>Source of Sample:</b> B-1 <b>Depth:</b> 22.5 <b>Sample Number:</b> 1I □ <b>Source of Sample:</b> B-2 <b>Depth:</b> 7.5 <b>Sample Number:</b> 2C △ <b>Source of Sample:</b> B-2 <b>Depth:</b> 10.5 <b>Sample Number:</b> 2E	
	<b>PLATE</b> B-1b

Tested By: MP      Checked By: GM

# Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
<input type="radio"/>	0.0	0.0	0.9	8.8	28.2	35.0	27.1	
<input type="checkbox"/>	0.0	0.0	0.7	7.3	31.6	37.1	23.3	

	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>	27	16	1.4051	0.3810	0.2424	0.0899				
<input type="checkbox"/>	23	16	1.3717	0.4173	0.2592	0.1066				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
<input type="radio"/> Clayey Sand	2/25/20	SC	11.8
<input type="checkbox"/> Silty, Clayey Sand	2/25/20	SC-SM	10.9

<p><b>Project No.</b> 2556      <b>Client:</b> POGGEMEYER</p> <p><b>Project:</b> TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION</p> <p><input type="radio"/> <b>Source of Sample:</b> TP-1      <b>Depth:</b> 1      <b>Sample Number:</b> 1A</p> <p><input type="checkbox"/> <b>Source of Sample:</b> TP-2      <b>Depth:</b> 1      <b>Sample Number:</b> 2A</p>	<p><b>Remarks:</b></p>
<p><b>PLATE</b>      B-1c</p>	

**Tested By:** MP      **Checked By:** AH



## **APPENDIX C**

**LIQUEFACTION EVALUATION SUMMARY SHEET**

Project: Consolidated TMFD- Washoe Valley  
 Job No. 2556  
 Date 2/24/2020  
 Engineer RAR

**Earthquake and SPT Inputs:**

SPT ER =	80 %	Estimated Based on automatic hammer
EQ(M <sub>w</sub> )mag =	6.85 Mw	<a href="#">USGS 2014 Earthquake Deaggregation Data</a>
peak ground acceleration (ah)=	1.00 g	<a href="#">ASCE 7-16 (osphd Earthquake Hazards Program)</a>

Shaded column headings Indicate Input

Boring No.	USCS Soil Classification	Depth to Water ft	Sample Depth ft	Uncorrected SPT Blow Counts N	Plasticity Index <sup>3</sup> %	Fines Content %	Unit Weight of Soil pcf	$\delta v$ psf	$\delta v'_0$ psf	$C_n$	$(N_1)_{60}$	$(N_1)_{60r}$	$r_d$	$\Delta N_1$	$N_1$	$(N_1)_{60-cs}$	CRR	$K_m$	$K_o$	CRR <sub>c</sub>	CSR	F.O.S <sub>1</sub>	ACC	$Y_{lim}$	$F_\alpha$	$Y_{max}$	$\Delta H$	$\epsilon_v$	$\Delta S$ inches
B-1	SC	6	3	34	16	31.9	115.0	345	345	1.59	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	5.5	15	16	31.9	115.0	633	633	1.39	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	8	10	16	31.9	115.0	920	795	1.31	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	4.30	0.00	0.00
B-1	SC	6	10.5	11	16	31.9	115.0	1208	927	1.26	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	0.70	0.00	0.00
B-1	SC	6	13	9	8	47.4	115.0	1495	1058	1.21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	15.5	12	8	47.4	115.0	1783	1190	1.18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	18	10	8	47.4	115.0	2070	1321	1.14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	20.5	18	17	22.9	115.0	2358	1453	1.11	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	23	12	17	22.9	115.0	2645	1584	1.08	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	25.5	33	17	22.9	115.0	2933	1716	1.05	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SP-SC	6	28	34	11	15	115.0	3220	1847	1.03	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SP-SC	6	30.5	38	11	15	115.0	3508	1979	1.01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	35.5	35	8	47.4	115.0	4083	2242	0.96	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	SC	6	40.5	40	8	47.4	115.0	4658	2505	0.93	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
<b>TOTAL ANTICIPATED SETTLEMENT<sub>2</sub>:</b>																													0.00

Designates soil layers that are potentially liquefiable located below the water table.

1. N.L.-Not Liquefiable based on material type and plasticity

2. Liquefaction Analysis based on EERI, Soil Liquefaction During Earthquakes, by Idriss and Boulanger (2006)

3. N.P.=Non-plastic

**Notations:**

$\delta v$ total overburden pressure	$(N_1)_{60-cs}$ Clean sand equivalent blows	$Y_{lim}$ limiting shear strain
$\delta v'_0$ effective overburden pressure	CRR Critical Resistance Ratio	$F_\alpha$ parameter defining max. shear strain for a given FOS
$C_n$ Overburden SPT correction factor	$K_m$ Earthquake magnitude Correction Factor	$Y_{max}$ Maximum Shear Strain
CSR Critical Stress Ratio	$K_o$ Stress Level Correction Factor	$\Delta H$ Layer thickness (feet)
$(N_1)_{60}$ corrected blow counts	CRR <sub>c</sub> Corrected Cyclic Resistance Ratio	$\epsilon_v$ vertical Reconsolidation Strain
$(N_1)_{60r}$ Reduces $(N_1)_{60}$ values to a recommended maximum of 37	F.O.S Factor of Safety	$\Delta S$ Total Estimate Settlement (inches)
$r_d$ stress reduction factor	ACC Acceleration to Induce Liquefaction	



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**Poggemeyer**  
**TMFG Washoe Valley Consolidation**  
 Washoe City, NEVADA

PROJECT No.: 2556

Date: 02/24/2020

PLATE

C-1a

### LIQUEFACTION EVALUATION SUMMARY SHEET

Project: Consolidated TMFD- Washoe Valley

#### Earthquake and SPT Inputs:

Job No. 2556  
Date 2/24/2020  
Engineer RAR

SPT ER =	80	%	Estimated Based on automatic hammer
EQ(M <sub>w</sub> )mag =	6.85	Mw	<a href="#">USGS 2008 Earthquake Deaggregation Data</a>
peak ground acceleration (ah)=	1.00	g	<a href="#">ASCE 7-16 (USGS Earthquake Hazards Program)</a>

Shaded column headings Indicate Input

Boring No.	USCS Soil Classification	Depth to Water ft	Sample Depth ft	Uncorrected SPT Blow Counts N	Plasticity Index <sup>3</sup> %	Fines Content %	Unit Weight of Soil pcf	$\delta v$ psf	$\delta v'_0$ psf	$C_n$	$(N_1)_{60}$	$(N_1)_{60r}$	$r_d$	$\Delta N_1$	$N_1$	$(N_1)_{60-cs}$	CRR	$K_m$	$K_o$	CRR <sub>C</sub>	CSR	F.O.S <sub>1</sub>	ACC	$Y_{lim}$	$F_\alpha$	$Y_{max}$	$\Delta H$	$\epsilon_v$	$\Delta S$ inches
B-2	SC	6	3	28	11	27.1	115.0	345	345	1.59	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	SM	6	5.5	21	N.P.	12.3	115.0	633	633	1.39	N.A.	N.A.	0.989	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	SM	6	8	22	N.P.	12.3	115.0	920	795	1.31	42.3	37.0	0.980	2.25	39.2	44.5	3.26	1.19	1.00	3.87	0.62	6.23	5.25	0.00	-1.15	0.00	4.30	0.00	0.00
B-2	SM	6	9.5	15	N.P.	13	115.0	1093	874	1.28	30.7	30.7	0.974	2.54	33.2	33.2	0.79	1.19	1.00	0.94	0.67	1.41	1.19	0.03	-0.31	0.02	0.70	0.00	0.02
B-2	SM	6	11	28	N.P.	13.4	115.0	1265	953	1.25	56.0	37.0	0.967	2.71	39.7	58.7	3.76	1.19	1.00	4.46	0.70	6.35	5.35	0.00	-2.31	0.00	2.50	0.00	0.00
B-2	SC	6	12.5	29	8	27	115.0	1438	1032	1.22	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	SC	6	14	35	8	27	115.0	1610	1111	1.20	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	SC	6	15.5	30	8	27	115.0	1783	1190	1.18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00

**TOTAL ANTICIPATED SETTLEMENT<sub>2</sub>: 0.02**

Designates soil layers that are potentially liquefiable located below the water table.

1. N.L.-Not Liquefiable based on material type and plasticity

2. Liquefaction Analysis based on EERI, Soil Liquefaction During Earthquakes, by Idriss and Boulanger (2006)

3. N.P.=Non-plastic

#### Notations:

<p><math>\delta v</math> total overburden pressure</p> <p><math>\delta v'_0</math> effective overburden pressure</p> <p><math>C_n</math> Overburden SPT correction factor</p> <p>CSR Critical Stress Ratio</p> <p><math>(N_1)_{60}</math> corrected blow counts</p> <p><math>(N_1)_{60r}</math> Reduces <math>(N_1)_{60}</math> values to a recommended maximum of 37</p> <p><math>r_d</math> stress reduction factor</p>	<p><math>(N_1)_{60-cs}</math> Clean sand equivalent blows</p> <p>CRR Critical Resistance Ratio</p> <p><math>K_m</math> Earthquake magnitude Correction Factor</p> <p><math>K_o</math> Stress Level Correction Factor</p> <p>CRR<sub>C</sub> Corrected Cyclic Resistance Ratio</p> <p>F.O.S Factor of Safety</p> <p>ACC Acceleration to Induce Liquefaction</p>	<p><math>Y_{lim}</math> limiting shear strain</p> <p><math>F_\alpha</math> parameter defining max. shear strain for a given FOS</p> <p><math>Y_{max}</math> Maximum Shear Strain</p> <p><math>\Delta H</math> Layer thickness (feet)</p> <p><math>\epsilon_v</math> vertical Reconsolidation Strain</p> <p><math>\Delta S</math> Total Estimate Settlement (inches)</p>
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**CME CONSTRUCTION MATERIALS ENGINEERS INC.**  
6980 SIERRA CENTER PARWAY, SUITE 90 RENO, NEVADA 89511

**Poggemeyer  
TMFD Consolidated  
Washoe City, NEVADA**

PROJECT No.: 2556

Date: 02/24/2020

PLATE

C-1b



## **APPENDIX D**

# TEST RESULTS - PERCOLATION TEST 1A

**PROJECT: TMFD CONSOLIDATION**  
**CLIENT: POGGEMEYER DESIGN GROUP**

**PROJECT NO: 2556**

**COMMENTS:**

Percolation testing was completed inside test pit **TP-1** on a bench located at a depth of about **3.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **4.6 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

**LOG OF TEST PIT TP-1**

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
—	3.0 - 10.0: CLAYEY SAND (SC); mostly fine to coarse sand; some low plasticity fines; green to brown.
—	
—	
—	
5	
—	TOTAL DEPTH: 10 ft
—	GROUNDWATER: 7 ft
—	
—	
10	
—	
—	
—	
15	

DATE OF TESTING: 2/20/2020

SURFACE ELEVATION: -

DEPTH TO TEST?: 3.0 FT

**PRESOAK TESTING:** YES (2/19/2019)

Time at Start of Testing: 9:20 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:20 AM		Initial Depth: 6"		
9:50 AM	30	Refill to 6"	1/2	60.0
10:20 AM	30	Refill to 6"	1/4	120.0
10:50 AM	30	Refill to 6"	1/2	60.0
11:20 AM	30	Refill to 6"	1/4	120.0
11:50 AM	30	Refill to 6"	1/8	240.0
12:20 PM	30	Refill to 6"	1/8	240.0
12:50 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			<b>1/8</b>	<b>240.0</b>

**Notes:**

FIELD PERCOLATION RATE = >120 min/inch

CORRECTED PERCOLATION RATE = >120 min/inch

 <p>300 Sierra Manor Drive, Suite 1 Reno, Nevada 89511</p>	<p><b>TMFD CONSOLIDATION PERCOLATION TEST RESULTS WASHOE VALLEY, NEVADA</b></p>	<p>PLATE  <b>D-1a</b></p>
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# GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 1A

PROJECT: TMFD CONSOLIDATION  
CLIENT: POGGEMEYER DESIGN GROUP

PROJECT NO: 2556

## Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

**h** = average height of water in hole during test      **h** = 3.1 inches  
**d** = diameter of test hole      **d** = 4.6 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**CF** = correction factor for perc hole volume to wetted area      **CF** = 1.81

$$CF = \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

## Void Space Calculation

**V<sub>1</sub>** = volume of container      **V<sub>1</sub>** = 1620 mL  
**V<sub>2</sub>** = volume of voids      **V<sub>2</sub>** = 760 mL  
**X** = void space      **X** = 0.47

$$X = \frac{V_2}{V_1}$$

## Correction for use of perforated pipe + gravel

**R<sub>1</sub>** = radius to the outside diameter of perforated pipe      **R<sub>1</sub>** = 2.125 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**X** = void space in gravel      **X** = 0.47  
**h** = average height of water in hole during test      **h** = 3.1 inches

**V** = volume of hole below **h** without gravel and liner      **V** = 50.90 in<sup>3</sup>  
**V<sub>p</sub>** = volume inside perforated pipe      **V<sub>p</sub>** = 43.45 in<sup>3</sup>  
**V<sub>g</sub>** = volume of voids within gravel      **V<sub>g</sub>** = 3.50 in<sup>3</sup>  
**V<sub>pg</sub>** = volume of voids due to pipe and gravel      **V<sub>pg</sub>** = 46.94 in<sup>3</sup>  
**AF** = adjustment factor due to gravel      **AF** = 1.08

## Percolation Correct Calculation

**CF** = correction factor for perc hole volume to w      **CF** = 1.81  
**AF** = adjustment factor due to gravel      **AF** = 1.08  
**FPR** = field percolation rate      **FPR** = >120 min/inch  
**CPR** = corrected percolation rate      **CPR** = ##### min/inch

$$CPR = FPR * CF * AF$$

# TEST RESULTS - PERCOLATION TEST 1B

**PROJECT: TMFD CONSOLIDATION**  
**CLIENT: POGGEMEYER DESIGN GROUP**

**PROJECT NO: 2556**

**COMMENTS:**

Percolation testing was completed inside test pit **TP-1** on a bench located at a depth of about **5.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **4.5 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

**LOG OF TEST PIT TP-1**

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
3.0	3.0 - 10.0: CLAYEY SAND (SC); mostly fine to coarse sand; some low plasticity fines; green to brown.
5	
TOTAL DEPTH: 10 ft	
GROUNDWATER: 6 ft	
10	
15	

DATE OF TESTING: 2/20/2020

SURFACE ELEVATION: -

DEPTH TO TEST?: 5.0 FT

**PRESOAK TESTING:** YES (2/19/2019)

Time at Start of Testing: 9:22 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:22 AM		Initial Depth: 6"		
9:52 AM	30	Refill to 6"	1/4	120.0
10:22 AM	30	Refill to 6"	1/4	120.0
10:52 AM	30	Refill to 6"	1/4	120.0
11:22 AM	30	Refill to 6"	1/4	120.0
11:52 AM	30	Refill to 6"	1/8	240.0
12:22 PM	30	Refill to 6"	1/8	240.0
12:52 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			<b>1/8</b>	<b>240.0</b>

**Notes:** FIELD PERCOLATION RATE = >120 min/inch  
**CORRECTED PERCOLATION RATE = >120 min/inch**

 <p>300 Sierra Manor Drive, Suite 1 Reno, Nevada 89511</p>	<p><b>TMFD CONSOLIDATION                  PERCOLATION TEST RESULTS                  WASHOE VALLEY, NEVADA</b></p>	<p>PLATE  D-2c</p>
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# GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 1B

PROJECT: TMFD CONSOLIDATION  
CLIENT: POGGEMEYER DESIGN GROUP

PROJECT NO: 2556

## Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

**h** = average height of water in hole during test      **h** = 3.1 inches  
**d** = diameter of test hole      **d** = 4.5 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**CF** = correction factor for perc hole volume to wetted area      **CF** = 1.84

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

## Void Space Calculation

**V<sub>1</sub>** = volume of container      **V<sub>1</sub>** = 1620 mL  
**V<sub>2</sub>** = volume of voids      **V<sub>2</sub>** = 760 mL  
**X** = void space      **X** = 0.47

$$= \frac{V_2}{V_1}$$

## Correction for use of perforated pipe + gravel

**R<sub>1</sub>** = radius to the outside diameter of perforated pipe      **R<sub>1</sub>** = 2.125 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**X** = void space in gravel      **X** = 0.47  
**h** = average height of water in hole during test      **h** = 3.1 inches

**V** = volume of hole below **h** without gravel and liner      **V** = 48.71 in<sup>3</sup>  
**V<sub>p</sub>** = volume inside perforated pipe      **V<sub>p</sub>** = 43.45 in<sup>3</sup>  
**V<sub>g</sub>** = volume of voids within gravel      **V<sub>g</sub>** = 2.47 in<sup>3</sup>  
**V<sub>pg</sub>** = volume of voids due to pipe and gravel      **V<sub>pg</sub>** = 45.91 in<sup>3</sup>  
**AF** = adjustment factor due to gravel      **AF** = 1.06

## Percolation Correct Calculation

**CF** = correction factor for perc hole volume to w      **CF** = 1.84  
**AF** = adjustment factor due to gravel      **AF** = 1.06  
**FPR** = field percolation rate      **FPR** = >120 min/inch  
**CPR** = corrected percolation rate      **CPR** = ##### min/inch

$$= \text{FPR} * \text{CF} * \text{AF}$$

# TEST RESULTS - PERCOLATION TEST 2A

**PROJECT: TMFD CONSOLIDATION**  
**CLIENT: POGGEMEYER DESIGN GROUP**

**PROJECT NO: 2556**

**COMMENTS:**

Percolation testing was completed inside test pit **TP-2** on a bench located at a depth of about **3.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **6.0 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

**LOG OF TEST PIT TP-2**

Depth	Description
0	0.0 - 4.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
5	4.0 - 8.5: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
TOTAL DEPTH: 8.5 ft	
GROUNDWATER: 7 ft	
10	
15	

DATE OF TESTING: 2/20/2020

SURFACE ELEVATION: -

DEPTH TO TEST?: 3.0 FT

**PRESOAK TESTING:** YES (2/19/2019)

Time at Start of Testing: 9:30 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:30 AM		Initial Depth: 6"		
10:00 AM	30	Refill to 6"	1/16	480.0
10:30 AM	30	Refill to 6"	1/16	480.0
11:00 AM	30	Refill to 6"	1/16	480.0
11:30 AM	30	Refill to 6"	1/16	480.0
12:00 PM	30	Refill to 6"	1/8	240.0
12:30 PM	30	Refill to 6"	1/4	120.0
1:00 PM	30	Refill to 6"	1/4	120.0
Stabilized Rate:			<b>1/4</b>	<b>120.0</b>

**Notes:**

FIELD PERCOLATION RATE = 120.0 min/inch

**CORRECTED PERCOLATION RATE = 235.5 min/inch**

 <p>300 Sierra Manor Drive, Suite 1 Reno, Nevada 89511</p>	<p><b>TMFD CONSOLIDATION PERCOLATION TEST RESULTS WASHOE VALLEY, NEVADA</b></p>	<p>PLATE</p> <p style="font-size: 1.5em;"><b>D-1f</b></p>
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# GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 2A

PROJECT: TMFD CONSOLIDATION  
CLIENT: POGGEMEYER DESIGN GROUP

PROJECT NO: 2556

## Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

**h** = average height of water in hole during test      **h** = 3.1 inches  
**d** = diameter of test hole      **d** = 4.5 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**CF** = correction factor for perc hole volume to wetted area      **CF** = 1.85

$$CF = \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

## Void Space Calculation

**V<sub>1</sub>** = volume of container      **V<sub>1</sub>** = 1620 mL  
**V<sub>2</sub>** = volume of voids      **V<sub>2</sub>** = 760 mL  
**X** = void space      **X** = 0.47

$$X = \frac{V_2}{V_1}$$

## Correction for use of perforated pipe + gravel

**R<sub>1</sub>** = radius to the outside diameter of perforated pipe      **R<sub>1</sub>** = 2.125 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**X** = void space in gravel      **X** = 0.47  
**h** = average height of water in hole during test      **h** = 3.1 inches

**V** = volume of hole below **h** without gravel and liner      **V** = 49.70 in<sup>3</sup>  
**V<sub>p</sub>** = volume inside perforated pipe      **V<sub>p</sub>** = 44.33 in<sup>3</sup>  
**V<sub>g</sub>** = volume of voids within gravel      **V<sub>g</sub>** = 2.52 in<sup>3</sup>  
**V<sub>pg</sub>** = volume of voids due to pipe and gravel      **V<sub>pg</sub>** = 46.85 in<sup>3</sup>  
**AF** = adjustment factor due to gravel      **AF** = 1.06

## Percolation Correct Calculation

**CF** = correction factor for perc hole volume to w      **CF** = 1.85  
**AF** = adjustment factor due to gravel      **AF** = 1.06  
**FPR** = field percolation rate      **FPR** = 120.0 min/inch  
**CPR** = corrected percolation rate      **CPR** = 235.5 min/inch

$$CPR = FPR * CF * AF$$

# TEST RESULTS - PERCOLATION TEST 2B

**PROJECT: TMFD CONSOLIDATION**  
**CLIENT: POGGEMEYER DESIGN GROUP**

**PROJECT NO: 2556**

**COMMENTS:**

Percolation testing was completed inside test pit **TP-2** on a bench located at a depth of about **5.0** feet below the existing ground surface within **poorly graded sand with clay (SP-SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **4.5 inch O.D.** gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

**LOG OF TEST PIT TP-2**

Depth	Description
0	0.0 - 4.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
—	4.0 - 8.5: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
—	
—	
—	
5	
—	TOTAL DEPTH: 8.5 ft
—	GROUNDWATER: 7 ft
—	
—	
10	
—	
—	
—	
15	

DATE OF TESTING:	2/20/2020
SURFACE ELEVATION	-
DEPTH TO TEST?	5.0 FT
<b>PRESOAK TESTING:</b>	YES (2/19/2019)
Time at Start of Testing:	9:32 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:32 AM		Initial Depth: 6"		
10:02 AM	30	Refill to 6"	3 1/8	9.6
10:32 AM	30	Refill to 6"	3 1/2	8.6
11:02 AM	30	Refill to 6"	3 1/2	8.6
11:32 AM	30	Refill to 6"	3 1/8	9.6
12:02 PM	30	Refill to 6"	2 1/2	12.0
12:32 PM	30	Refill to 6"	3	10.0
1:02 PM	30	Refill to 6"	3	10.0
Stabilized Rate:			<b>3</b>	<b>10.0</b>

<b>Notes:</b>	FIELD PERCOLATION RATE = 10.0 min/inch
	<b>CORRECTED PERCOLATION RATE = 21.2 min/inch</b>

 <p>300 Sierra Manor Drive, Suite 1 Reno, Nevada 89511</p>	<b>TMFD CONSOLIDATION                  PERCOLATION TEST RESULTS                  WASHOE VALLEY, NEVADA</b>	PLATE  <b>D-1h</b>
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# GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 2B

PROJECT: TMFD CONSOLIDATION  
CLIENT: POGGEMEYER DESIGN GROUP

PROJECT NO: 2556

## Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

**h** = average height of water in hole during test      **h** = 4.5 inches  
**d** = diameter of test hole      **d** = 4.5 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**CF** = correction factor for perc hole volume to wetted area      **CF** = 2.00

$$CF = \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

## Void Space Calculation

**V<sub>1</sub>** = volume of container      **V<sub>1</sub>** = 1620 mL  
**V<sub>2</sub>** = volume of voids      **V<sub>2</sub>** = 760 mL  
**X** = void space      **X** = 0.47

$$X = \frac{V_2}{V_1}$$

## Correction for use of perforated pipe + gravel

**R<sub>1</sub>** = radius to the outside diameter of perforated pipe      **R<sub>1</sub>** = 2.125 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**X** = void space in gravel      **X** = 0.47  
**h** = average height of water in hole during test      **h** = 4.5 inches

**V** = volume of hole below **h** without gravel and liner      **V** = 71.57 in<sup>3</sup>  
**V<sub>p</sub>** = volume inside perforated pipe      **V<sub>p</sub>** = 63.84 in<sup>3</sup>  
**V<sub>g</sub>** = volume of voids within gravel      **V<sub>g</sub>** = 3.63 in<sup>3</sup>  
**V<sub>pg</sub>** = volume of voids due to pipe and gravel      **V<sub>pg</sub>** = 67.47 in<sup>3</sup>  
**AF** = adjustment factor due to gravel      **AF** = 1.06

## Percolation Correct Calculation

**CF** = correction factor for perc hole volume to w      **CF** = 2.00  
**AF** = adjustment factor due to gravel      **AF** = 1.06  
**FPR** = field percolation rate      **FPR** = 10.0 min/inch  
**CPR** = corrected percolation rate      **CPR** = 21.2 min/inch

$$CPR = FPR * CF * AF$$

# TEST RESULTS - PERCOLATION TEST 3

**PROJECT: TMFD CONSOLIDATION**  
**CLIENT: POGGEMEYER DESIGN GROUP**

**PROJECT NO: 2556**

**COMMENTS:**

Percolation testing was completed inside test pit **TP-3** on a bench located at a depth of about **2.5** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **6.0 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

**LOG OF TEST PIT TP-3**

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
3.0	3.0 - 7.0: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
5	TOTAL DEPTH: 7ft GROUNDWATER: 6ft
10	
15	

DATE OF TESTING:	2/20/2020
SURFACE ELEVATION	-
DEPTH TO TEST?	2.5 FT
<b>PRESOAK TESTING:</b>	YES (2/19/2019)
Time at Start of Testing:	9:35 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:35 AM		Initial Depth: 6"		
10:05 AM	30	Refill to 6"	1/16	480.0
10:35 AM	30	Refill to 6"	1/16	480.0
11:05 AM	30	Refill to 6"	1/8	240.0
11:35 AM	30	Refill to 6"	1/8	240.0
12:05 PM	30	Refill to 6"	1/8	240.0
12:35 PM	30	Refill to 6"	1/8	240.0
1:05 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			<b>1/8</b>	<b>240.0</b>

**Notes:** FIELD PERCOLATION RATE = >120 min/inch  
**CORRECTED PERCOLATION RATE = >120 min/inch**

 <p>300 Sierra Manor Drive, Suite 1 Reno, Nevada 89511</p>	<p><b>TMFD CONSOLIDATION                  PERCOLATION TEST RESULTS                  WASHOE VALLEY, NEVADA</b></p>	<p>PLATE  D-1j</p>
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# GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 3

PROJECT: TMFD CONSOLIDATION  
CLIENT: POGGEMEYER DESIGN GROUP

PROJECT NO: 2556

## Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

**h** = average height of water in hole during test      **h** = 3.1 inches  
**d** = diameter of test hole      **d** = 4.5 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**CF** = correction factor for perc hole volume to wetted area      **CF** = 1.84

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

## Void Space Calculation

**V<sub>1</sub>** = volume of container      **V<sub>1</sub>** = 1620 mL  
**V<sub>2</sub>** = volume of voids      **V<sub>2</sub>** = 760 mL  
**X** = void space      **X** = 0.47

$$= \frac{V_2}{V_1}$$

## Correction for use of perforated pipe + gravel

**R<sub>1</sub>** = radius to the outside diameter of perforated pipe      **R<sub>1</sub>** = 2.125 inches  
**r** = radius of test hole      **r** = 2.3 inches  
**X** = void space in gravel      **X** = 0.47  
**h** = average height of water in hole during test      **h** = 3.1 inches

**V** = volume of hole below **h** without gravel and liner      **V** = 48.71 in<sup>3</sup>  
**V<sub>p</sub>** = volume inside perforated pipe      **V<sub>p</sub>** = 43.45 in<sup>3</sup>  
**V<sub>g</sub>** = volume of voids within gravel      **V<sub>g</sub>** = 2.47 in<sup>3</sup>  
**V<sub>pg</sub>** = volume of voids due to pipe and gravel      **V<sub>pg</sub>** = 45.91 in<sup>3</sup>  
**AF** = adjustment factor due to gravel      **AF** = 1.06

## Percolation Correct Calculation

**CF** = correction factor for perc hole volume to w      **CF** = 1.84  
**AF** = adjustment factor due to gravel      **AF** = 1.06  
**FPR** = field percolation rate      **FPR** = >120 min/inch  
**CPR** = corrected percolation rate      **CPR** = ##### min/inch

$$= \text{FPR} * \text{CF} * \text{AF}$$