Geotechnical Investigation Report,
Proposed Senior Living Development,
Morningstar of Granada Hills,
17551 - 17563 Rinaldi Street,
Granada Hills, California

Prepared For

CONFLUENT DEVELOPMENT

November 22, 2022

GMU Project No. 20-307-00

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CONFLUENT DEVELOPMENT
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PROJECT: 20-307-00

DATE: November 22, 2022

ATTENTION: Mr. Cody Cowan

SUBJECT: Geotechnical Investigation Report, Proposed Senior Living Development, Morningstar of Granada Hills, 17551 – 17563 Rinaldi Street, Granada Hills, California.

Dear Mr. Cowan:

GMU is pleased to present this geotechnical investigation report for the subject project, which summarizes our data, conclusions, and recommendations.

Please note that this report has not been prepared for the use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

We appreciate the opportunity to work on this project. Please do not hesitate to contact the undersigned if you have any questions regarding any aspect of this report.

Respectfully submitted,

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Associate Geotechnical Engineer

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Principal Geologist

DISTRIBUTION:

Addressee: Electronic copy

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INTRODUCTION

PURPOSE

This report presents the results of our geotechnical investigation for the proposed senior living development and site improvements, as shown on the reference (1) architectural plans by HPI Architecture and the reference (2) conceptual grading plan by David Evans and Associates, to be located at 17551 – 17563 Rinaldi Street in the City of Granada Hills, California.

SCOPE

The scope of our geotechnical investigation along with future plan reviews, as outlined in our September 24, 2020 proposal, is as follows:

1. Staked five (5) hollow stem auger drill holes and seven (7) test pits, coordinated with Confluent Development, and contacted Utility Underground Service Alert (USA/Dig Alert) to provide advance notification of the 5 subsurface drill holes and 7 test pits planned within the project area.

2. Performed a field subsurface exploration that consisted of the advancement of two (2) hollow stem auger drill hole to a depth of approximately 51.5 feet below the existing grade, three (3) hollow stem auger drill holes to a depth of approximately 21.5 feet below the existing grade, and seven (7) backhoe test pits to depths of approximately 4 to 10.5 feet. Logged the drill holes and test pits and obtained bulk and drive soil samples for geotechnical laboratory testing.

3. Performed laboratory testing on soil samples obtained from the drill holes. Testing included the determination of in-situ moisture content and dry density, maximum dry density and optimum moisture content, grain size analysis, Atterberg Limits, expansion potential, corrosion potential, consolidation and shear strength characteristics, and R-value tests.

4. Interpreted and evaluated the acquired field and laboratory data to perform geotechnical engineering design which included settlement analysis, liquefaction analysis, bearing capacity and associated settlement, pavement design, and seismic parameters in accordance with the California Building Code (CBC) 2019 standards.

5. Prepared and distributed this geotechnical investigation report containing our geotechnical conclusions and recommendations to support the design of the project.

SITE LOCATION AND DESCRIPTION

The site is located at 17551 to 17563 Rinaldi Street in the City of Granada Hills, California. The site is bounded by Rinaldi Street on the south, Ridgeway Road on the west, existing single-family residences on the north, and Shoshone Avenue on the east. The general location of the project site is shown on Plate 1.

The subject site is currently occupied by three single family residences and associated out-buildings that are situated on relatively flat and level pads along Shoshone Avenue. To the west of these residential pads, an approximately 10-to 55-foot-high slope ascends towards the west to northwest to an existing dirt roadway (Ridgeway Road) located along the western property line of the site. This slope has variable gradients that range from as gentle as 5:1, horizontal to vertical, to as steep as 2:1, horizontal to vertical. The residential building pads and slope are covered by weeds and grasses with numerous mature trees around the residences and scattered shrubs and trees on the slope.

PROPOSED DEVELOPMENT

Based on review of the reference (2) conceptual grading plan, it is proposed to create a large split-level building pad to the north of Rinaldi Street and to the west of the existing residential building pads along Shoshone Avenue. The lower level of the split-level pad will have a pad elevation of approximately 1138 feet above mean sea level while the upper pad will have a pad elevation of approximately 1150 feet above mean sea level. The building pad will be bordered on the east by an access driveway and parking stalls and on the south by a parking lot. An approximately 2- to 12-foot-high retaining wall will be constructed between the existing residential building pads and the proposed access driveway. Approximately 3- to 9-foot-high retaining walls and 5- to 20-foot-high 2:1 to 3:1 manufactured slopes are also proposed along the north and west sides of the building pad and an approximately 2- to 10-foot-high 4:1 to 2:1 slope is proposed between the parking lot and Rinaldi Street. Based on the proposed grades, cuts and fills of up to approximately 17 feet and 12 feet, respectively, will be required to reach proposed grades.

The reference (1) architectural plans indicate that a two- to three-story assisted living and memory care facility building will be constructed within the new building pad. In addition, an assisted living courtyard will be constructed to the west of the building while a memory care courtyard will be constructed adjacent to the north side of the building. The courtyards will contain concrete walkways and patios, a fire pit, a putting green, a water feature, and an out-door barbecue with an overhead shade structure. The parking lot and driveway will be paved by asphalt with exception of the north branch of the access driveway which will consist of a fire lane with a turf block surface.

It is also our understanding that the existing residences along Shoshone Avenue will be renovated and converted into independent living units.

SUBSURFACE EXPLORATION

GMU conducted a subsurface exploration to evaluate the soil conditions below the proposed building, parking lot, and proposed access driveway. A total of five (5) hollow-stem-auger, truck-mounted drill holes were excavated to a maximum depth of 51.5 feet below the existing grade and a total of seven (7) backhoe-dug test pits were excavated to a maximum depth of 9 feet below the existing grade. The drill hole and test pit locations are shown on Plate 2 – Geotechnical Map. Drill hole and test pit logs are contained in Appendix A. The drill holes were logged and samples were collected in each of the drill holes for laboratory testing.

LABORATORY TESTING

Laboratory testing for the subject investigation was performed to determine in-situ moisture content and dry density, optimum moisture content and maximum dry density, grain size distribution, Atterberg Limits, expansion index, corrosion potential, shear strength and consolidation characteristics, and R-value. The results of our laboratory testing are summarized on Table B-1 and included within Appendix B – Laboratory Testing.

GEOLOGIC FINDINGS

REGIONAL GEOLOGIC SETTING

According to the geologic map of the Oat Mountain and Canoga Park Quadrangle, the project site is underlain by older alluvium deposits (Qoal) that are typically comprised of sands, clays and gravels. The site is also underlain by bedrock materials of the Sunshine Ranch Member of the Saugus Formation (Tsr).

SUBSURFACE MATERIALS

Undocumented Artificial Fill (Qafu)

Artificial fill soils were encountered in the majority of the excavations at the site. The fills were encountered to a maximum depth of 10 feet below the existing grade and generally consist of light brown to dark brown, damp to moist, medium dense to dense silty and clayey sands, and firm to very stiff sandy clays. Some of the fill soils were observed to contain man-made debris such as concrete, asphalt, PVC pipes, etc. The artificial fill materials are not considered suitable for support of the planned improvements.

Older Alluvium (Qoal)

Older alluvial materials underlie the artificial fill materials. The older alluvium consists of yellow brown to light brown to brown, damp to slightly moist, silty sands, clayey sands, and stiff clays. These materials were observed to be dense to very dense; however, the surficial older alluvial materials are locally weathered and medium dense. The older alluvium is considered suitable for support of the planned improvements after removal of any artificial fill, topsoil, and weathered/low density surficial older alluvium.

Bedrock of the Sunshine Ranch Member of the Saugus Formation (Tsr)

Bedrock materials of the Sunshine Ranch Member of the Saugus formation were observed below the artificial fill and older alluvium. The bedrock consists light brown, hard siltstone, and dense to very dense sandstone. The bedrock is thickly bedded and well indurated Where exposed within the test pits, the upper approximately 2 feet of the bedrock is moderately weathered and fractured. The Saugus formation is considered suitable for support of the planned grading and improvements after removal of any overlaying artificial fill, topsoil, or weathered/low density surficial older alluvium.

GROUNDWATER

Groundwater was not observed during our subsurface exploration to the maximum depth explored (51.5 feet below the existing grade). Based on review of nearby well data, we found that groundwater is anticipated to be deeper than 100 feet below the existing grade. Groundwater conditions may vary across the site due to stratigraphic and hydrologic conditions and may change over time due to seasonal and meteorological fluctuations, or activities by humans at this site and nearby sites. However, based on the above findings, groundwater is unlikely to impact the proposed development.

GEOLOGIC HAZARDS

FAULTING AND SEISMICITY

The site is not located within an Alquist-Priolo Earthquake Fault Zone, and no known active faults are shown on the reviewed geologic maps crossing the site, however, the site is located in a seismically active region of Southern California. The nearest known active faults are the Santa Susana and Sierra Madre fault systems, which are located approximately 1.8 and 2.6 miles from the site, respectively, and capable of generating maximum earthquake magnitudes (Mw) of 6.9 and 7.3, respectively.

Given the proximity of the site to these and numerous other active and potentially active faults, the site will likely be subject to earthquake ground motions in the future.

LIQUEFACTION

Based on our review of the State of California Official Map of Seismic Hazard for the Oat Mountain Quadrangle, the site is not located within a zone of required investigation for liquefaction. In addition, based on the lack of shallow groundwater, the dense to very dense nature of the site soils, and the relatively shallow depth of bedrock, it is our professional opinion that the liquefaction potential at the site is very low.

LANDSLIDES

Based on our review of available geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the subject site. Due to the overall relatively gently sloping nature of the site and surrounding areas, the potential for landslides to occur at the project site is considered negligible.

TSUNAMI, SEICHE, AND FLOODING

The site is not located on any State of California Tsunami Inundation Map for Emergency Planning. The potential for the site to be adversely impacted by earthquake-induced tsunamis is considered to be negligible because the site is located several miles inland from the Pacific Ocean coast at an elevation exceeding the maximum height of potential tsunami inundation.

The potential for the site to be adversely impacted by earthquake-induced seiches is considered to be negligible due to the lack of any significant enclosed bodies of water located in the vicinity of the site.

According to the County of Los Angeles FEMA Flood Insurance Rate Map, the site is located within an Area of Minimal Flood Hazard (Zone X). The potential for the site to be adversely impacted by significant flooding is considered low.

GEOTECHNICAL ENGINEERING FINDINGS

STATIC SETTLEMENT/COMPRESSIBILITY

Static settlement of the site will be induced by introducing new fills and building loads to existing grades and subsurface soils. The underlying alluvial soils and bedrock materials (i.e., Saugus formation) encountered were found to be dense to very dense. However, the upper approximately 5 to 10 feet of the site is comprised of artificial fill that is not considered suitable for support of the proposed improvements. Therefore, remedial grading recommendations are provided in this report to remediate the artificial fill material and provide a uniform blanket of engineered fill below the building pad and site improvements.

FOUNDATION SYSTEMS

Based on the existing subsurface conditions, our evaluation, and our understanding that the proposed structure will be 3-stories or less in height, we recommend that the proposed building be supported on a conventional spread footing foundation system underlain by compacted engineered fill.

SOIL EXPANSION

Based on our evaluation and experience with similar material types, the soils encountered near the ground surface at the site exhibit a very low to low expansion potential. Therefore, the recommendations provided in this report are based on a ***low expansion potential.***

SOIL CORROSION

Based on laboratory test results for pH, soluble chlorides, sulfate, and minimum resistivity of the site soils obtained during our subsurface investigation, the on-site soils should be considered to have the following:

- A negligible sulfate exposure to concrete per ACI 318-14, Table 19.3.1.1
- A low minimum resistivity indicating conditions that are corrosive to ferrous metals.
- An elevated chloride content (corrosive to ferrous metals).

The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary). The above discussion is provided for general guidance regarding the corrosiveness of the on-site soils to

typical metal structures used for construction. Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview. If detailed recommendations are required, a corrosion engineer should be consulted to develop appropriate mitigation measures.

EXCAVATION CHARACTERISTICS

The majority of the soil materials underlying the site can be excavated with scrapers and other conventional grading equipment.

CONCLUSIONS

Based on our geotechnical findings, the following is a summary of our conclusions:

1. The project area is not underlain by any known active faults.

2. Groundwater is not expected to be encountered and is not anticipated to have a significant impact on the proposed development.

3. The site is not subject to liquefaction.

4. The proposed building may be supported on a shallow conventional foundation system underlain by engineered fill.

5. Based on our consolidation data, the magnitude of total static settlements beneath the structure is expected to be less than 1 inch, provided that the corrective grading recommendations are performed during construction.

6. Site soils within the at-grade foundation influence zone are anticipated to have a very low to low expansion potential based on our recent laboratory test results. Recommendations for the proposed developments are based on a “low” expansive condition.

7. Corrosion testing indicates that the on-site soils have a negligible sulfate exposure but have elevated levels of chlorides and are corrosive to buried ferrous metals and reinforcing steel. Consequently, any metal exposed to the soil shall be protected.

RECOMMENDATIONS

DEVELOPMENT FEASIBILITY

Based on the geologic and geotechnical findings, it is our opinion that the proposed grading shown on the reference (2) conceptual grading plan is feasible and practical from a geotechnical standpoint if accomplished in accordance with the City of Los Angeles grading requirements and the recommendations presented herein.

It is also the opinion of GMU Geotechnical that all slopes impacting the site are considered stable and the proposed grading and construction will not adversely affect the geologic stability of adjoining properties provided grading and construction are performed in accordance with the recommendations provided in this report.

SITE PREPARATION AND GRADING

General

The following recommendations pertain to any required grading associated with the proposed improvements and corrective grading needed to support the proposed improvements. All site preparation and grading should be performed in accordance with the City of Los Angeles grading code requirements and the recommendations presented in this report.

Clearing and Grubbing

All significant organic material such as weeds, grasses, shrubs, trees and their roots, or construction debris such as old irrigation lines, asphalt concrete, and other decomposable material should be removed from the areas to be graded. No rock or broken concrete greater than 6 inches in diameter should be utilized in the fills.

Remedial Grading

Planned remedial grading is anticipated for this development due to the sloping terrain, variations between cuts and fills, and the presence of unsuitable artificial fill material and locally weathered older alluvium. The remedial grading will generally consist of: (1) removal of low-density, compressible, and unsuitable soil materials, and (2) over-excavation of pad, driveway and parking

lot areas to eliminate cut-fill transitions. These conventional remedial grading procedures will serve to stabilize designed grades and mitigate excessive future settlement.
The undocumented fill, topsoil, and weathered/low density older alluvium will require remedial grading to variable depths to mitigate settlement and provide a uniform support for the proposed building and associated site improvements. Over-excavations for building pads and street/driveway areas in a cut condition are required to minimize differential movement between the cut and fill transition, and to provide a layer of new engineered fill below improvements.

Typical remedial grading is shown on the Cross Sections (Plate 3). It should be noted that the recommendations provided herein are approximations based on our subsurface exploration and knowledge of the on-site geology. Actual removals may vary in configuration and volume based on observations of geologic materials and conditions encountered during grading. The bottom of all remedial grading removals should be observed by the Geotechnical Engineer of Record representative to verify the suitability of in-place soils prior to fill placement. General remedial grading recommendations are outlined below:

Fill Areas: All topsoil and artificial fill material along with local weathered surficial older alluvial materials are considered unsuitable for support of new building foundations and associated site improvements and should be removed to expose competent older alluvium or bedrock material.

Cut Areas: Building foundations within a cut area should be over-excavated to a depth of at least 3 feet below the bottom of the proposed footing. The over-excavations should extend across the entire pad area and at least 5 feet horizontally beyond the foundation limits.

Driveway and Parking Lot Over-Excavations: The driveway and parking lot shown on the grading plans should be over-excavated to a depth of three feet below finish grade when in a cut condition. Where topsoil, undocumented fill, or weathered older alluvium is exposed, the remedial grading shall extend to competent older alluvial materials. The over-excavations should extend across the entire driveway and parking lot areas and at least 3 feet horizontally beyond the perimeter edges.

Processing of Exposed Bottom Surfaces

Before replacing the excavated materials as properly compacted fill, the exposed bottom surfaces should be:

- Cleared of all loose materials.
- Where alluvium/colluvium is exposed, these materials should be tested to confirm that the exposed alluvium/colluvium has a suitable relative compaction and degree of saturation.
- Moisture conditioned (as necessary) to at least 2 percentage points above the optimum moisture content (i.e., if the optimum moisture content is 10%, the compacted fill's moisture content shall be at least 12%).

FILL MATERIAL AND PLACEMENT

Suitability and Selective Grading

All on-site soil materials within the limits of grading are suitable for use as compacted fill if care is taken to remove all significant organic and other decomposable debris and to separate and selectively place and/or stockpile rock materials larger than 6 inches in diameter.

Compaction Standard and Moisture Requirements

All on-site soil material used as compacted fill, or material processed in place or used to backfill trenches, should be moistened, dried, or blended as necessary to achieve a minimum of 2 percentage points above the optimum moisture content for compaction, placed in loose lifts no greater than 8 inches thick, and densified to at least 90% relative compaction as determined by ASTM Test Method D 1557. We note that majority of the onsite soils are below optimum moisture content, and significant addition of water will be required. Soils will need to be moisture conditioned and thoroughly mixed to achieve proper moisture content and compaction.

Following completion of grading, the final surface subgrade soils should be frequently watered to keep the soil moist until building slabs, flatwork, or any other final improvements are installed. If the soil is allowed to dry out and deep shrinkage cracks appear, at least the upper foot should be re-processed, moisture conditioned to 2% over optimum, and compacted.

Use of Rock or Broken Concrete

No rock or broken concrete greater than 6 inches in diameter should be utilized in the fills.

TEMPORARY EXCAVATION STABILITY

During site grading, temporary excavations will be created for remedial removals, pad over-excavations, and during construction of the proposed retaining walls. Trench excavations will also be required for new utility lines, if any. During remedial grading, the sidewalls of these temporary excavations are expected to expose new existing artificial fill materials, native older alluvial materials and bedrock materials of the Sunshine Ranch Member of the Saugus Formation. During site construction, the sidewalls of the temporary excavations to construct the retaining walls and to install underground utility lines are expected to expose new compacted fill materials and native older alluvial materials. Based on the anticipated engineering characteristics of these materials, OSHA Type B soil characteristics should be assumed for the new fill, existing fill and older alluvial materials while the bedrock materials may be considered to be “sound rock”.

From a geotechnical point of view, we anticipate that unsurcharged excavations with vertical side slopes less than 4 feet high will generally be stable. Our recommendations for temporary excavations are as follows:

- Temporary, unsurcharged excavation sides over 4 feet in height should be sloped no steeper than an inclination provided by OSHA for a Type B soil.
- Where sloped excavations are created, the tops of the slopes should be barricaded so that vehicles and storage loads do no encroach within 10 feet of the tops of the excavated slopes. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. GMU should be advised of such heavy vehicle loadings so that specific setback requirements can be established.
- If the temporary construction slopes are to be maintained during the rainy season, berms are recommended to be graded along the tops of the slopes to prevent runoff water from entering the excavation and eroding the slope faces.

Our temporary excavation recommendations are provided only as **minimum** guidelines. All work associated with temporary excavations should meet the minimal requirements as set forth by CAL-OSHA. Temporary slope construction, maintenance, and safety are the responsibility of the contractor. Other factors that should be considered with respect to the stability of temporary slopes include construction traffic and storage of materials on or near the tops of the slopes, construction scheduling, presence of nearby walls or structures, and weather conditions at the time of construction.

Based on the conceptual grading plans, there is room within the site to lay back the sidewalls of the excavations at the above configuration without undermining or encroaching into any adjacent properties.

MANUFACTURED SLOPES

Planned Cut and Fill Slopes

Cut slopes are proposed along the north and west sides of the proposed building pad while a fill slope is proposed along the south side of the proposed parking lot. The planned cut and fill slopes are illustrated on Plate 2 – Geotechnical Map and on Plate 3 – Geotechnical Sections.

Cut Slope Construction

The proposed cut slopes will expose either older alluvial materials or bedrock materials of the Sunshine Ranch Member of the Saugus Formation. These materials are expected to be dense or

moderately hard to hard. Therefore, these cut slopes are expected to be grossly and surficially stable.

Fill Slope Construction

The fill slope should be carefully constructed to obtain the specified degree of compaction. This slope should be overfilled and trimmed back to expose firm, dense fill. "Track walking" is not a recommended means of compacting the fill slope surface.

Fill Support Bench

The bottom of the proposed fill slope should be supported on a bench that has a minimum width of 15 feet. Further benching (minimum 6 feet in width) should be performed uphill from this bench simultaneously with fill placement to remove unsuitable soils and provide level surfaces for fill support where the natural ground surface is 5 horizontal to 1 vertical, or steeper.

Surficial Stability of Fill Slopes

Fill slopes that are constructed from the on-site materials may be subject to erosion and shallow slumping when saturated. Engineered surface drainage devices designed to control surface runoff, utilized in conjunction with slope landscaping programs specifically designed for the soil and geologic conditions on the slopes, should be sufficient to: (1) reduce the long-term potential for erosion and surficial failures on engineered slopes to acceptable levels, and (2) adequately protect the proposed improvements from off-site hazards.

NATURAL SLOPES

Gross Stability

The natural slopes to remain within the site to the north and northwest of the proposed building pad are underlain by older alluvium and bedrock materials of the Sunshine Ranch Member of the Saugus Formation. The colluvial materials are dense while the bedrock materials are moderately hard to hard. Based on our literature review, no landslides exist on or near the site, and no evidence of landsliding was observed during our subsurface exploration. Based on these conditions, the ascending natural slopes are considered to be grossly stable.

Surficial Stability

The natural slopes have slope ratios that range from approximately 5:1 to 2:1, horizontal to vertical. The slopes are composed of moderately hard to hard siltstone and sandstone bedrock with the lower portions mantled by dense older alluvial materials. In addition, the natural slopes are also covered by a moderate protective growth of native weeds, grasses, and occasional shrubs and trees. Based on these conditions, it is our opinion that the natural slopes are also surficially stable.

Utility Trench Backfill Considerations

General

New utility line pipelines (greater than 2 feet deep), should be backfilled with both select bedding materials beneath and around the pipes (pipe zone) and compacted soil above the pipe bedding. Recommendations for the types of the materials to be used and the proper placement of these materials are provided in the following sections.

Pipe Zone (Bedding and Shading)

The pipe bedding materials should above the crown of the pipes to a depth sufficient to protect the pipes during compaction of the trench backfill. Pipe bedding should consist of either clean sand with a sand equivalent (SE) of at least 30 or crushed rock. If crushed rock is used, it should consist of ¾-inch crushed rock that conforms to current "Greenbook" standards. Pipe zone material having a sand equivalent of 30 or greater should be properly placed in thicknesses not exceeding 3 feet, and thoroughly jetted in place. The top of the jetted sand should be tamped with hand operated compaction equipment prior to the placement of trench backfill. With proper techniques, jetting is not expected to have an adverse impact on the adjacent site soils.

Pipe bedding should also meet the minimum requirements of the County of Orange. If the requirements of the County are more stringent, they should take precedence over the geotechnical recommendations. Sufficient laboratory testing should be performed to verify the bedding meets the minimum requirements of the current "Greenbook."

Based on our subsurface exploration, the onsite soils that will be excavated from the pipeline trenches will not meet the recommendations for pipe zone materials; therefore, imported materials will be required for pipe bedding and shading.

Trench Backfill

All existing soil material within the limits of the pipeline alignment are considered suitable for use as trench backfill above the pipe bedding zone if care is taken to remove all significant organic and other decomposable debris and separate and selectively place and/or stockpile any rock, concrete or other inert materials larger than 6 inches in maximum diameter outside of building pad areas or 4 inches within building pad areas.
Imported soils are not anticipated for backfill since the on-site soils are suitable. However, if imported soils are used, the soils should consist of clean materials with physical and chemical characteristics similar to those described herein for on-site soils. Any imported soils to be used as backfill should be evaluated and approved by GMU prior to placement.

Soils to be used as trench backfill should be moistened, dried, or blended as necessary to achieve a minimum of 2 percentage points over optimum moisture content for compaction, placed in loose lifts no greater than 8 inches thick, and mechanically compacted/densified to at least 90% relative compaction as determined by ASTM Test Method D 1557.

Where trenches closely parallel a footing (i.e., for retaining walls) and the trench bottom is located within a 1 horizontal to 1 vertical plane projected downward and outward from any structure footing, concrete slurry backfill should be utilized to backfill the portion of the trench below this plane. The use of concrete slurry is not required for backfill where a narrow trench crosses a footing at about right angles.

SURFACE DRAINAGE

Design of surface drainage is outside GMU's purview and should be designed and confirmed by the project civil engineer to be in accordance with Section 1804.4 of the 2019 CBC.

Surface drainage should be carefully controlled to prevent runoff over graded slope surfaces and ponding of water on flat pad areas. Positive drainage away from graded slopes and pad areas is essential to reduce the potential for erosion or saturation. Maintaining positive drainage of all landscaping areas along with avoiding over-irrigation will help minimize the possibility of "perched" groundwater accumulating slightly below the graded surfaces.

SLOPE LANDSCAPING AND MAINTENANCE

Newly graded slopes within the site should be landscaped and maintained as recommended below:

1. The slopes should be landscaped as soon as practical at the completion of grading. The landscaping should consist of a deep-rooted, drought-resistant and relatively maintenance-free plant species. If landscaping cannot be provided within a reasonable period of time, jute

matting, plastic sheeting, or equivalent, or a spray-on product designed to seal slope surfaces should be considered as a temporary measure to inhibit surface erosion.

2. Irrigation systems should be installed on the slopes and a watering program then implemented which maintains a uniform, near-optimum moisture condition in the soils. Overwatering and subsequent saturation of the slope soils should be avoided. On the other hand, allowing the soils to dry out is also detrimental to slope performance.

3. The irrigation systems should be constructed at the surface only. Construction of sprinkler lines in trenches should be avoided.

4. A permanent slope maintenance program should be initiated. Proper slope maintenance must include the care of drainage and erosion control provisions, rodent control and repair of leaking irrigation systems.

5. The owner is advised that potential problems can develop when drainage on the graded level pad and slopes is altered in any way. Drainage can be altered due to excavations and/or placement of fill, and due to construction of retaining walls.

GEOTECHNICAL FOUNDATION DESIGN PARAMETERS

General

The following geotechnical foundation design parameters for the proposed building and associated exterior improvements to be constructed within the subject lots are based on anticipated conditions within the building pad at the completion of proposed grading and recommended remedial grading.

These recommendations are considered preliminary in nature and may require revisions or additions based on the geotechnical conditions that are actually created during grading and based on the final location and elevation of the proposed building and associated exterior improvements as depicted on future precise grading plans.

At the completion of rough grading and recommended remedial grading, a geotechnical report of observation and testing will be prepared for submittal to the County. In addition, a grading plan review letter will be prepared when precise grading plans become available. This report and letters will provide any necessary revised or additional geotechnical design parameters based on the as-graded conditions and the final proposed location of the building and exterior improvements as shown on the future precise grading plans.

Structure Seismic Design

Based on the average standard penetration resistance (N-value) of the upper 100 feet of subsurface soils, the site is designated as Site Class C ("very dense soil and soft rock" soil profile). The seismic design parameters based on ASCE 7-16 and 2019 CBC are listed in the following Table 1 below.

Table 1: 2019 CBC and ASCE 7-16 Seismic Design Parameters

Seismic Item	Design Values[(a)]	2016 ASCE 7-16 or 2019 CBC Reference
Site Class based on soil profile (ASCE 7-16 Table 20.3-1)	C	ASCE 7-16 Table 20.3-1
Short Period Spectral Acceleration S_s	2.569	CBC Figures 1613.2.1 (1-8)
1-sec. Period Spectral Acceleration S_1	0.888	CBC Figures 1613.2.1 (1-8)
Site Coefficient F_a (2019 CBC Table 1613.2.3(1))	1.2	CBC Table 1613.2.3 (1)
Site Coefficient F_v (2019 CBC Table 1613.2.3(2))	1.4	CBC Table 1613.2.3 (2)
Short Period MCE* Spectral Acceleration S_{MS} $S_{MS} = F_a S_s$	3.082	CBC Equation 16-36
1-sec. Period MCE Spectral Acceleration S_{M1} $S_{M1} = F_v S_1$	1.243	CBC Equation 16-37
Short Period Design Spectral Acceleration S_{DS} $S_{DS} = 2/3S_{Ms}$	2.055	CBC Equation 16-38
1-sec. Period Design Spectral Acceleration S_{D1} $S_{D1} = 2/3S_{M1}$	0.829	CBC Equation 16-39
MCE[(b)] Peak Ground Acceleration (PGA)	1.084	ASCE 7-16 Figures 22-9 to 22-13
Site Coefficient F_{PGA} (ASCE 7-16 Table 11.8-1)	1.2	ASCE 7-16 Table 11.8-1
Modified MCE[(b)] Peak Ground Acceleration (PGA_M)	1.301	ASCE 7-16 Equation 11.8-1
Seismic Design Category	E	ASCE 7-16 Tables 11.6.1 and 11.6.2

(a) Design Values Obtained from USGS Earthquake Hazards Program website that are based on ASCE-7-16 and 2019 CBC and site coordinates of N34.2799371° and W118.5167883°.
(b) MCE: Maximum Considered Earthquake.

Per the 2019 CBC and ASCE 7-16, the Design Earthquake peak ground acceleration (PGA_D) may be assumed to be equivalent to $S_{DS}/2.5$; therefore, for the subject site, a PGA_D value of 0.82g (2.055/2.5) should be used.

It should be recognized that much of southern California is subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. Design utilizing the 2019 CBC is not meant to completely protect against damage or loss of function. Therefore, the preceding parameters should be considered as minimum design criteria.

Building Clearances from Ascending Slopes

To conform with Subarticle 10 of the County of Orange Grading and Excavation Code and Grading Manual and with Section 1808.7.1 and Figure 1808.7.1 of the 2019 CBC, a minimum building clearance of H/2 (one-half of the total slope height) varying from a minimum of 3 feet to a maximum of 15 feet should be maintained between the future building and the toes of the adjacent ascending slopes. Toe-of-slope retaining walls may be used to create the necessary clearances.

As shown on the preliminary grading plan, retaining walls and drainage channels are proposed around the perimeter of the proposed building pad to protect the future building. The perimeter drainage channels should be sized to accommodate typical minor soil debris and surface water runoff volumes. In addition, the toe-of-slope retaining walls should be provided with at least 12 inches of freeboard and designed to support the additional load of minor soil debris.

Foundation Type

As described previously, the results of our laboratory expansion tests on the onsite soil and bedrock materials (Appendix B) indicate that they have a very low to low expansion potential as defined by the CBC. However, it is expected that the onsite soils will be mixed and blended during grading; therefore, an overall low expansion potential should be assumed for design purposes. As required by the CBC, foundations for structures resting on soils with an EI greater than 20 require special design consideration.

It is expected that the proposed building will be designed with a conventional slab-on-ground foundation system. Therefore, the proposed building should be designed with a foundation system that is designed for a low expansive soil condition in accordance with Section 1808.6 of the 2019 CBC. The foundation system will also need to be designed for future anticipated settlements and building loads.

The foundation system should be designed in accordance with the following soil parameters and foundation design recommendations. The foundation system will also need to be designed for future anticipated settlement and building loads.

The methods used in the design and construction of the slab-on-ground foundation system should conform to all applicable and current codes, ordinances, and standards. The allowable limits selected for foundation deflection due to any differential soil expansion should be coordinated with the architect and structural engineer responsible for the design of the structure framing and roof systems. They should confirm that such deflection will not cause excessive distress to those systems or to interior and exterior walls and ceilings of the planned structures.

Soil Parameters

- Bearing Material: Engineered Fill
- Removal and Re-compaction Depth: See ***Remedial Grading*** Section
- Minimum Footing Size:
  - Width: 24 inches
  - Depth: 24 inches embedment below lowest adjacent soil grade (depth)

- Allowable Bearing Capacity: 3,000 psf for the minimum footing size given above.
  - May be increased by 225 psf for each additional foot of width and 675 psf for each additional foot of depth to a maximum allowable bearing pressure of 4,000 psf.
  - Above value may be increased by 1/3 for temporary loads such as wind or seismic
- Settlement:
  - Static Settlement:
    - Total: 1 inch
    - Differential: 0.5 inches over a span of 40 feet
- Lateral Foundation Resistance:
  - Allowable passive resistance: 230 psf/ft (disregard upper 6 inches, max 2,300 psf).
  - Allowable friction coefficient: 0.35
  - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

Slab Subsection and Slab Design Recommendations

Minimum Thickness: The minimum slab thickness shall be 5 inches.

Minimum Slab Reinforcement: Minimum slab reinforcement shall not be less than No. 4 bars placed at 18 inches on center, both ways. Care should be taken to position the reinforcement bars in the center of the slab.

Slab Subgrade

- The upper 18 inches of the slab subgrade soil should be moisture conditioned to minimum of 2% above the optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with the latest version of ASTM D1557.
- Place moisture vapor retarder per the following ***Vapor Retarder/Barrier*** section of this report.

Vapor Retarder/Barrier

- 15 Mil Stego® Wrap, Husky Yellow Guard®, or equivalent
    - Constructed below the entire slab area of the foundation system, including non-living areas.
    - Installed per manufacture's specifications as well as with all applicable recognized installation procedures such as ASTM E 1643-18A.
    - Joints between the sheets and the openings for utility piping should be lapped and taped.
    - If the barrier is not continuously placed across footings/ribs, the barrier should, as a minimum, be lapped into the sides of the footing/rib trenches down to the bottom of the trench.
    - Punctures in the vapor barrier should be repaired prior to concrete placement.

- The moisture vapor retarder may be placed directly on-grade. Prior to placing the retarder, the subgrade should be smooth and free of any protrusions that may damage the retarder.

- The need for sand above the moisture vapor retarder/barrier is not required from a geotechnical perspective. If sand is used, it should consist of at least 2 inches of clean dry sand (see *Note* below).

- To achieve full Green Code compliance, if required, the 15 mil vapor barrier should be underlain by a capillary break as described in the Green Code (i.e. 4-inch-thick layer of ½ inch or larger clean gravel or crushed rock containing no more than 10 percent of material that passes through the No. 4 sieve).

Note: some structural engineers, geotechnical professionals and concrete experts consider the clean sand above the moisture vapor barrier as a layer that can entrap excess water during concrete placement which later migrates up through the slab and adversely impacts moisture-sensitive floor coverings. This potential for future upward moisture intrusion into the concrete slab can be reduced by eliminating the sand layer and placing the concrete directly on the moisture vapor barrier. However, if this sand layer is eliminated, appropriate concrete curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified materials engineer with experience in slab design and construction should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing. Steps will also need to be taken to prevent puncturing of the vapor barrier during concrete placement.

Water Vapor Transmission

As discussed above, placement of a moisture vapor retarder below all slab areas is recommended. This moisture vapor retarder recommendation is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry for residential construction in Southern California. It is not intended to provide a "waterproof" or "vapor proof" barrier or reduce vapor transmission from sources above the retarder. Sources above the retarder include any sand placed on top of the retarder (i.e., to be determined by the project structural designer) and from the concrete itself (i.e., vapor emitted during the curing process). The evaluation of water vapor from any source and its effect on any aspect of the proposed living space above the slab (i.e., floor covering applicability, mold growth, etc.) is outside our purview and the scope of this report.

Floor Coverings

Prior to the placement of flooring, the floor slabs should be properly cured and tested to verify that the water vapor transmission rate (WVTR) is compatible with the flooring requirements.

SITE WALL AND RETAINING WALL DESIGN AND CONSTRUCTION CRITERIA

The following design parameters are considered applicable to site walls and retaining walls to be constructed within the site. The design parameters for the retaining walls assume the use of on-site select backfill in accordance with Plate C-1 – Retaining Wall Construction Detail presented in Appendix C.

Soil Parameters

Bearing Material:	Engineered fill
Allowable Bearing Value:	2500 psf, based on an 18-inch deep by 24-inch wide footing: (see subsequent section for minimum footing embedments.) o May be increased 10% for each additional foot of width and by 20% for each additional foot of depth to a maximum of 4000 psf. o One-third increase for wind or seismic loading.
Coefficient of Friction:	0.35 o One-third increase for wind or seismic loading.

Allowable Passive Resistance:	230 psf/ft (static – level ground) 187.5 psf/ft of depth (static – 2:1 sloping ground) o Disregard upper 6 inches (level ground) o Disregard upper 12 inches (sloping ground) o Reduce passive by one-third when combined with friction in sliding resistance o One-third increase for wind or seismic loading.

Retaining Wall Lateral Earth Pressures

Unit Weight of Backfill:	125 pcf
Static Lateral Earth Pressures:	40 pcf (Active – Level Backfill). 60 pcf (Active – 2:1 Backfill). 55 pcf (At-Rest – Level Backfill). 70 pcf (At-Rest – 2:1 Backfill).

The above values assume the use of select soils in the backfill zone as shown on Plate C-1 of Appendix C. The unrestrained values are applicable only when the walls are designed and constructed as cantilevered walls allowing sufficient wall movement to mobilize active pressure conditions. This wall movement should not be less than 0.01 H (H = height of wall) for the unrestrained values to be applicable.

As mentioned previously, walls proposed at the toes of the adjacent ascending natural slopes should be provided with at least 12 inches of freeboard. **The freeboard sections of the walls should be designed to support saturated soil with an equivalent fluid pressure of 125 pcf.**

Per the 2019 CBC, the following seismic lateral earth coefficients and lateral earth pressures should be utilized for walls with a retaining height in excess of 6 feet. These values are based on a "design level ground" acceleration (PGA) equivalent to $S_{DS}/2.5$ (2.055/2.5 = 0.82g).

Seismic Lateral Earth Coefficient:	$K_H = (0.5)PGA = (0.5)0.82g = 0.41g$
Seismic Earthquake Pressure (EFP):	40 pcf

Waterproofing

The back side of all retaining walls should be waterproofed down to and across the top of the foundation prior to placing subdrains or backfill. The design and selection of the waterproofing system is outside our purview.

Wall Backfill and Drainage

See Retaining Wall Construction Details (Plate C-1 of Appendix C) for backfill and drainage requirements.

POLE FOUNDATIONS

It is expected that the shade structures and light poles will be supported on pole foundations. As a minimum, the pole foundations should be at least 18 inches in diameter and at least 4 feet deep; however, the actual dimensions should be determined by the project structural engineer based on the following design parameters.

Bearing Materials. The pole foundations may bear into engineered fill soils or competent native soils approved by a representative of the Geotechnical Engineer of Record.

Bearing Values. End-bearing capacity and skin friction may be combined to determine the allowable bearing capacities of the pole foundations. An allowable bearing pressure of 3,000 pounds per square foot (psf) may be used for pole foundations at least 18 inches in diameter and embedded a minimum of 4 feet below the lowest adjacent grade.

Lateral Load Design. Lateral loads may be resisted by passive resistance within the adjacent earth materials. For passive resistance, an allowable passive earth pressure of 230 pounds per foot of pile diameter per foot of depth into competent bearing material may be used; however, passive resistance should be disregarded within the upper foot due to possible disturbance during drilling. The passive resistance value may be applied over an area equivalent to two pile diameters.

STRUCTURAL CONCRETE

Laboratory tests indicate that the onsite soils are classified as having a "negligible" sulfate exposure and "S0" sulfate exposure category per ACI 318-14, Table 19.3.1.1. However, due to the low to moderate soil resistivity and elevated chloride contents obtained from our test result, the on-site soil is severely corrosive to ferrous metals such as reinforcing steel. On this basis, we recommend that a Type II/V cement with a maximum water to cement ratio of 0.50 be used for structural elements (i.e., foundations, walls, etc.). Utilization of CBC moderate sulfate level requirements will also serve to reduce the permeability of the concrete and help minimize the potential of water and/or vapor transmission through the concrete. Wet curing of the concrete per ACI Publication 308 is also recommended.

The aforementioned recommendations regarding concrete are made from a soils perspective only. Final concrete mix design is beyond our purview. All applicable codes, ordinances, regulations,

and guidelines should be followed in regard to the designing a durable concrete with respect to the potential for sulfate exposure from the on-site soils and/or changes in the environment.

FERROUS METAL CORROSION PROTECTION

The results of the laboratory chemical tests performed on a sample of soil collected within the site indicate that the on-site soils are corrosive to ferrous metals. Consequently, metal structures which will be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal sign posts, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to corrosion. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential. Additional provisions will be required to address high chloride contents of the soil per the 2016 CBC to protect the concrete reinforcement. The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary).

The above discussion is provided for general guidance in regards to the corrosiveness of the on-site soils to typical metal structures used for construction. Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview. If detailed testing is required, a corrosion engineer should be consulted to perform the testing and develop appropriate mitigation measures.

ASPHALT CONCRETE PAVEMENT THICKNESS RECOMMENDATIONS

Based on the R-value test results, an R-value of 24 was used for the design. Table 2 below provides recommended minimum thicknesses for asphalt concrete (AC) and aggregate base sections for two traffic indices.

Table 2: Recommended Minimum AC and Base Section Thicknesses

Location	R-Value	Traffic Index	Asphalt Concrete (in.)	Aggregate Base* (in.)
Driveways	24	5.5	4.0	6.0
Parking Stalls	24	4.0	4.0	4.0

* assumed R-Value = 78

Asphalt concrete pavement construction should be in accordance with the following recommendations:

- The planned pavement structural sections should consist of aggregate base materials (AB) and asphalt concrete materials (AC) of a type meeting the minimum Greenbook and City of Los Angeles requirements.
- The subgrade soils should be prepared in accordance with the ***Remedial Grading*** section of this report, and Fill Material and Placement section of this report.
- The AB and AC should be compacted to at least 95% relative compaction.

CONCRETE FLATWORK DESIGN

We recommend that the subgrade for the subject concrete flatwork be moisture conditioned to 2% over optimum to a depth of 18 inches below finish grade and compacted to 90% relative compaction. Please see Table 3 below for summary of flatwork recommendations:

Table 3: Concrete Flatwork Recommendations

Description	Subgrade Preparation (1)	Minimum Concrete Thickness	Reinforcement(2)	Joint Spacing (Max.)	Concrete(3)
Concrete Paving (Patio, flatwork, sidewalk) (< 5 feet in width)	2% over optimum to 18 inches at 90% relative compaction	4 inches	1) No. 3 bars at 24" o.c. extend into thickened edge, 2) Thickened Edge: two horizontal No. 3 bar placed at the top and bottom 3) dowel into building and curb using 9-inch Speed Dowels @ 18"o.c	5 feet	Type II/V
Concrete Paving (Patio, flatwork, sidewalk) (> 5 feet in width)	2% over optimum to 18 inches at 90% relative compaction	4 inches	1) No. 3 bars at 24" o.c. extend into thickened edge, 2) Thickened Edge: two horizontal No. 3 bar placed at the top and bottom 3) dowel into building and curb using 9-inch Speed Dowels @ 18"o.c	8 feet	Type II/V

(1) The moisture content and compaction of the subgrade must be verified by the geotechnical consultant prior to placement of concrete/reinforcement. .
(2) Reinforcement to be placed in the middle of the recommended concrete section.
(3) Final concrete mix design to be supplied by others.

PLANTERS AND TREES

Where new trees or large shrubs are to be located in close proximity of new concrete flatwork, rigid moisture/root barriers should be placed around the perimeter of the flatwork to at least 2 feet in depth in order to offer protection to the adjacent flatwork against potential root and moisture damage. Existing mature trees near flatwork areas should also incorporate a rigid moisture/root barrier placed at least 2 feet in depth below the top of the flatwork.

BIORETENTION AREAS

If bioretention area are incorporated into the design, we recommend that an impermeable liner be installed at the bottom and in the sides of all bioretention areas at the subject site to prevent lateral water migration into the adjacent structures and pavements.

PLAN REVIEW / GEOTECHNICAL TESTING DURING GRADING

Plan Review

GMU should review the final construction plans (grading and foundation plans) to confirm that they are consistent with our recommendations provided in this report.

Geotechnical Testing

Geotechnical observation and testing should be performed by the Geotechnical Engineer of Record during the following stages of precise grading and construction:

- During site clearing and grubbing.
- During removal of any buried irrigation lines utilities, foundations, or other subsurface structures.
- During all phases of grading including over-excavation, temporary excavations, removals, scarification, ground preparation, moisture conditioning, proof-rolling, and placement and compaction of all fill materials.
- During remedial grading for the proposed building and associated site improvements.
- During pavement and flatwork section placement and compaction.
- During backfill of retaining walls and installation of subsurface drainage.
- Foundation and slab construction.
- During backfill of underground utilities.
- When any unusual conditions are encountered.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgments. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and site construction will be identical to those observed, sampled, and interpreted during our study, or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the grading and use of the property.

Our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during construction and grading of the project to observe the actual conditions exposed, to verify our design concepts and the grading contractor's general compliance with the project geotechnical specifications, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report. Since our conclusions and recommendations are based on a limited amount of current and previous geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during grading of the project.

It should be further noted that the recommendations presented herein are intended solely to minimize the effects of post-construction soil movements. Consequently, minor cracking and/or distortion of all on-site improvements should be anticipated.

This report has not been prepared for the use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

CLOSURE

If you have any questions concerning our findings or recommendations, please do not hesitate to contact us and we will be happy to discuss them with you. The Plates and Appendices that complete this report are listed in the Table of Contents.

Respectfully submitted,

David Hansen, M. c, PE, GE 3056
Associate Geotechnical Engineer

Aron Taylor, M.Sc., PG, CEG 2455
Principal Geologist

dwh/20-307-00 (11-22-2022)

REFERENCES

SITE-SPECIFIC REFERENCES

(1) *Morningstar of Granada Hills, 17551 – 17563 Rinaldi Street, Granada Hills, CA*; prepared by HPI Architecture, dated October 3, 2022.

(2) *Conceptual Grading Plan, Morningstar Senior Living*; prepared by David Evans and Associates, Inc., dated October 3, 2022.

TECHNICAL REFERENCES

California Building Standards Commission and International Conference of Building Officials, 2019, *2019 California Building Code.*

California Geological Survey, Department of Conservation, Seismic Hazard Zone Report for the Oat Mountain 7.5-Minute Quadrangle, Los Angeles County California, 1997. Seismic Hazard Zone Report 05.

Dibblee, T.W., and Ehrenspeck, H.E., ed., 1992, Geologic Map of the Oat Mountain and Canoga Park (north ½) Quadrangles, Los Angeles County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-36, scale 1:24,000.

Standard Specifications for Public Works Construction, by Public Works Standards, Inc., 2018, *The Greenbook 2018 Edition*.

U.S. Geological Survey, 2013a, 2014 Interactive De-aggregations Program; web site address: http://geohazards.usgs.gov/deaggint/2008/.

U.S. Geological Survey, 2013b, U.S. Seismic Design Maps, web site address: http://earthquake.usgs.gov/hazards/designmaps/usdesign.php.

APPENDIX A

Geotechnical Exploration Procedures and Logs

APPENDIX A

GMU GEOTECHNICAL EXPLORATION PROCEDURES AND LOGS

Our exploration at the subject site consisted of five (5) drill holes and seven (7) test pits. The estimated locations of the explorations are shown on Plate 2 – Geotechnical Map. Our drill holes were logged by a Staff Geologist and Staff Engineer, and (California Modified, bulk, and SPT samples of the excavated soils were collected. "Undisturbed" samples were taken using a 3.0-inch thin walled, outside-diameter drive sampler which contains a 2.416-inch-diameter brass sample sleeve 6 inches in length. Blow counts recorded during sampling from the California Modified and SPT sampler are shown on the drill hole and test pit logs. The logs of each drill hole and test pit are contained in this Appendix A, and the Legend to Logs is presented as Plate A-1 and A-2.

The geologic and engineering field descriptions and classifications that appear on these logs are prepared according to Corps of Engineers and Bureau of Reclamation standards. Major soil classifications are prepared according to the Unified Soil Classification System as modified by ASTM Standard No. 2487. Since the descriptions and classifications that appear on the Log of Borings and Test Pits are intended to be that which most accurately describe a given interval of a boring and test pit (frequently an interval of several feet), discrepancies do occur in the Unified Soil Classification System nomenclature between that interval and a particular sample in that interval. For example, an 8-foot-thick interval in a log may be identified as silty sand (SM) while one sample taken within the interval may have individually been identified as sandy silt (ML). This discrepancy is frequently allowed to remain to emphasize the occurrence of local textural variations in the interval.

MAJOR DIVISIONS			Group Letter	Symbol	TYPICAL NAMES
COARSE-GRAINED SOILS More Than 50% Retained On No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	GRAVELS 50% or More of Coarse Fraction Retained on No.4 Sieve	Clean Gravels	GW		Well Graded Gravels and Gravel-Sand Mixtures, Little or No Fines.
			GP		Poorly Graded Gravels and Gravel-Sand Mixtures Little or No Fines.
		Gravels With Fines	GM		Silty Gravels, Gravel-Sand-Silt Mixtures.
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures.
	SANDS More Than 50% of Coarse Fraction Passes No.4 Sieve	Clean Sands	SW		Well Graded Sands and Gravelly Sands, Little or No Fines.
			SP		Poorly Graded Sands and Gravelly Sands, Little or No Fines.
		Sands With Fines	SM		Silty Sands, Sand-Silt Mixtures.
			SC		Clayey Sands, Sand-Clay Mixtures.
FINE-GRAINED SOILS 50% or More Passe The No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	SILTS AND CLAYS Liquid Limit Less Than 50%		ML		Inorganic Silts, Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity.
			CL		Inorganic Clays of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit 50% or Greater		MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts.
			CH		Inorganic Clays of High Plasticity, Fat Clays.
			OH		Organic Clays of Medium To High Plasticity, Organic Silts.
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils.

The descriptive terminology of the logs is modified from current ASTM Standards to suit the purposes of this study

ADDITIONAL TESTS

DS = Direct Shear
HY = Hydrometer Test
TC = Triaxial Compression Test
UC = Unconfined Compression
CN = Consolidation Test
(T) = Time Rate
EX = Expansion Test
CP = Compaction Test
PS = Particle Size Distribution
EI = Expansion Index
SE = Sand Equivalent Test
AL = Atterberg Limits
FC = Chemical Tests
RV = Resistance Value
SG = Specific Gravity
SU = Sulfates
CH = Chlorides
MR = Minimum Resistivity
pH
(N) = Natural Undisturbed Sample
(R) = Remolded Sample
CS = Collapse Test/Swell-Settlement

GEOLOGIC NOMENCLATURE

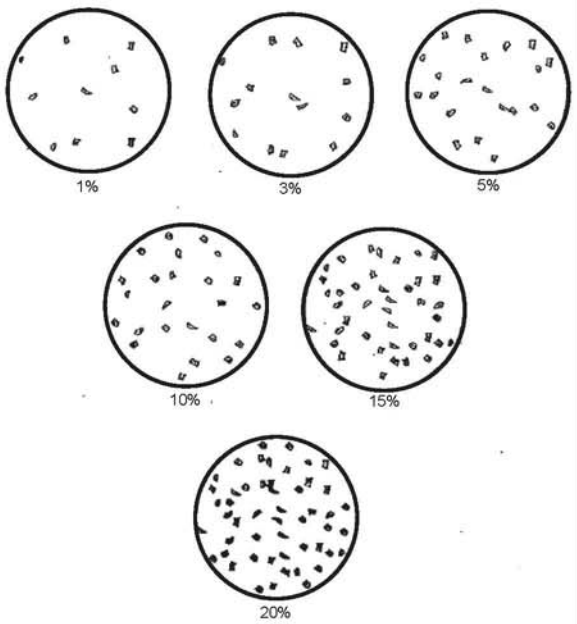
B = Bedding C = Contact J = Joint
F = Fracture Flt = Fault S = Shear
RS = Rupture Surface = Seepage
= Groundwater

SAMPLE SYMBOLS

Undisturbed Sample (California Sample)
Undisturbed Sample (Shelby Tube)
Bulk Sample
Unsuccessful Sampling Attempt
SPT Sample

5
10 Blows per 6-Inches Penetration
15

10: 10 Blows for 12-Inches Penetration
6/4": 6 Blows for 4-Inches Penetration
P: Push
(13): Uncorrected Blow Counts ("N" Values) for 12-Inches Penetration- Standard Penetration Test (SPT)



GMU

LEGEND TO LOGS

ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
A-1

P8-11/16/2012

SOIL DENSITY/CONSISTENCY

FINE GRAINED

Consistency	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Soft	Easily penetrated by thumb, exudes between fingers	<2	<3
Soft	Easily penetrated one inch by thumb, molded by fingers	2-4	3-6
Firm	Penetrated over 1/2 inch by thumb with moderate effort	4-8	6-12
Stiff	Penetrated about 1/2 inch by thumb with great effort	8-15	12-25
Very Stiff	Readily indented by thumbnail	15-30	25-50
Hard	Indented with difficulty by thumbnail	>30	>50

COARSE GRAINED

Density	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Loose	Easily penetrated with 0.5" rod pushed by hand	<4	<5
Loose	Easily penetrated with 0.5" rod pushed by hand	4-10	5-12
Medium Dense	Easily penetrated 1' with 0.5" rod driven by 5lb hammer	10-30	12-35
Dense	Dificult to penetrat 1' with 0.5" rod driven by 5lb hammer	31-50	35-60
Very Dense	Penetrated few inches with 0.5" rod driven by 5lb hammer	>50	>60

BEDROCK HARDNESS

Density	Field Test	SPT (#blows/foot)
Soft	Can be crushed by hand, soil like and structureless	1-30
Moderately Hard	Can be grooved with fingernails, crumbles with hammer	30-50
Hard	Can't break by hand, can be grooved with knife	50-100
Very Hard	Scratches with knife, chips with hammer blows	>100

MODIFIERS

Trace	1%
Few	1-5%
Some	5-12%
Numerous	12-20%
Abundant	>20%

GRAIN SIZE

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than a basketball
Cobbles		3-12"	3-12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4-3"	3/4-3"	Thumb-sized to fist-sized
	Fine	#4-3/4"	0.19-0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19"	Rock-salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079"	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017"	Flour-sized to sugar-sized
Fines		passing #200	<0.0029"	Flour-sized and smaller

MOISTURE CONTENT

Dry- Very little or no moisture
Damp- Some moisture but less than optimum
Moist- Near optimum
Very Moist- Above optimum
Wet/Saturated- Contains free moisture

GMU

LEGEND TO LOGS

ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
A-2

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-1

Date(s) Drilled	**10/9/20**	Logged By	**RC**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**50.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8"**	Approx. Surface Elevation, ft MSL	**1131.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**California Modified sampler with 6-inch sleeve/SPT**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1130			**ARTIFICIAL FILL UNDOCUMENTED (Qaf)**		SILTY SAND (SM); yellowish brown, damp to moist, medium dense to dense, fine to coarse grained sand						
1125	5		**OLDER ALLUVIUM (Qoal)**		SILTY SAND (SM); yellowish brown, damp to moist, very dense, fine to coarse grained sand		31 50/6"		8	118	
1120	10		**SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)** Weathered Sandstone		SILTY SANDSTONE (SM); light brown, dry to damp, very dense, fine to coarse grained sand		50/5"		3	123	CN
1115	15						40 50/6"		4		PS

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Log of Drill Hole DH-1

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1110			**SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)**		SILTY SANDSTONE (SM); light brown, dry to damp, very dense, fine to coarse grained sand		50/4"		5	113	
	25				CLAYEY SILTSTONE (ML); light brown, damp to moist, very dense, fine grained sand		50/4"		8		PS, AL
1105											
	30		Black pinholes				50/4"		15	118	CN
1100											
	35				Becomes dense		10 18 21				
1095											
	40						50/6"		5	109	
1090					SILTY SANDSTONE (SM); light brown, dry to damp, very dense, fine to medium grained sand						

Project: Confluent Development
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Log of Drill Hole DH-1

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1085			**SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)**		SILTY SANDSTONE (SM); light brown, dry to damp, very dense, fine to medium grained sand		50/4"				
					CLAYEY SANDSTONE (SC); brown, moist, very dense, fine to medium grained sand						
	50				SILTY SANDSTONE (SM); light brown, moist, very dense, fine to medium grained sand		50/5"		10	109	
					Total Depth: 50.5' No groundwater						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-2

Date(s) Drilled	**10/9/20**	Logged By	**RC**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**21.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8"**	Approx. Surface Elevation, ft MSL	**1122.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**California Modified sampler with 6-inch sleeve/SPT**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1120	0		**ARTIFICIAL FILL UNDOCUMENTED (Qaf)** Some rootlets		CLAYEY SAND (SC); dark brown, damp, medium dense, trace fine grained sand				7		PS, HY, AL, FC
	5				SANDY CLAY (CL); brown, dry to damp, stiff, fine grained		12 12 16		5	111	
1115											
	10		**OLDER ALLUVIUM (Qoal)**		SANDY CLAY (CL); brown, dry to damp, stiff, fine grained		8 12 18				
1110											
	15				SILTY SAND (SM); light brown, dry to damp, very dense, fine to corase grained sand, some gravel up to 1" diameter		34 50/4"		4	114	PS
1105			Possible weathered bedrock Rig chatter								

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Drill Hole DH-2

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-2

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)		SILTY SANDSTONE (SM); light brown, dry to damp, very dense, fine grained sand		15 25 49				
					Total Depth: 21.5' No groundwater						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-3

Date(s) Drilled	**10/9/20**	Logged By	**RC**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**21.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8"**	Approx. Surface Elevation, ft MSL	**1124.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**California Modified sampler with 6-inch sleeve/SPT**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL UNDOCUMENTED (Qaf) Gravel up to 3/8"		SILTY CLAY (CL); dark grayish brown, dry to damp, stiff, trace fine grained sand, trace gravel				8		CP
1120	5				Becomes very stiff		9 9 11				
1115	10		**OLDER ALLUVIUM (Qoal)**		CLAYEY SAND to SILTY SAND (SC-SM); light brown, medium dense, fine grained sand		13 13 19		6	118	
1110	15				SANDY CLAY (CL); light brown, damp, hard, very fine grained sand		12 21 27		9		PS
1105											

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Project Location: Granada Hills, CA
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Log of Drill Hole DH-3

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)		SILTY SANDstone (SM); light brown, damp, very dense, fine to coarse grained sand, trace gravel up to 2"		30 33 50/4"		6	102	
					Total Depth: 21.5' No groundwater						

Project: Confluent Development **Project Location: Granada Hills, CA** **Project Number: 20-307-00**	**Log of Drill Hole DH-4** Sheet 1 of 2

Date(s) Drilled **10/9/20**	Logged By **RC**	Checked By **NS**
Drilling Method **Hollow Stem Auger**	Drilling Contractor **2R Drilling**	Total Depth of Drill Hole **20.7 feet**
Drill Rig Type **CME 75**	Diameter(s) of Hole, inches **8"**	Approx. Surface Elevation, ft MSL **1129.0**
Groundwater Depth [Elevation], feet **NA []**	Sampling Method(s) **California Modified sampler with 6-inch sleeve/SPT**	Drill Hole Backfill **Native**
Remarks		Driving Method and Drop **140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1125			**ARTIFICIAL FILL UNDOCUMENTED (Qaf)**		SILTY SAND (SM); light brown, damp to moist, dense, fine to coarse grained sand, some gravel up to 3/8"						
	5		**OLDER ALLUVIUM (Qoal)**		SILTY SAND (SM); light brown, damp to moist, very dense, fine to coarse grained sand, some gravel up to 3/8"		21 42 50/5"		7		PS
1120											
	10		Granitic sands				31 50/4"		5	119	
1115											
	15				Becomes white to light brown		28 50/6"				
1110											

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Project Location: Granada Hills, CA
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Log of Drill Hole DH-4

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA			TEST DATA		
						SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Possible weathered bedrock				40 50/2"		5	109	
					Total Depth: 20.5' No groundwater						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-5

Date(s) Drilled	**10/9/20**	Logged By	**RC**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling**	Total Depth of Drill Hole	**51.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8"**	Approx. Surface Elevation, ft MSL	**1132.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**California Modified sampler with 6-inch sleeve/SPT**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1130	0		**ARTIFICIAL FILL UNDOCUMENTED (Qaf)**		SILTY CLAY (CL); dark brown, damp, very stiff, trace fine grained sand						FC
1125	5		**OLDER ALLUVIUM (Qoal)** White pinholes		SILTY SAND (SM); light brown, dry to damp, dense to very dense, fine grained sand		21 50/6"		14	115	CN
1120	10						14 24 24		6		PS, AL
1115	15						25 35 35		7		

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Project Location: Granada Hills, CA
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Log of Drill Hole DH-5

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)		SILTY SANDSTONE (SM); white to light brown, dry to damp, dense, fine grained sand		18 21 24				
1110											
	25						27 50/5"		6	107	CN
1105											
	30						21 50/6"				
1100											
	35				Becomes light brown		30 50/4"		10	101	
1095											
	40						23 50/6"				
1090											
					CLAYEY SILTSTONE (ML); brown, moist, firm, fine grained sand						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole DH-5

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)				37 50/3"		9	108	
1085					SILTY SANDSTONE (SM); white to light brown, damp, very dense, fine grained sand						
	50						19 38 50/6"				
					Total Depth: 51.5' No groundwater						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-1

Date(s) Drilled **10/12/2020**	Logged By **DW**	Checked By
Drilling Method **Backhoe**	Drilling Contractor **JES**	Total Depth of Drill Hole **8.5 feet**
Drill Rig Type	Diameter(s) of Hole, inches	Approx. Surface Elevation, ft MSL **1131.0**
Groundwater Depth [Elevation], feet **NA []**	Sampling Method(s) **Bulk**	Drill Hole Backfill **Native**
Remarks		Driving Method and Drop **Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1130			**ARTIFICIAL FILL, UNDOCUMENTED (Qafu)** PVC fragments, clay bricks, platic, asphalt fragments Concrete fragments		SILTY SAND (SM) with CLAY; yellowish brown, damp, medium dense to dense, fine to coarse grained sand, some gravel Increased CLAY abundance	X					
			OLDER ALLUVIUM (Qoal) Faint soil structure		SANDY CLAY (CL); yellowish brown, moist, stiff, fine grained sand						
	5				SANDY CLAY - CLAYEY SAND (CL-SC); yellowish brown, damp, moist, dense, fine to medium grained sand	X					
1125			**SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)** Highly weathered, highly fractured, no discernible bedding		SANDSTONE; yellowish brown with white staining, damp, moderately hard, fine grained sand Total Depth = 8.5' No Caving No Groundwater						

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Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-2

Sheet 1 of 1

Date(s) Drilled	**10/8/2020**	Logged By	**DW**	Checked By	
Drilling Method	**Backhoe**	Drilling Contractor	**JES**	Total Depth of Drill Hole	**10.5 feet**
Drill Rig Type		Diameter(s) of Hole, inches		Approx. Surface Elevation, ft MSL	**1144.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**Open drive sampler with 8-inch sleeve, Bulk**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL, UNDOCUMENTED (Qafu) Abundant bioturbation near the surface, 1/4" metal wire, angular to subround gravel up to 2", angular fine grained sandstone fragments		SILTY SAND (SM) with some CLAY; medium brown, dry, dense, fine to coarse grained sand, few gravels and bedrock fragments				7		RV
			Subround gravel 0.25"		SILTY SAND (SM) with some CLAY; yellowish brown, damp, medium dense to dense, fine to medium grained sand, few gravels		22/12"	140	7	115	
			Possibly faint lift, concrete fragments		Increased clay abundance, medium brown						
1140			~2" granitic gravel slightly decomposed		Becomes yellowish brown, damp to moist, dense						
	5		Asphalt fragments								
			Asphalt fragments		CLAYEY SAND (SC); medium brown and brownish yellow, moist to very moist, dense, fine to coarse grianed sand, some gravel		20/12"	140	10	119	
			Wood fragments		Becomes very moist to wet, no free water						
1135			**OLDER ALLUVIUM (Qoal)** Sandy silt lenses, faint ped surfaces around clasts, some pinhole porosity, some very dense lenses, some gray lenses, no recovery - sample slid out of sleeve		CLAYEY SAND (SC); reddish brown, yellow, and gray, very moist, dense to very dense, fine to coarse grained sand, some gravel		11/12"	140			
	10				Total Depth = 10.5' No Caving No Groundwater						

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Drill Hole TP-2

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-3

Date(s) Drilled	**10/8/2020**	Logged By	**DW**	Checked By	
Drilling Method	**Backhoe**	Drilling Contractor	**JES**	Total Depth of Drill Hole	**9.0 feet**
Drill Rig Type		Diameter(s) of Hole, inches		Approx. Surface Elevation, ft MSL	**1145.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**Open drive sampler with 8-inch sleeve, Bulk**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL, UNDOCUMENTED (Qafu) Angular to subround gravel up to 3", few asphalt fragments, fine grained sandstone fragments Granitic clasts		SILTY SAND (SM); light brown, dry, very dense, fine to coarse grained sand, some gravel and bedrock fragments						
			Asphalt fragments in sampler spoils, piece of rubber hose				31/12"	140	5	104	
1140	5		Hard digging, large (1-1.5') concrete fragments, subround cobble approximately 8"		Becomes damp, numerous gravels, few cobbles						
			OLDER ALLUVIUM (Qoal) Some rootlets, some caliche, pinhole porosity, subangular cobble 8-10"		SILTY SAND to CLAYEY SAND (SM-SC); medium brown, damp, very dense, fine to coarse grained sand, some gravel, some cobble						
					Total Depth = 9' No Caving No Groundwater						

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Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-4

Sheet 1 of 1

Date(s) Drilled	**10/12/2020**	Logged By	**DW**	Checked By	
Drilling Method	**Backhoe**	Drilling Contractor	**JES**	Total Depth of Drill Hole	**10.0 feet**
Drill Rig Type		Diameter(s) of Hole, inches		Approx. Surface Elevation, ft MSL	**1147.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**Bulk**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1145			**ARTIFICIAL FILL, UNDOCUMENTED (Qafu)** Hard digging Old 4" PVC pipe filled with soil Angular to subround gravel up to 3", granitic clasts		SILTY SAND (SM) with CLAY; yellowish brown, dry, very dense, fine to coarse grained sand, some to numerous gravel Becomes brownish yellow						
	5		**OLDER ALLUVIUM (Qoal)** Some rootlets, rare roots up to 0.25", some pinhole caliche 1" root, subround cobble 4-6", moderate porosity Homogeneous		CLAYEY SAND to SILTY SAND (SC-SM); brown, damp, dense to very dense, fine to medium grained sand, some coarse grained sand, some gravel, rare cobble	X					
1140			Some rootlets, pinhole porosity		Increased clay abundance						
	10				Total Depth = 10' No Caving No Groundwater						

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Drill Hole TP-4

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-5

Sheet 1 of 1

Date(s) Drilled	**10/12/2020**	Logged By	**DW**	Checked By	
Drilling Method	**Backhoe**	Drilling Contractor	**JES**	Total Depth of Drill Hole	**9.0 feet**
Drill Rig Type		Diameter(s) of Hole, inches		Approx. Surface Elevation, ft MSL	**1156.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**Bulk**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1155			**ARTIFICIAL FILL, UNDOCUMENTED (Qafu)** Moderate porosity, some roots up to 1"		SILTY SAND (SM) with some CLAY; brown, dry, very dense, fine to coarse grained sand, some gravel						
			Angular to subround gravel up to 2", some granitic clasts. concrete fragment 1.5'		SILTY SAND (SM); brownish yellow to yellow, dry, dense, fine to coarse grained sand, some gravel						
			OLDER ALLUVIUM (Qoal) Some rootlets, pinhole porosity, subround gravel ~0.25"		CLAYEY SAND to SILTY SAND (SC-SM); brown, damp, dense to very dense, fine to medium grained sand, some coarse grained sand, some gravel						
	5		Subround cobble 4-6"		Few cobble						
1150			Slightly decomposed granitic cobbles Some caliche on soil structure fractures, porous		Increased CLAY abundance, very dense						
			Roothole porosity								
			Hard digging, pinhole porosity								
					Total Depth = 9' Refusal on Very Dense Alluvium No Caving No Groundwater						

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Drill Hole TP-5

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-6

Date(s) Drilled **10/12/2020**	Logged By **DW**	Checked By
Drilling Method **Backhoe**	Drilling Contractor **JES**	Total Depth of Drill Hole **4.2 feet**
Drill Rig Type	Diameter(s) of Hole, inches	Approx. Surface Elevation, ft MSL **1140.0**
Groundwater Depth [Elevation], feet **NA []**	Sampling Method(s) **Bulk**	Drill Hole Backfill **Native**
Remarks		Driving Method and Drop **Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			ARTIFICIAL FILL, UNDOCUMENTED (Qafu) Subangular to subround gravel up to 2", PVC fragments		SILTY SAND to CLAYEY SAND (SM-SC); grayish brown, damp, dense, fine to coarse grained sand, some gravel, some bedrock fragments						
			2" rusted metal pipe - old irrigation line? Digging beyond the pipe with hand equipment exposed abundant bedrock fragments - possible contact or bedrock adundant fill		Numerous sandstone fragments Total Depth = 4.2' Refusal on Metal Pipe No Caving No Groundwater						

Project: Confluent Development
Project Location: Granada Hills, CA
Project Number: 20-307-00

Log of Drill Hole TP-7

Sheet 1 of 1

Date(s) Drilled	**10/12/2020**	Logged By	**DW**	Checked By	
Drilling Method	**Backhoe**	Drilling Contractor	**JES**	Total Depth of Drill Hole	**6.0 feet**
Drill Rig Type		Diameter(s) of Hole, inches		Approx. Surface Elevation, ft MSL	**1158.0**
Groundwater Depth [Elevation], feet	**NA []**	Sampling Method(s)	**Bulk**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**Cat Head**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
1155			**ARTIFICIAL FILL, UNDOCUMENTED (Tsr)** Numerous concrete fragments up to 2', cinder blocks, clay bricks - abundant buried debris		SILTY SAND (SM) with CLAY; grayish brown, damp, dense, fine to coarse grained sand, numerous fine gravel, some coarse gravel, few cobble						
	5		**SAUGUS FORMATION, SUNSHINE RANCH MEMBER (Tsr)** Moderately weathered, highly fractured, no discernible bedding		SANDSTONE; brownish yellow with white staining, damp, moderately hard, fine grained sand	X					
					Total Depth = 6' Minor Caving of Debris No Groundwater						

DH_REV3 20-307-00.GPJ GMULAB.GPJ 11/11/20

APPENDIX B

Geotechnical Laboratory Procedures and Test Results

APPENDIX B

GMU GEOTECHNICAL LABORATORY PROCEDURES AND TEST RESULTS

MOISTURE AND DENSITY

Field moisture content and in-place density were determined for each 6-inch sample sleeve of undisturbed soil material obtained from the drill holes. The field moisture content was determined in general accordance with ASTM Test Method D 2216 by obtaining one-half the moisture sample from each end of the 6-inch sleeve. The in-place dry density of the sample was determined by using the wet weight of the entire sample.

At the same time the field moisture content and in-place density were determined, the soil material at each end of the sleeve was classified according to the Unified Soil Classification System. The results of the field moisture content and in-place density determinations are presented on the right-hand column of the Log of Drill Hole and are summarized on Table B-1. The results of the visual classifications were used for general reference.

PARTICLE SIZE DISTRIBUTION

As part of the engineering classification of the materials underlying the site, samples were tested to determine the distribution of particle sizes. The distribution was determined in general accordance with ASTM Test Method D 422 using U.S. Standard Sieve Openings 3", 1.5", 3/4, 3/8, and U.S. Standard Sieve Nos. 4, 10, 20, 40, 60, 100, and 200. The results of the tests are contained in Appendix B. Key distribution categories (% gravel; % sand, etc.) are contained on Table B-1.

ATTERBERG LIMITS

As part of the engineering classification of the soil material, samples of the on-site soil material were tested to determine relative plasticity. This relative plasticity is based on the Atterberg limits determined in general accordance with ASTM Test Method D 4318. The results of these tests are contained in this Appendix B and also Table B-1.

CHEMICAL TESTS

The corrosion potential of typical on-site materials under long-term contact with both metal and concrete was determined by chemical and electrical resistance tests. The soluble sulfate test for potential concrete corrosion was performed in general accordance with California Test Method 417, the minimum resistivity test for potential metal corrosion was performed in general accordance with California Test Method 643, and the concentration of soluble chlorides was determined in general accordance with California Test Method 422. The results of these tests are contained in Appendix B and also Table B-1.

COMPACTION TESTS

A bulk sample representative of the on-site materials was tested to determine the maximum dry density and optimum moisture content of the soil. These compactive characteristics were determined in general accordance with ASTM Test Method D 1557. The results of this test are contained in Appendix B and also Table B-1.

CONSOLIDATION TESTS

The one-dimensional consolidation properties of "undisturbed" samples were evaluated in general accordance with the provisions of ASTM Test Method D 2435. Sample diameter was 2.416 inches and sample height was 1.00 inch. Water was added during the test at various normal loads to evaluate the potential for hydro-collapse and to produce saturation during the remainder of the testing. Consolidation readings were taken regularly during each load increment until the change in sample height was less than approximately 0.0001 inch over a two-hour period. The graphic presentation of consolidation data is a representation of volume change in change in axial load. In addition, time rate tests were performed for select samples. The results of these tests are contained in Appendix B.

DIRECT SHEAR STRENGTH TESTS

Direct shear tests were performed on typical on-site materials. The general philosophy and procedure of the tests were in accord with ASTM Test Method D 3080 - "Direct Shear Tests for Soils Under Consolidated Drained Conditions".

The tests are single shear tests and are performed using a sample diameter of 2.416 inches and a height of 1.00 inch. The normal load is applied by a vertical dead load system. A constant rate of strain is applied to the upper one-half of the sample until failure occurs. Shear stress is monitored by a strain gauge-type precision load cell and deflection is measured with a digital dial indicator. This data is transferred electronically to data acquisition software which plots shear strength vs. deflection. The shear strength plots are then interpreted to determine either

peak or ultimate shear strengths. Residual strengths were obtained through multiple shear box reversals. A strain rate compatible with the grain size distribution of the soils was utilized. The interpreted results of these tests are shown in Appendix B.

R-VALUE TESTS

A bulk samples representative of the underlying on-site materials was tested to measure the response of a compacted sample to a vertically applied pressure under specific conditions. The R-value of a material is determined when the material is in a state of saturation such that water will be exuded from the compacted test specimen when a 16.8 kN load (2.07 MPa) is applied. The results from these test procedures are reported in this Appendix B-1.

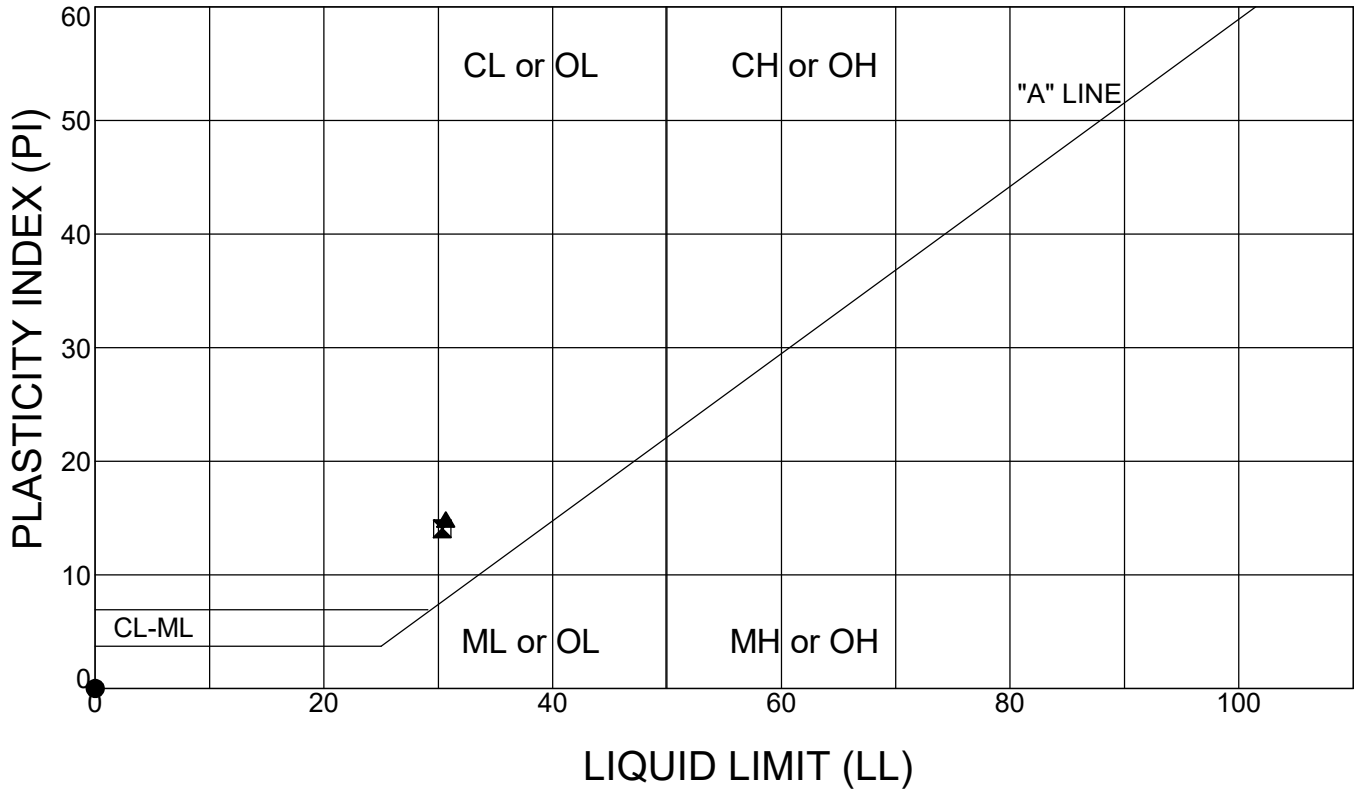
TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur-ation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-1	5	1126.0	Qoal	SM	7.7	118	51															
DH-1	10	1121.0	Qoal	SW	3.4	123	26															
DH-1	15	1116.0	Qoal	SM	4.0					17												
DH-1	20	1111.0	Qoal	SM	5.2	113	30															
DH-1	25	1106.0	Tsr	ML	8.3					53		NP	NP	NP								
DH-1	30	1101.0	Tsr	ML	15.4	118	100															
DH-1	40	1091.0	Tsr	SM	5.0	109	26															
DH-1	50	1081.0	Tsr	SM	10.1	109	51															
DH-2	0	1122.0	Qaf	SC	6.6			7	48	45		30	16	14					7.3	110	864	2190
DH-2	5	1117.0	Qaf	CL	5.4	111	29															
DH-2	15	1107.0	Qoal	SM	3.7	114	22			32												
DH-3	0	1124.0	Qaf	CL	8.2										122.0	10.5						
DH-3	10	1114.0	Qoal	CL	6.1	118	40															
DH-3	15	1109.0	Qoal	CL	8.7					53												
DH-3	20	1104.0	Qoal	SM/ML	5.5	102	24															
DH-4	5	1124.0	Qoal	SM	6.5					21												
DH-4	10	1119.0	Qoal	SM	4.9	119	33															
DH-4	20	1109.0	Qoal	SM	5.1	109	26															
DH-5	0	1132.0	Qaf	CL															8.5	26	624	1467
DH-5	5	1127.0	Qoal	CL	13.6	115	82															
DH-5	10	1122.0	Qoal	CL	6.1					58		31	16	15								
DH-5	15	1117.0	Qoal	SM	6.6																	
DH-5	25	1107.0	Tsr	SM	6.1	107	30															
DH-5	35	1097.0	Tsr	SM	10.1	101	42															
DH-5	45	1087.0	Tsr	SM	8.9	108	44															

Project: Confluent Development
Project No. 20-307-00

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Saturation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
TP-2	0	1144.0	Qafu	SC	6.9													24				
TP-2	2	1142.0	Qafu	SC	7.1	115	43															
TP-2	7	1137.0	Qafu	SC	10.4	119	71															
TP-3	3	1142.0	Qafu	CL	5.1	104	23															



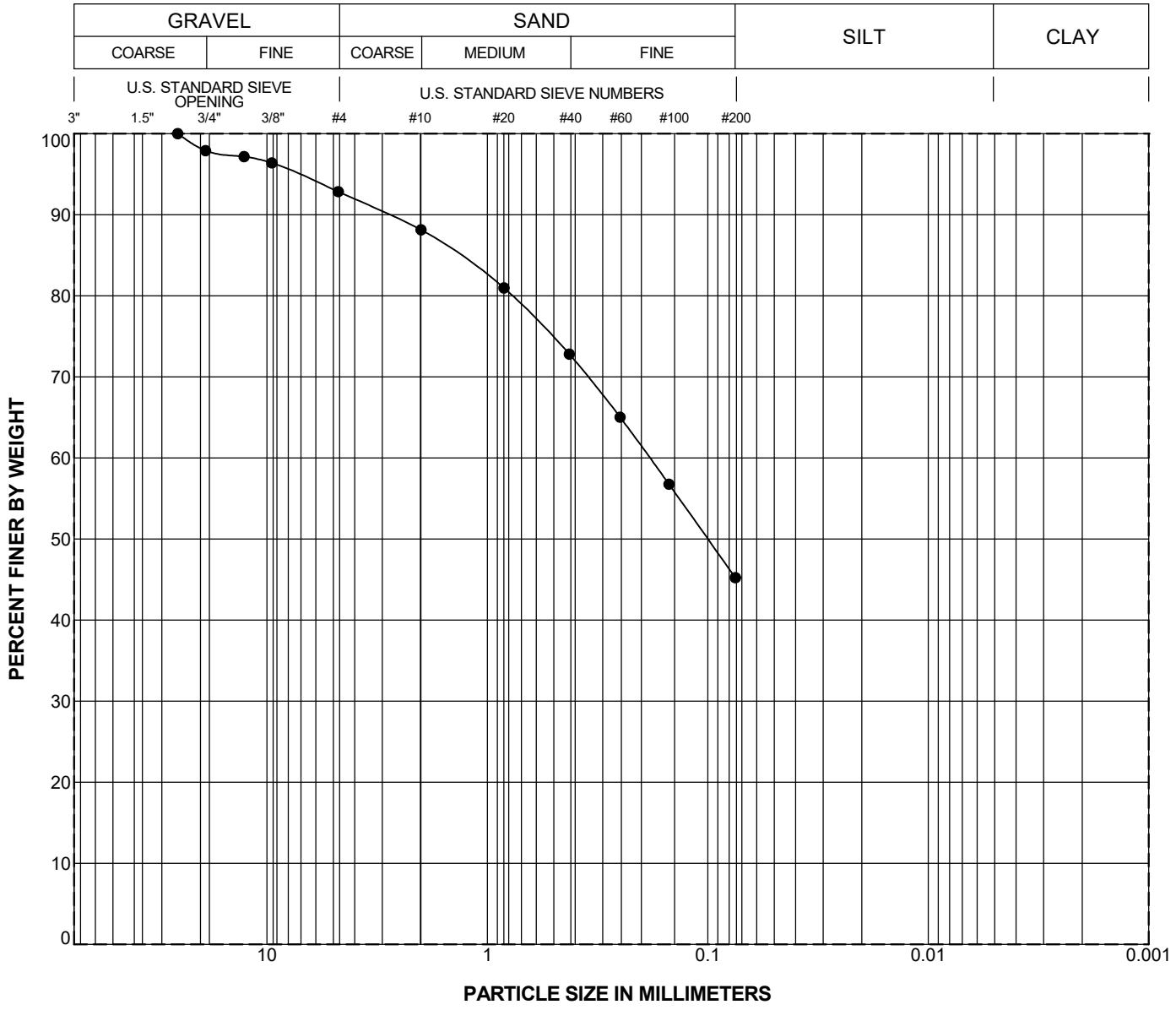
Boring Number	Depth (feet)	Geologic Unit	Test Symbol	Insitu Water Content (%)	LL	PL	PI	Classification
DH-1	25.0	Tsr	●	8	NP	NP	NP	SANDY SILT (ML)
DH-2	0.0	Qaf	⊠	7	30	16	14	CLAYEY SAND (SC)
DH-5	10.0	Qoal	▲	6	31	16	15	SANDY LEAN CLAY (CL)

LIMITS 20-307-00.GPJ 11/2/20

ATTERBERG LIMITS

Project: Confluent Development
Project No. 20-307-00

GMU



Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH-2	0.0	Qaf	●	30	14	CLAYEY SAND (SC)

GMU_GRAIN_SIZE 20-307-00.GPJ 11/2/20

PARTICLE SIZE DISTRIBUTION

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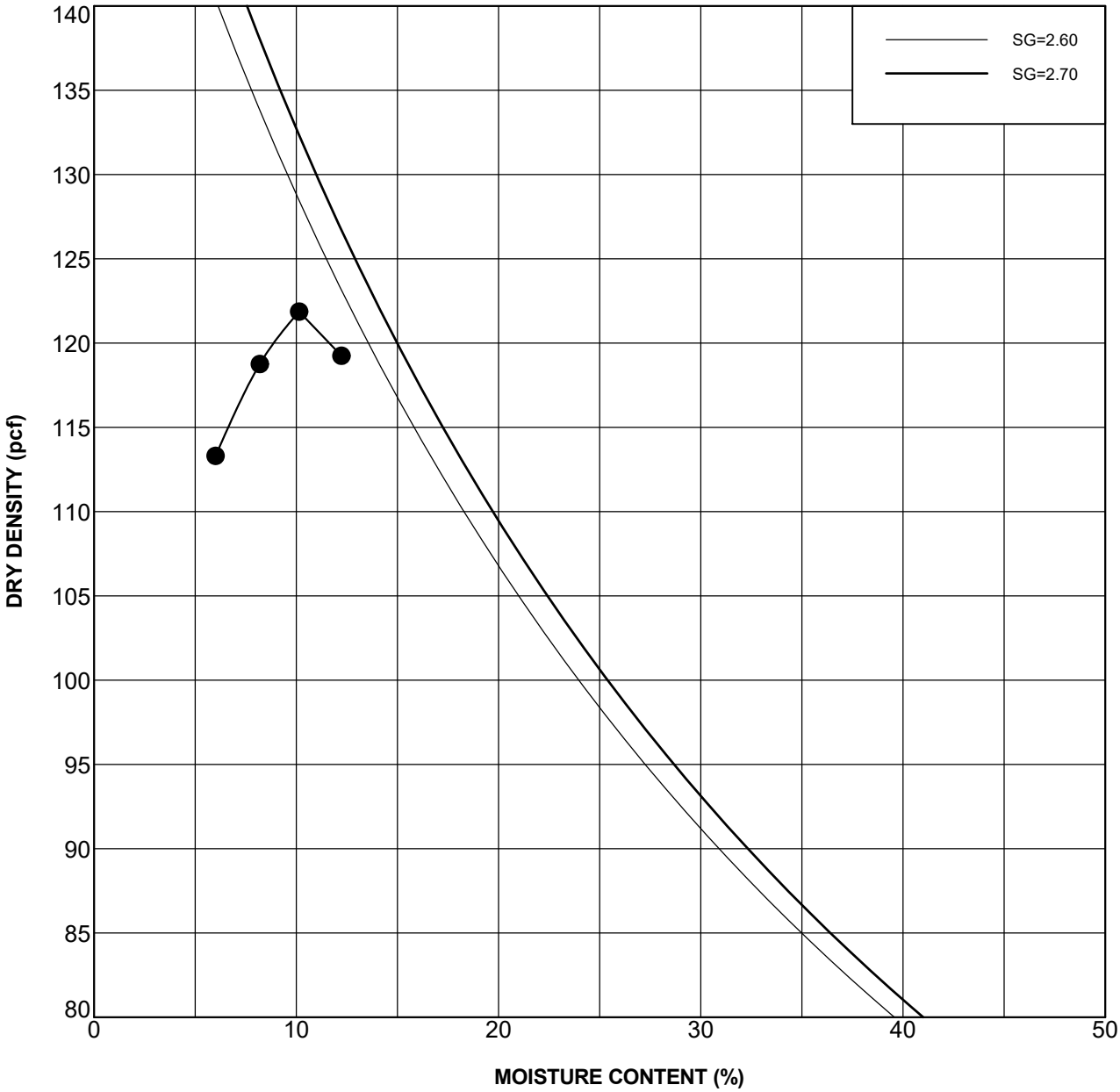


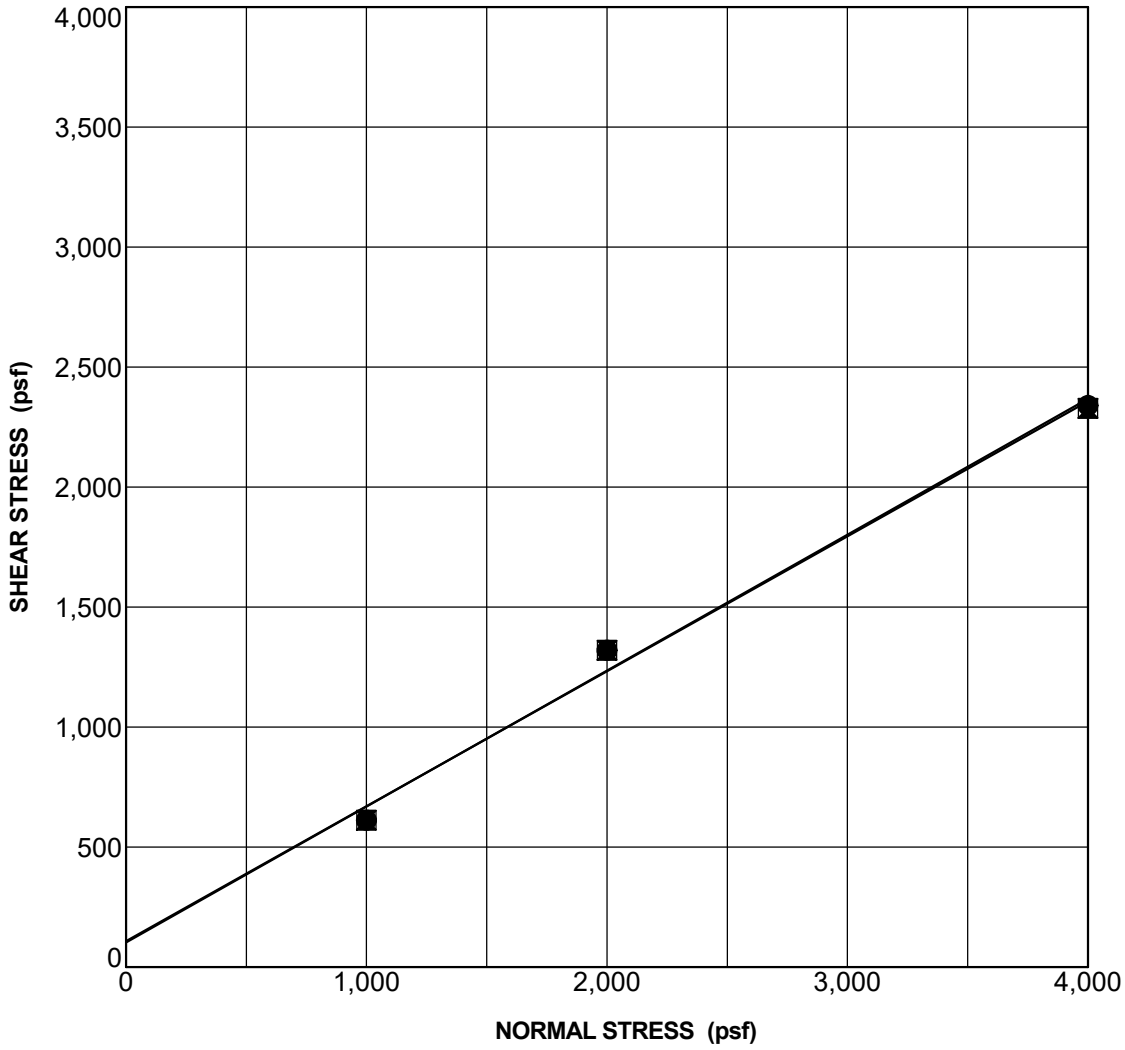
Boring Number	Depth (feet)	Geologic Unit	Symbol	Maximum Dry Density, pcf	Optimum Moisture Content, %	Classification
DH-3	0.0	Qaf	●	122	10.5	SANDY CLAY (CL)

DVTCOMP 20-307-00.GPJ 11/10/20

COMPACTION TEST DATA

Project: Confluent Development

Project No. 20-307-00



SAMPLE AND TEST DESCRIPTION
Sample Location: DH-2 @ 5.0 ft **Geologic Unit:** Qaf **Classification:** SANDY CLAY (CL) **Strain Rate (in/min):** 0.005 **Sample Preparation:** Undisturbed **Notes:** Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	102	29.5
⊠ Ultimate Strength	108	29.3

SHEAR TEST DATA

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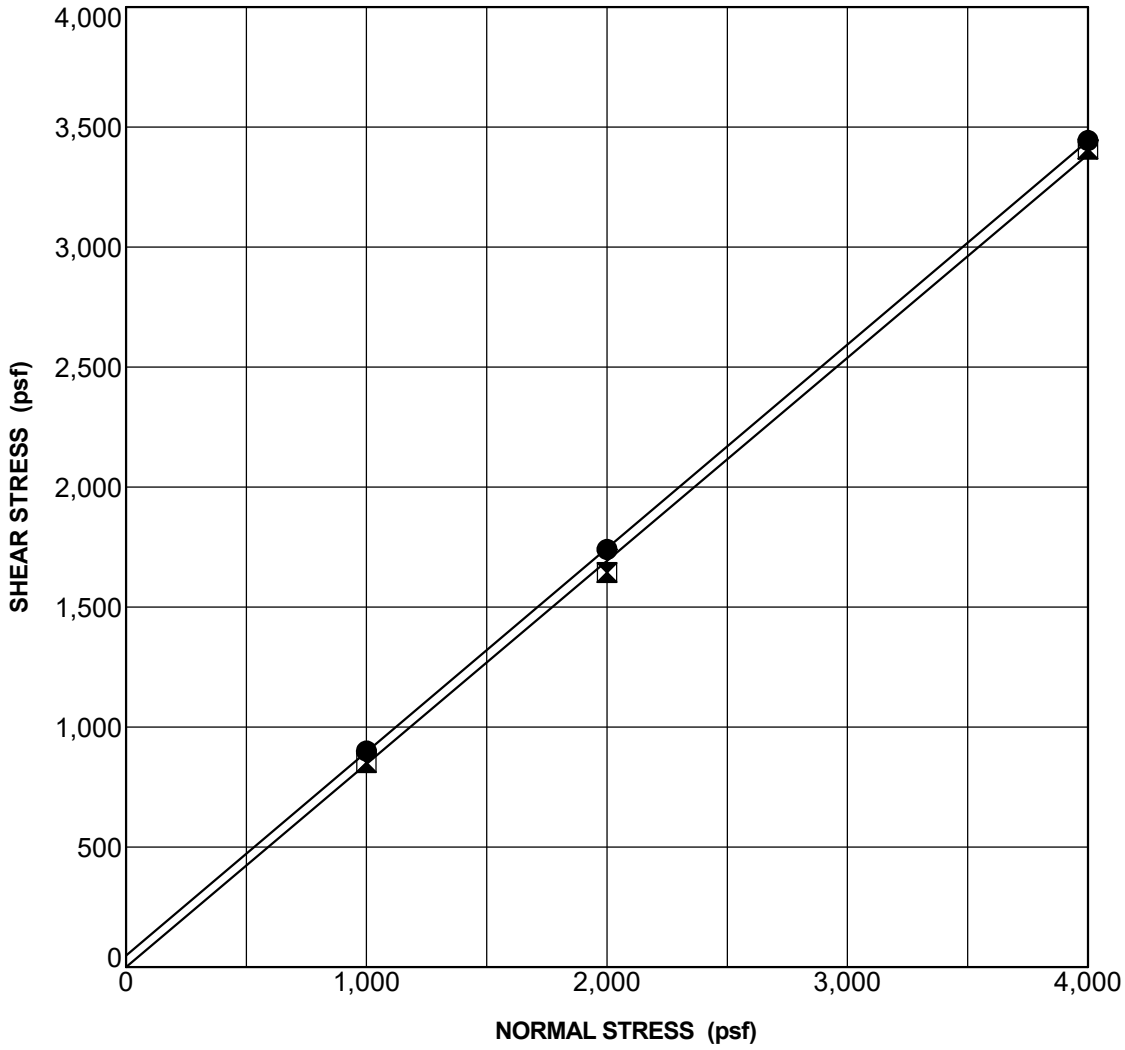
GMU



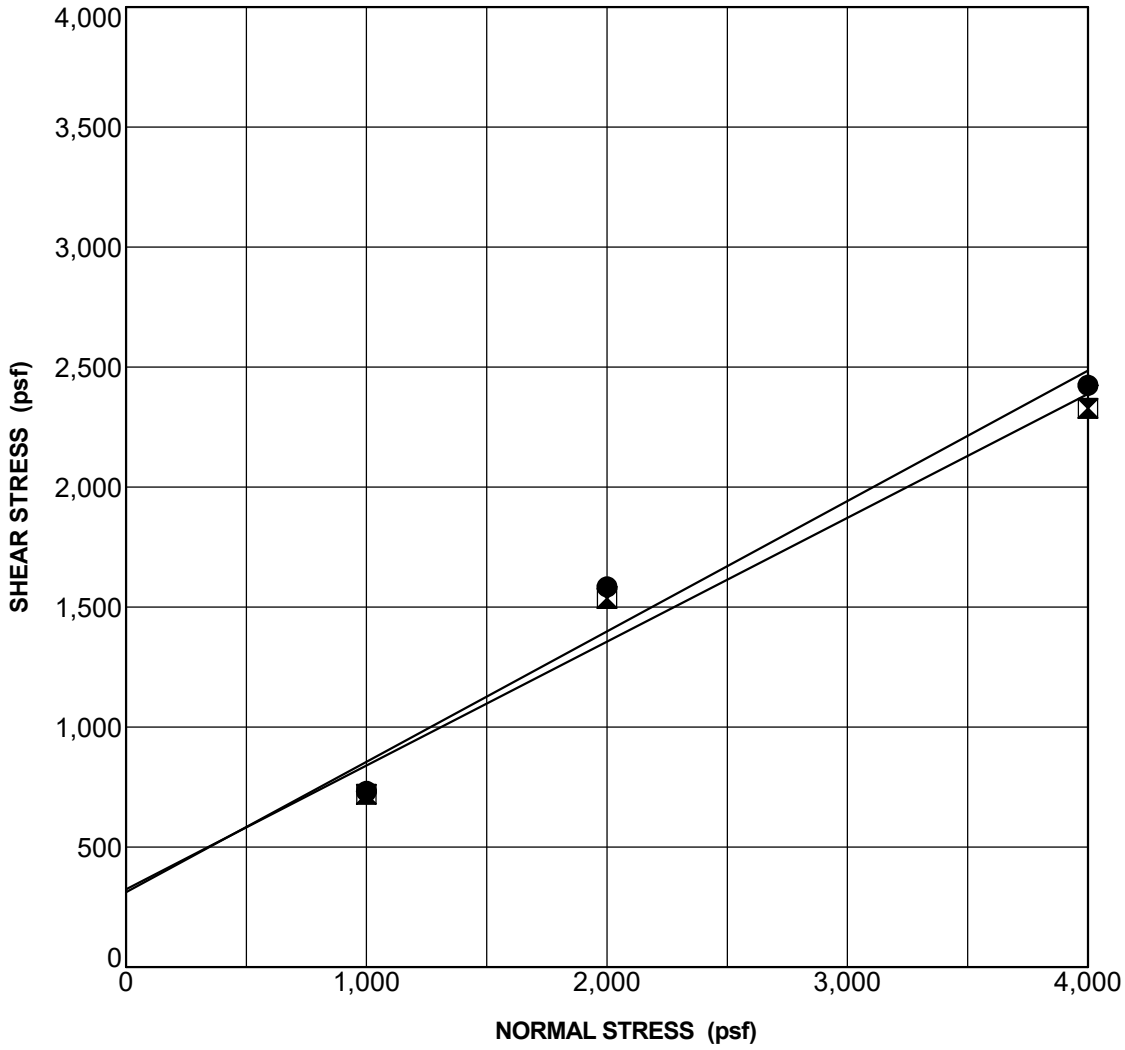
SAMPLE AND TEST DESCRIPTION
Sample Location: DH-4 @ 10.0 ft **Geologic Unit:** Qoal **Classification:** SILTY SAND (SM) **Strain Rate (in/min):** 0.005 **Sample Preparation:** Undisturbed **Notes:** Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	48	40.3
⊠ Ultimate Strength	0	40.2

SHEAR TEST DATA

Project: Confluent Development
Project No. 20-307-00

GMU_DIRECT_SHEAR 20-307-00.GPJ GM&U.GDT 11/2/20



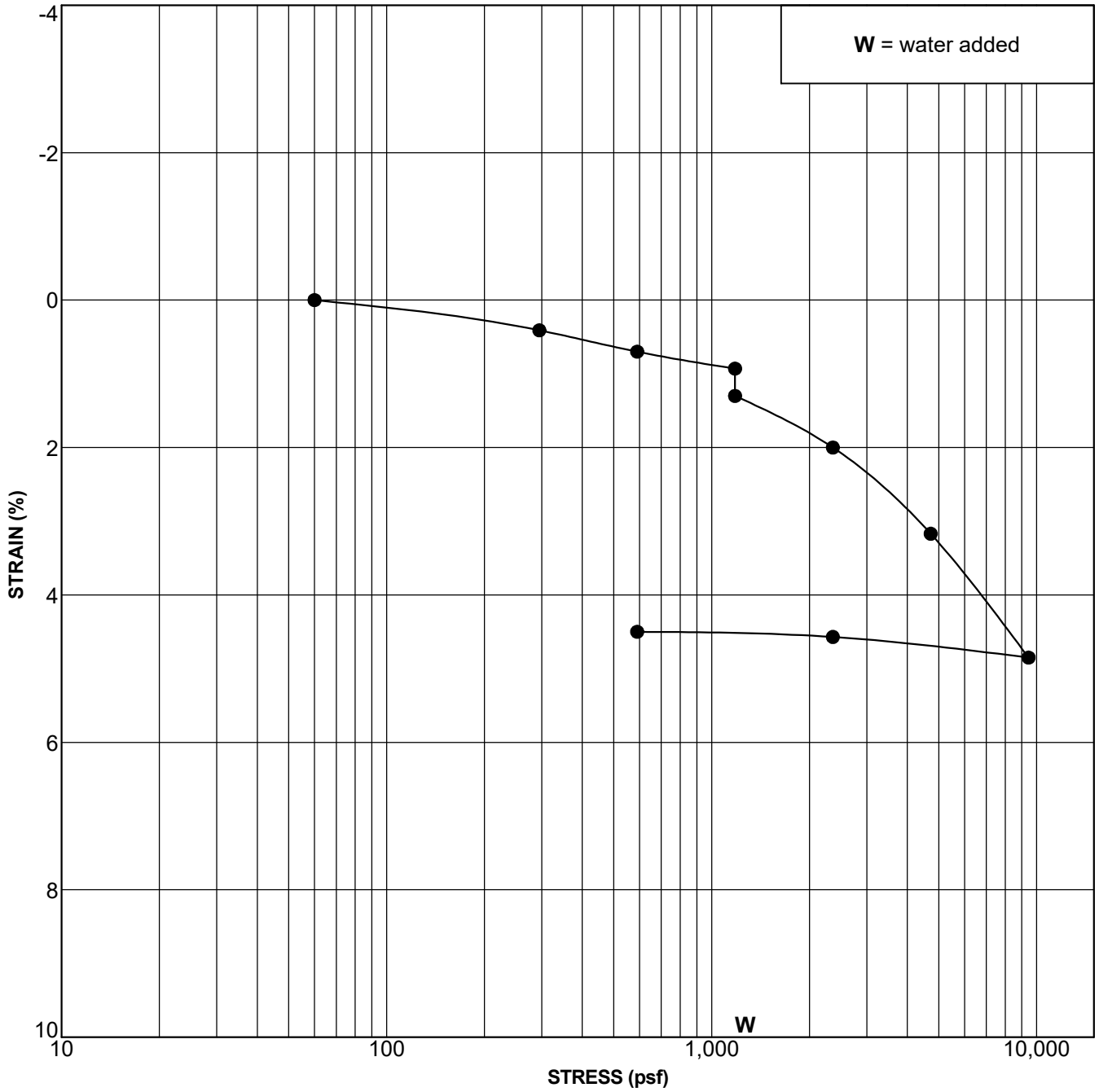
SAMPLE AND TEST DESCRIPTION
Sample Location: TP-3 @ 3.0 ft **Geologic Unit:** Qafu **Classification:** SANDY CLAY (CL) **Strain Rate (in/min):** 0.005 **Sample Preparation:** Undisturbed **Notes:** Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	312	28.5
⊠ Ultimate Strength	324	27.3

SHEAR TEST DATA

Project: Confluent Development
Project No. 20-307-00

GMU_DIRECT_SHEAR 20-307-00.GPJ GM&U.GDT 11/2/20



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-1	10.0	Qoal	●	In Situ	-0.12	WELL GRADED SAND (SW)

GMU_CONSOL 20-307-00.GPJ GM&U.GDT 11/2/20

CONSOLIDATION TEST DATA

Project: Confluent Development

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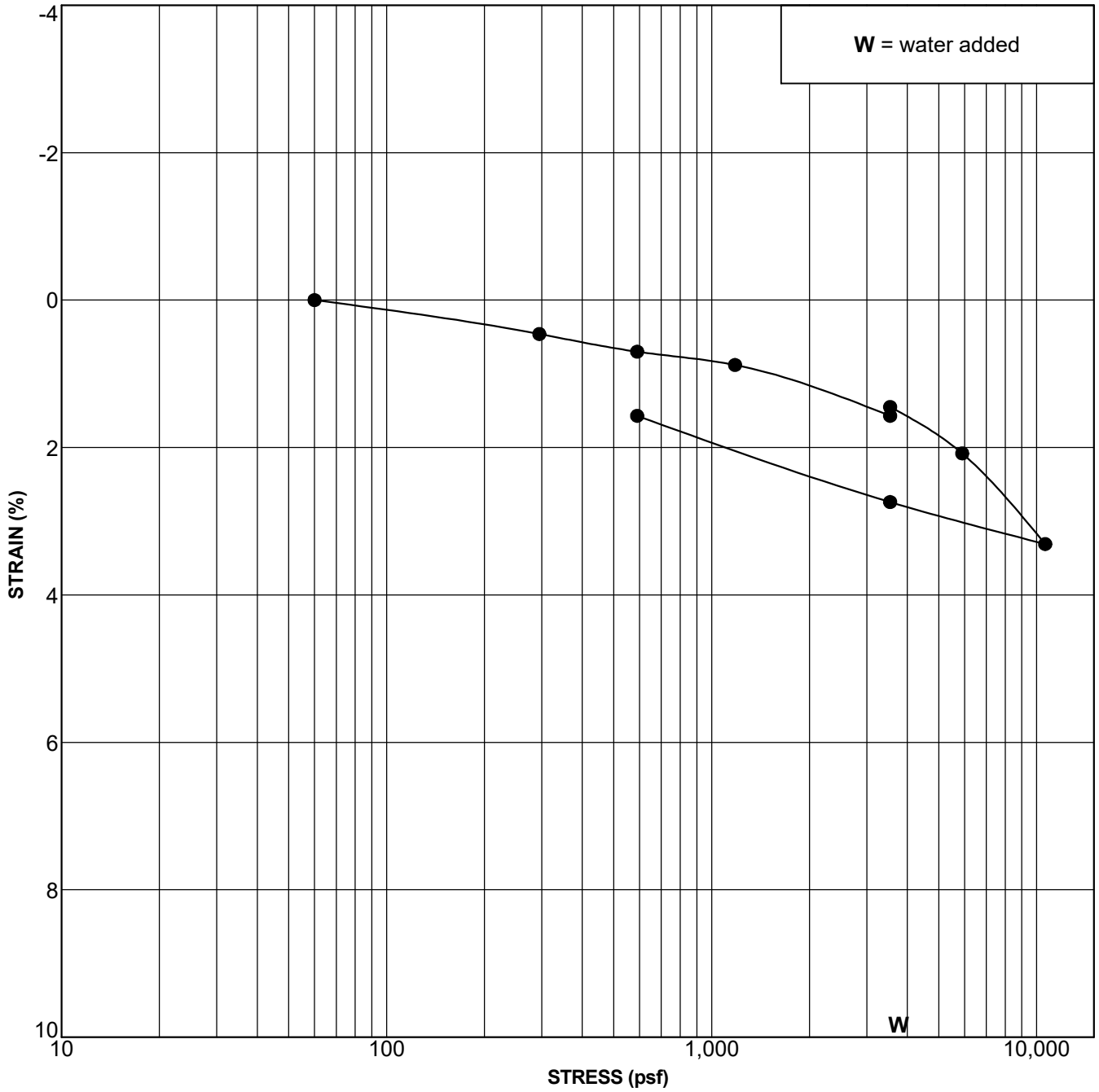


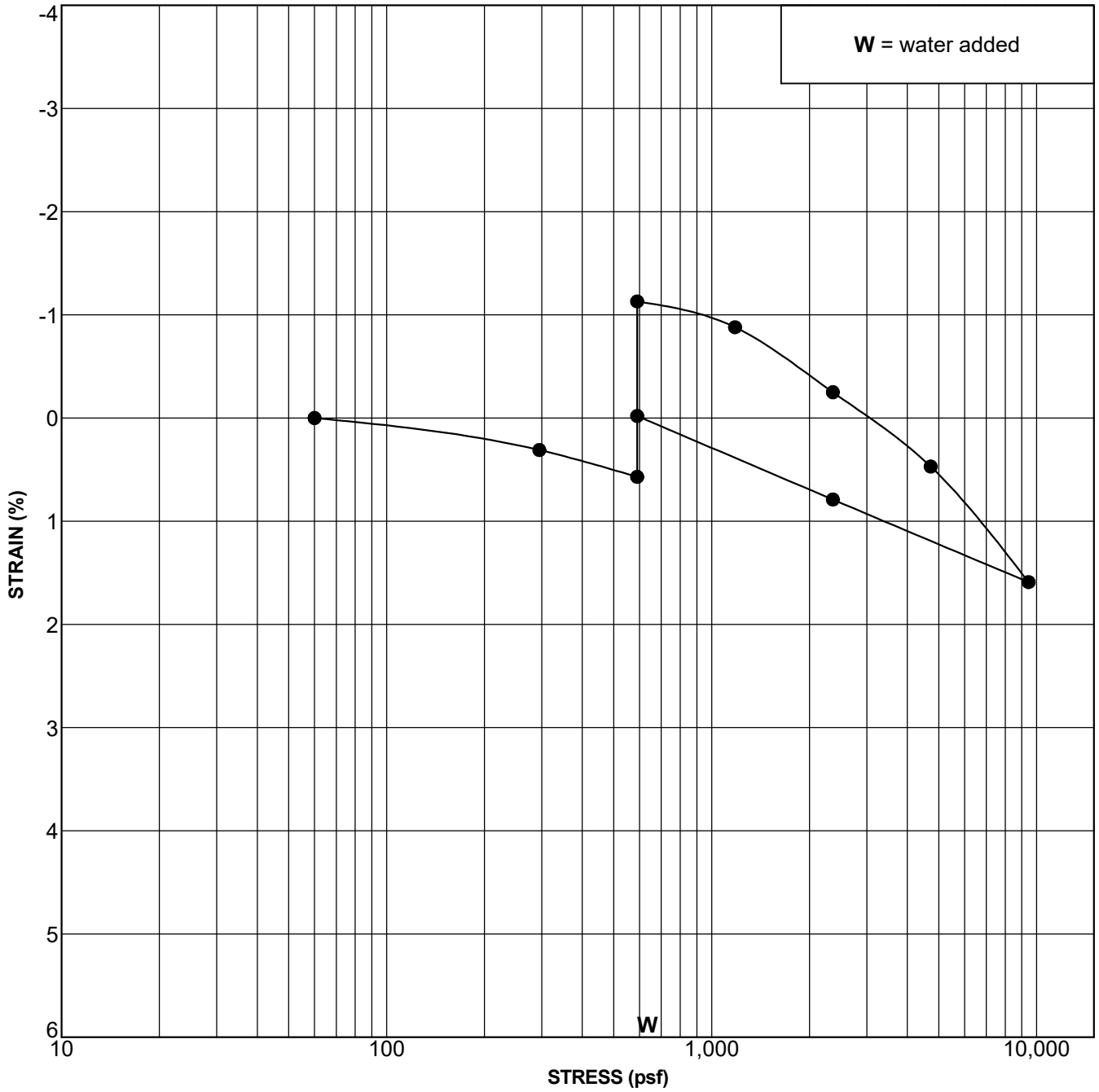
Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-1	30.0	Tsr	●	In Situ	0.37	SANDY SILT (ML)

GMU_CONSOL 20-307-00.GPJ GM&U.GDT 11/2/20

CONSOLIDATION TEST DATA

Project: Confluent Development

Project No. 20-307-00



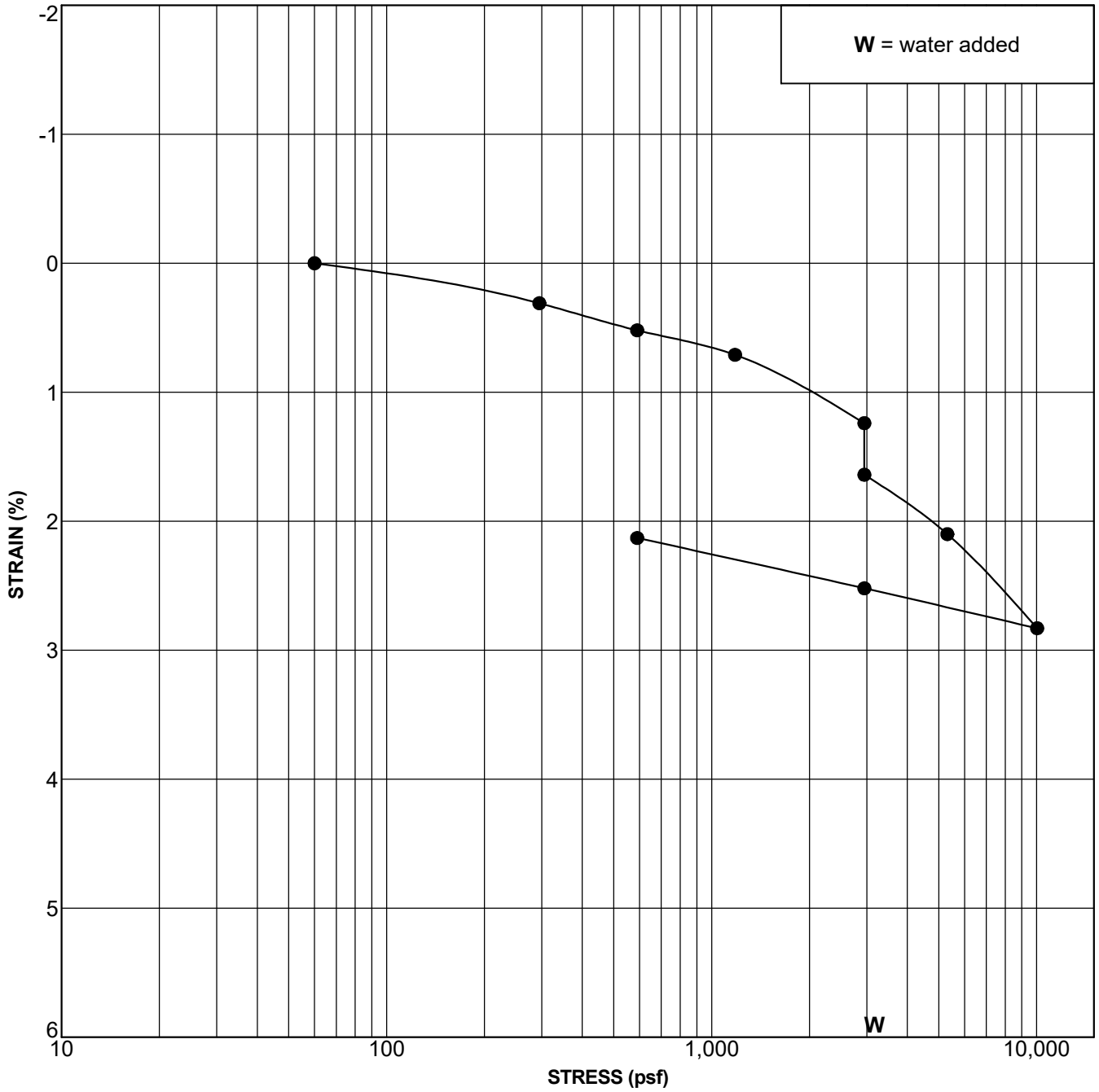
Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-5	5.0	Qoal	●	In Situ	-1.7	SANDY CLAY (CL)

GMU_CONSOL 20-307-00.GPJ GM&U.GDT 11/2/20

CONSOLIDATION TEST DATA

Project: Confluent Development

Project No. 20-307-00



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-5	25.0	Tsr	●	In Situ	0.4	SILTY SAND (SM)

GMU_CONSOL 20-307-00.GPJ GM&U.GDT 11/2/20

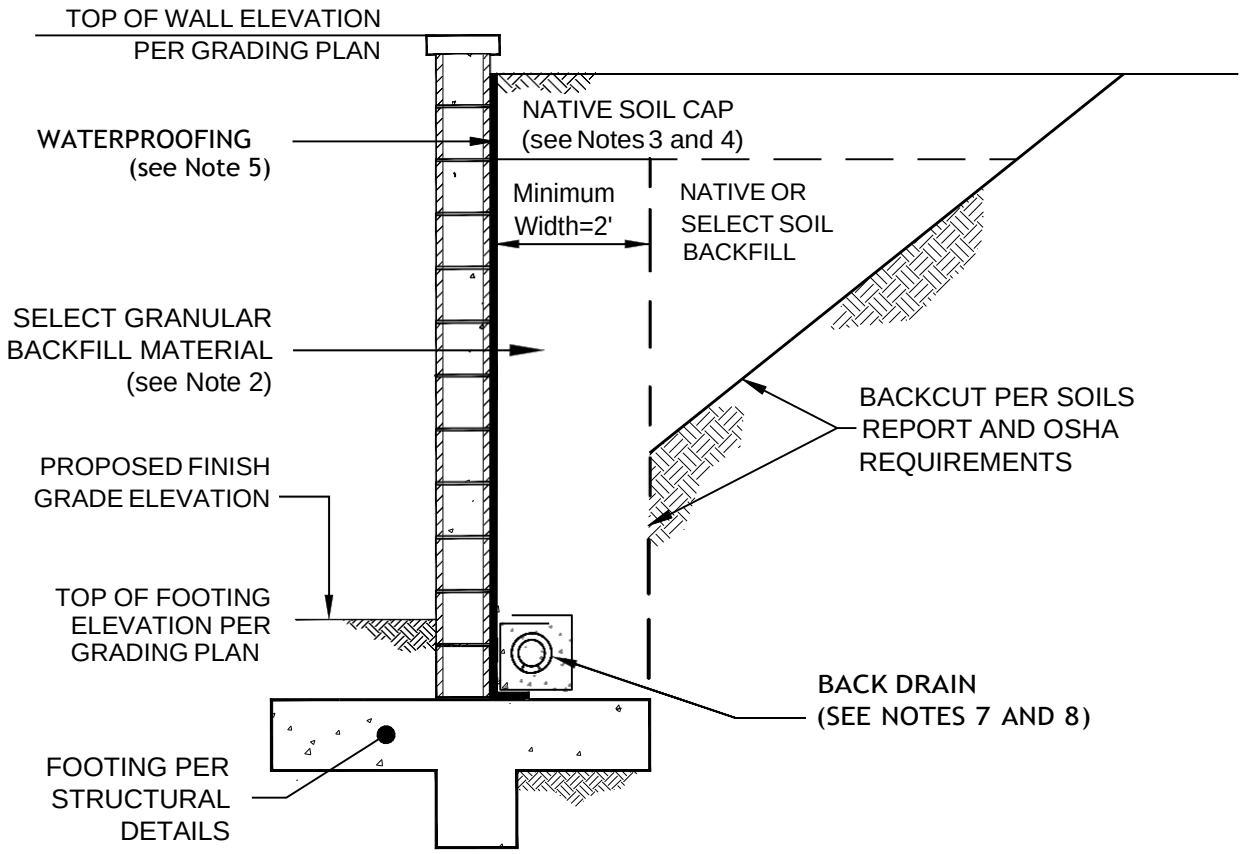
CONSOLIDATION TEST DATA

Project: Confluent Development

Project No. 20-307-00

APPENDIX C

Retaining Wall Construction Detail



RETAINING WALL DETAIL
NOT TO SCALE

1. FINAL DETERMINATION OF THE MATERIAL TO BE USED FOR BACKFILL SHALL BE MADE BY GMU.
2. ALL SELECT BACKFILL TO WITHIN 1 TO 2 FEET OF FINAL GRADE SHOULD CONSIST OF FREE-DRAINING GRANULAR MATERIAL (I.E. SE 30 SAND, PEA GRAVEL, OR CRUSHED ROCK). CRUSHED ROCK, IF USED, SHOULD BE WRAPPED IN FILTER FABRIC (MIRAFI 140N OR EQUIVALENT) TO MINIMIZE THE POTENTIAL FOR MIGRATION OF FINES INTO THE ROCK. THE SELECT BACKFILL SHOULD BE MOISTURE CONDITIONED TO ACHIEVE OVER OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.
3. FINE-GRAINED NATIVE SOILS SHOULD BE USED TO CAP THE SELECT BACKFILL ZONE.
4. ALL NATIVE OR SELECT SOIL WALL BACKFILL SHOULD BE MOISTURE CONDITIONED AS NECESSARY TO A MINIMUM 5% OVER THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.
5. THE BACKSIDE OF THE WALLS SHOULD BE WATERPROOFED DOWN TO AND ACROSS THE TOP OF THE FOOTING. THE DESIGN AND SELECTION OF THE WATERPROOFING SYSTEM IS OUTSIDE THE SCOPE OF THIS REPORT.
6. THE WATERPROOFING SYSTEM AND ANY DRAIN BOARDS SHOULD BE PROTECTED FROM DAMAGE BY CONSTRUCTION ACTIVITIES. THE TOP EDGE OF THE WATERPROOFING AND ANY DRAIN BOARDS SHOULD BE PROPERLY ADHERED TO THE WALL AND SEALED TO PREVENT THE POSSIBLE ACCUMULATION OF DEBRIS BETWEEN THE DRAINAGE/WATERPROOFING SYSTEM AND THE WALL.
7. THE BACKDRAIN SYSTEM SHOULD CONSIST OF 4" PERFORATED PIPE SURROUNDED BY AT LEAST ONE CUBIC FOOT OF 3/4"-1.5" OPEN GRADED GRAVEL WRAPPED IN MIRAFI 140N FILTER FABRIC (OR EQUIVALENT). THE PERFORATED PIPE SHOULD CONSIST OF SDR-35 OR SCHEDULE 40 PVC PIPE (OR APPROVED EQUIVALENT) LAID ON AT LEAST 2" OF CRUSHED ROCK WITH THE PERFORATIONS LAID DOWN. THE BACKDRAIN GRADIENT SHOULD NOT BE LESS THAN 1% WHEN POSSIBLE. THE PERFORATED PIPE SHOULD OUTLET INTO AREA DRAINS AT RUNS OF 200 FEET OR LESS, IF PRACTICAL. IF THE BACKDRAINS CANNOT BE OUTLETTED BY GRAVITY FLOW, A SUMP PUMYP SYSTEM WILL NEED TO BE DESIGNED AND CONSTRUCTED. REDUNDANT BACK-UP PUMPS AND COMPONENTS ARE RECOMMENDED. DESIGN OF THIS SYSTEM IS OUTSIDE OF THE PURVIEW OF GMU.
8. THE TIE-IN LOCATIONS FOR BACKDRAIN OUTLETS SHOULD BE SHOWN ON THE PRECISE GRADING, SITE WALL, AND/OR LANDSCAPE PLANS.

GMU	**RETAINING WALL CONSTRUCTION DETAIL**	PLATE C-1