




FINAL GEOTECHNICAL STUDY REPORT

EAST BAY MUNICIPAL UTILITY DISTRICT
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT PRE-DESIGN SERVICES

AGS Job No: AGS-23-006

Prepared for:

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1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of the geotechnical engineering study conducted by AGS, Inc. (AGS) for the Walnut Creek Water Treatment Plant Pretreatment (WCWTPP) Project, Project No. 202764, in Walnut Creek, California. The project site is shown on Plate 1 – Site Vicinity Map.

This report includes the results of AGS' field exploration and laboratory testing program, engineering analyses, and geotechnical engineering conclusions and recommendations related to the subsurface conditions, geological and seismic hazards, earthwork and dewatering considerations, foundations, resistance to lateral loads, and construction monitoring for the proposed project. The conclusions and recommendations presented in this report are based on available data from previous geotechnical investigations, available geologic information, and subsurface conditions encountered during our field exploration for this study. The nature and extent of variations between the borings may not become evident until construction. In the event variations occur it will be necessary to reevaluate the recommendations of this report. The conclusions and recommendations presented in this report should not be extrapolated to other areas or used for other facilities without prior review by AGS.

1.2 PROJECT DESCRIPTION

The Walnut Creek Water Treatment Plant (WCWTP) is a 115-million-gallon-per-day (MGD) facility located at 2201 Larkey Lane in Walnut Creek, California. It was originally constructed in 1967 to treat Sierra Mountain snowmelt water stored in Pardee Reservoir and conveyed to the EBMUD service area by the Mokelumne Aqueducts, which border the northwestern side of the WCWTP. This aqueduct transports water to the WCWTP via north and south treatment trains. In recent years, source water quality has periodically degraded due to wildfires in the watershed, high-intensity storms, algae-blooms, and

utilization of drought water supplies. Currently, the WCWTP has limited ability to treat incoming water sources that contain high levels of sediments, organic compounds, and other pollutants. This project will consist of two phases to construct new pretreatment facilities that will remove sediments, organics, and pollutants in the source water and ensure reliable drinking production under a wide range of source water conditions.

Phase I will upgrade one treatment train to a capacity of 125 MGD, and Phase II will upgrade the second treatment train to a capacity of 160 MGD. This report covers Phase I of the project, while Phase II is a future construction phase that will be scheduled as needed to supply service area demands and is not currently within AGS' scope of work.

Based on our review of the Request for Proposal for Consultant Design Services for the WCWTPP Project Design Services (EBMUD 2023) and the Basis of Design Report (EBMUD 2020), we understand that there are a total of twenty (20) proposed facilities and building structures for Phase 1 of the project. The proposed structures are in fourteen (14) different locations that are located about 200 to 1000 feet away from each other at the site. These include ballasted flocculation structures, intermediate ozone pumping plant, intermediate ozone contactors, ozone generation building, liquid oxygen storage area, pre-ozone pumping plant, solids dewatering building, truck loading canopy, gravity thickeners, thickened solids pumping plant, electrical facilities, consolidated maintenance building, and chemical storage building.

Facilities range from below-grade to at-grade structures. The maximum embedded depth is anticipated at about 30 feet below the existing ground surface (bgs), and the minimum burial depth is anticipated at about 1 foot. Their specific burial depths are summarized in **Table 1**, along with their live and dead load estimations, as understood from communications with Carollo Engineering (Carollo) in September 2024.

TABLE 1 – PROPOSED FACILITY INFORMATION

Facility ID[1]	Facility Description[1]	Finish Pad Elevation[1] (NGVD29)	Finish Pad Elevation from Existing Ground Elevation[1] (feet)	Maximum Dead Load[2] (ksf)	Maximum Live Load[2] (ksf)
1	Ballasted Flocculation	+360	24 feet below	2.9	0.05
2	Intermediate Ozone Pumping Plant	+370	14 feet below	2.5	0.05
3	Intermediate Ozone Contractors	+357	21 to 26 feet below	3.25	0.05
4	Ozone Generation Building	+361	1 foot below to 17 feet above	1.875	0.05
5	Liquid Oxygen Storage Area	+365	2 feet below to 5 feet above	3.375	0.05
6	Pre-Ozone Pumping Plant - E	+339	1 foot below to 3 feet above	2.5	0.05
7	Combined Reclaimed Metering Vault	+323	18 feet below	2.25	0.05
8	Ozone Gas Destruct	+346	5 to 14 feet below	1.5	0.05
9	Solids Dewatering Building	+317	3 to 7 feet below	3.375	0.05
9a	Truck Loading Canopy	+322	1 to 4 feet below	2.5	0.05
10	Thickened Solids Blending Tanks - N & S	+319	0 to 5 feet below	2.0	0.05
11	Gravity Thickeners - NE & NW	+290	4 to 20 feet below	2.125	0.05
11	Gravity Thickeners - southeast & SW	+293	18 to 25 feet below	2.125	0.05
12	Thickened Solids Pumping Plant - N	+286	22 to 28 feet below	3.375	0.05
12	Thickened Solids Pumping Plant - S	+290	26 to 29 feet below	3.375	0.05
13	Solids Transfer Facility	+320	1 foot below to 1 foot above	2.125	0.05
14	Electrical Facilities	+333	2 to 6 feet above	2.25	0.05
15	Consolidated Maintenance Building	+336	2 feet below to 7 feet above	3.375	0.05
16	Ozone Quenching Vault[3]	-	-	-	-
17	Chemical Storage Building	+380	1 foot below to 1 foot above	2.5	0.05
18	Hydrogen Peroxide Station - E	+382	1 foot below	1.875	0.05
18	Hydrogen Peroxide Station - W	+346	1 to 14 feet below	1.875	0.05

Notes:

1) Information from Basis of Design (EBMUD 2020).
2) Information provided by Carollo via email communication 9/30/2024.
3) Excluded from this study per Carollo verbal communication at on site meeting March 1, 2024.
4) NGVD29 = National Geodetic Vertical Datum 1929

1.3 WORK PERFORMED

As outlined in AGS' proposal for geotechnical engineering services, dated October 13, 2023, our tasks included a review of the available geological, geotechnical, and seismological data, preparation of a workplan for field exploration, completion of a field exploration program, completion of a laboratory testing program, and the performance of appropriate engineering analyses and report preparation. The work performed for the geotechnical study is outlined in the following sections.

1.3.1 Review of Available Data

AGS reviewed the available geotechnical reports of previous work completed by others to identify the site setting and subsurface conditions. Geotechnical reports and drawings that AGS reviewed were provided by Carollo and EBMUD include the following:

- Geotechnical Interpretive Report, Walnut Creek Water Treatment Plant, 2201 Larkey Lane, Prepared by Ninyo & Moore, dated June 9, 2022.
- Geotechnical Impact Assessment, EBMUD Water Treatment and Transmission Improvements Program, Contra Costa and Alameda Counties, Prepared by AGS, Inc., dated December 2004.
- Geotechnical Investigation Report, Walnut Creek Water Treatment Plant Improvements Project, Prepared by EBMUD, dated June 2001.
- Geotechnical Study for the Walnut Creek Water Treatment Plant Improvements Project, Prepared by Geomatrix Consultants, dated August 10, 2001.
- Appendix A of Final Report, Walnut Creek Water Treatment Plant Expansion, Seismic Study – Phase II, Prepared by Geomatrix Consultants, dated October 1998.
- Review of Geomatrix Consultants October 1998 "Final Report, Walnut Creek Water Treatment Plant Expansion, Seismic Study – Phase II", Prepared by William Lettis & Associates, dated July 19, 1999.
- Site Topography and Borings, Drawings 7831-G-1 through 7831-G-5, Walnut

Creek Water Treatment Plant Expansion, Prepared by EBMUD, dated 1986.

- Soils Report, Walnut Creek Filter Plant, Polymer Building and Rapid Mix Pumping Plant, Prepared by EBMUD, dated June 1984.
- Soils and Foundation Investigation, Walnut Creek Filter Plant, Prepared by EBMUD, dated March 1964.

AGS reviewed available geologic data for the site vicinity, including geologic reports and historical aerial photographs to identify features that may be associated with the fills and the various types of bedrock.

1.3.2 Geotechnical Exploration Work Plan

Prior to commencing the fieldwork, AGS prepared and submitted a geotechnical exploration work plan dated March 2024 for review and approval by EBMUD. The work plan included the locations of the borings, the soil sampling schedule, and the geotechnical laboratory program. Our work plan also included a health and safety plan relevant to the fieldwork.

1.3.3 Field Exploration

The subsurface exploration program consisted of drilling eighteen (18) borings at the locations shown on **Plate 2** – Boring Location Map.

AGS obtained a Soil Boring permit from the Contra Costa County Environmental Health Division (#0031341). AGS cleared each location by notifying Underground Service Alert (USA) and subcontracting to a private utility locator, Geotech Utility Locating, LLC (Geotech). Geotech visited the site on July 25, 2024 prior to drilling to clear locations, and again on August 22, 2024 during drilling to provide additional assistance and confirmation in an area identified as critical.

At each location hand augering was performed to verify any obstructions or utilities to at

least 5 feet deep. Locations that were accessible to a truck- or track-mounted drill rig were drilled by Terra-Ex Subsurface Exploration (Terra-Ex) of Dixon, California between August 19, 2024 and August 23, 2024. Terra-Ex utilized a truck-mounted Diedrich D-70 Turbo and a Track-mounted D-70 with automated hammer of 85.0 and 93.5 percent efficiency, respectively. The rig used at each boring is noted on the boring logs in **Appendix A**. Rotary wash method was utilized, with the drill rig supported by a flatbed carrying the drill rods, water tank, and supplemental equipment.

Locations that were not accessible to a truck- or track-mounted drill rig were drilled by California Geotech Services (Cal Geotech), LLC of Livermore, California. Cal Geotech utilized their Little Beaver portable rig with manual hammer of 60 percent efficiency at borings noted on the boring logs in **Appendix A**. Solid Flight Auger (SFA) method was used from the hand augered depth to the entire depth investigated with the Little Beaver.

The field exploration program was performed under the technical supervision of a qualified AGS geologist familiar with the geological conditions in the area. At each location AGS' geologist completed a log of boring, documented the drilling progress, and recorded the subsurface conditions encountered at the location of each boring. Modified California (MC) samples and Standard Penetration Test (SPT) samples were obtained from each boring, while bulk and rock core samples were obtained from selected borings. The geotechnical soil and rock samples were delivered to AGS' laboratory in San Francisco, California, and Cooper Testing Laboratory in Palo Alto, California, for further examination and analyses.

Upon completion, the boreholes were backfilled and patched in accordance with the requirements of the Contra Costa County Environmental Health Division. Logs of borings presented in **Appendix A** provide descriptions and graphic representations of the encountered materials and the depths at which samples were obtained. A legend to the logs is also shown in **Appendix A**. The soil cuttings and any drilling fluids / muds were placed in drums and off-hauled immediately by Terra-Ex for testing and disposal. The Chemical Testing report of the fluids/muds samples is presented in **Appendix E**.

1.3.4 Geotechnical Laboratory Testing

A laboratory testing program was performed on selected soil and rock samples obtained during the field exploration program. The laboratory tests of soil samples included moisture content, dry density, sieve analyses, percent passing No. 200 sieve, hydrometer, Atterberg limits, consolidation, compaction, unconsolidated-undrained triaxial, expansion index, R-value, and corrosivity tests, as appropriate for the various soils encountered. The laboratory tests of rock core samples included unconfined compressive strength, Young's modulus, and point load strength index. Geotechnical laboratory tests were performed by AGS and Cooper Testing Laboratories of Palo Alto, California, and the test results are presented in **Appendix B**.

1.3.5 Engineering Analyses and Report Preparation

The data collected were used to perform engineering analyses, in order to develop site-specific geotechnical conclusions and recommendations for the design and construction of the proposed project. AGS' geotechnical findings, conclusions, and recommendations, along with the supporting data, are presented in this geotechnical study report. The report addresses the following:

- A description of the proposed project;
- A summary of the subsurface soils and groundwater conditions at the site;
- Local geologic conditions;
- Faults and seismicity of the site area;
- Site-specific peak ground surface accelerations for the maximum considered earthquake;
- CBC 2022 and ASCE 7-22 seismic design parameters;
- Liquefaction potential, consequences, and mitigation measures;
- Feasibility of the proposed site to support proposed structures;
- Earthwork and subgrade preparation;

- Utility excavation and backfill;
- Engineering fill requirements, placement, and compaction;
- Soil settlement, differential settlements, and soil stabilization;
- Geotechnical recommendations for shoring;
- Geotechnical recommendations for dewatering during construction;
- Geotechnical parameters for design of the pipelines including subgrade reaction, bedding, backfill, passive resistance and friction for thrust block;
- Expansion potential, consequences, and mitigation measures;
- Modulus of subgrade reaction;
- Foundation design criteria, including the type, size, and depth of foundation;
- Slope stability analyses;
- Lateral earth pressures for dry and wet conditions;
- Resistance to lateral loads for dry and wet conditions;
- Resistance to hydrostatics uplift;
- Slab-on-grade sidewalk;
- Geotechnical recommendations for pavement design;
- Corrosion potential; and
- Geotechnical considerations and recommendations for the proposed structures construction.

2.0 FINDINGS

2.1 SITE CONDITIONS

The WCWTP is located on the northeastern slope of a northwest-trending ridge, positioned atop a smaller, northward-trending spur. The location is presented on Plate 1. In general, the site is bounded by undeveloped, open space to the north, south, and west, and residential homes to the east. A tall chain link fence serves as the boundary of most of the site and restricts access. Larkey Lane serves as the primary entrance to the WCWTP and is guarded. Various locked gates provide access through the chain link fence across the site. The eastern portion of the site is the most developed, consisting mostly of asphaltic concrete roads, and at-grade and below-grade facilities. The western portion of the site consists mostly of unpaved access roads that lead to various scattered facilities.

2.2 GEOLOGY

The area geology is shown on **Plate 3** – Regional Geological Map. The WCWTP lies in the East Bay Hills of the Bay Area and is part of the Coast Ranges Geomorphic Province. The province is a seismically active region characterized by northwest-trending mountains, valleys, and faults. The East Bay Hills, as part of the Coast Ranges, is characterized by high rates of tectonic deformation associated with the San Andreas Fault System as a part of the actively deforming North American plate margin. This deformation is expressed as dextral shear with a minor component of compression along north-northwest trending strike-slip. This combination of dextral shear and compression forms the north-northwest oriented topography and causes the uplift creating the hills and mountains of the Coast Ranges.

The project is located atop the northeastern limb of a synclinal fold in an area of moderately to steeply sloping hills with gently sloping stream valleys draining generally to the north. The synclinal fold has brought middle and upper Miocene-age sedimentary

bedrock up to the shallow subsurface at the WCWTP. The rock units predominantly encountered at the WCWTP during previous studies and this study include the Hambre and Briones Formation. This agrees with the preliminary geologic map emphasizing bedrock formations in Contra Costa County, California (Graymer et al., 1994) which is presented on **Plate 3**. General descriptions of the Hambre and Briones Formation are provided below.

2.2.1 Hambre Formation

The Hambre Formation was described by Richard B. Saul in 1973 as a Middle Miocene age, gray sandstone unit with interbedded shaly siltstone and shale. Shale being more predominant in the lower half of the unit, and sandstone more predominant in the upper half of the unit. There are sparse bedrock outcrops of this unit as it is known to produce a clay-rich loam from weathering. From slope stability investigations performed prior to 1973, the sandstone unit is described as having no tendency to slump and breaks down into fine sand and silt. However, the shale unit is noted as being present and could cause issues with slope stability.

2.2.2 Briones Formation

The Briones Formation is known to have two members, sandstone and shale, with shale conformably deposited over the sandstone member. Both members are Upper Miocene age. Descriptions of the two members of the Briones Formation are summarized below from Saul (1973).

- Sandstone Member – Predominantly fine- to coarse-grained, gray sandstone unit that weathers to brown with shaly siltstone and mudstone units ranging from 10 to 60 feet thick. The sandstone is commonly fossiliferous. The unit weathers into a clay-rich loam. Slope stability studies determined the unit is generally good with the interbedded shale units tending to gully and slump to a moderate extent and more so in fault zones. However, block gliding is noted as a potential hazard for this member. Workability of the unit is described as being easy due to its highly jointed and fractured nature, though it is noted that some harder sand could be encountered that may resist light earth moving equipment.

Alteration of rock type from sandstone to shaly siltstone and mudstone units may cause differential settlement of foundations.

- Shale Member – Clay shale interbedded with subordinate proportions of shaly siltstone. Upper half of member includes sandstone unit about 100 feet thick containing resistance, concretionary fossil beds in some outcrops. The unit weathers into a heavy adobe-type soil. Slope stability studies describe the unit as being poor, especially near and in fault zones as it tends to slake and swell in cuts forming small angular fragments. Workability of the unit is easy as it's generally highly fractured.

2.2.3 Native Soil

AGS reviewed United States Department of Agriculture's Web Soil Survey Map to determine expected soil types at WCWTP. For a majority of the site, the soil type is Lodo clay loam (LcF). In the northwestern portion of the WCWTP, predominantly where the major drainage channel just west of the soil ridge lies, is soil type Los Osos clay loam (LhE). Both belong to hydrologic group D, predominantly clays that have a high shrink-swell potential, very slow infiltration rate when thoroughly wet, have a claypan or clay layer at or near the surface (USDA, 2016). Additional soil properties are provided in the below **Table 2**.

TABLE 2 PROPERTIES OF SOIL TYPES

Soil Type	Parent Material	Natural Slopes (%)	Typical Depth to Weathered Bedrock (feet)	Corrosivity	Erosion Hazard	Shrink & Swell Potential
Lodo Clay Loam (LcF)	Sandstone & Shale	30-50	0.33-1.7	Moderate	High	Moderate
Los Osos Clay Loam (LhE)	Sandstone & Shale	15-30	2-3.33	High	Moderate	High

2.3 SITE HISTORY

The first and only known land use at the WCWTP prior to EBMUD acquiring the land, was cattle pasture. In 1963, a geological report and a field exploration program were

conducted to determine the suitability of the site for a water treatment plant (EBMUD 1964). The geological report was performed by Marliave Consulting Geologist (MCG) and recommended the site for acquisition and development. Borings from the EBMUD exploration program in 1964 investigation over the undeveloped site can be found in **Appendix C**, and locations of the borings are presented on **Plate 2**.

2.3.1 WC Filter Plant – Soils and Foundation Investigation (EBMUD, 1964)

The 1964 study performed by EBMUD consisted of 16 borings, which were performed in the eastern portion of the site, where the existing main plant operations is located. In this investigation, borings collected samples that included the fine-grained Hambre Sandstone and the Rodeo Shale, as identified by MCG (1963). Rodeo Shale and Hambre Sandstone samples from the ridge were composited as “Composite A” and “Composite B”, respectively, for triaxial testing. Results are presented below in **Table 3**.

TABLE 3 – 1964 TRIAXIAL TESTING RESULTS

Material	Cohesion (tsf)	Angle of Internal Friction (degrees)
Rodeo Shale (Composite A)	0.9	15
Hambre Sandstone (Composite B)	0.8	25.5

Additionally, compaction and consolidation testing was performed on “Composite A”, Rodeo Shale, and “Composite D”, overburden material predominantly identified as silty clay from the area, to determine if this material to be stripped could be used as fill onsite. Results are presented below in **Table 4**.

TABLE 4 – 1964 COMPACTION AND CONSOLIDATION TESTING RESULTS

Material	Initial Moisture Content[1] (%)	Initial Dry Unit Weight[1] (pcf)	Percent Compaction[1] (%)	Consolidation Results[2,3]
Rodeo Shale (Composite A)	33	84	99.5[4]	CR=0.170; RR=0.032; σ,yield=2.0;
Overburden Material (Composite D)	15	100	93.8[5]	CR=0.230; RR=0.038; σ,yield=1.2;

Notes:
1) Averaged from two to three tests to the nearest integer.
2) "CR" = compression ratio; "RR" = recompression ratio; "σ,yield" = yield stress (kips per square foot (ksf)).
3) Values approximated from 1964 test results chart.
4) ASTM D698 and ASTM D698 modified to produce 20,000 foot-pound per cubic foot compactive effort, and ASTM D1557.
5) State of California Test Method 216.

From the above results, it was calculated by EBMUD 1964 that the allowable bearing pressure of column and wall footings supported on fill composed of "Composite A", or comparable material, was 2.62 tons force per square foot (tsf) and 2.0 tsf, respectively. A settlement analysis was also performed on column footings founded on fill using a maximum column load of 16 kips various column dimensions of 2.0 feet by 2.0 feet, 2.5 feet by 2.5 feet, and 3.0 feet by 3.0 feet, respectively. The analysis determined the maximum settlement of the column footing under a load of 16 kips will be less than 0.5 inches, and the maximum differential settlement will be less than 0.25 inches.

The overburden material was classified as medium plasticity, silty clay with some fine sand and tested under "Composite D". Tests determined the overburden material was unsuitable for structural fill and plant site road fill and recommended to be placed in spoil areas or used for landscaping. Bedrock material was found to be suitable and recommended as structural fill at the site after being properly broken down.

Although the bedrock encountered at the WCWTP has been found to be variable in weathering degree and hardness, 5.0 tsf was determined to be a reasonable value for the allowable bearing pressure of footings supported on bedrock (EBMUD 1964). It was also mentioned that if unsuitable bedrock is encountered during excavation, widening or

deepening of the footing may be necessary. The lab testing results performed on bedrock in the 1964 study is presented in **Table 5** below.

TABLE 5 – 1964 LABORATORY RESULTS ON BEDROCK

1964 Boring ID	2024 Proposed Facility ID (within 100 feet)	Atterberg Limits[2,3]	Dry Density (pcf)	Moisture Content (%)	Bedrock Type
WC-1	2	LL = 32 PI = 5	-	13.3 – 13.9	Sandstone
WC-2	1 - northwest	LL = 33 – 38 PI = 15 – 17	-	15.6 – 29.1	Sandstone
WC-4	3	LL = 47 PI = 17	-	26.1 – 35.3	Sandstone
WC-5	1 – northwest	LL = 34 PI = 2	66.7 – 97.0	24.7 – 57.4	Siltstone
WC-6	1 – northeast	LL = 34 PI = 9	-	22.2	Sandstone

Notes:
1) Information in above table from Walnut Creek Filter Plant Soils and Foundation Investigation, prepared by EBMUD, dated March 1964.
2) Atterberg limit values are estimated from chart.
3) LL = Liquid Limit; PI = Plasticity Index
4) "-" = no results

2.3.2 WC Filter Plant – Polymer Building and Rapid Mix Pumping Plant (EBMUD, 1984)

In 1984, EBMUD performed an additional study to determine the suitability of the compacted soil from the circa 1964 construction for a polymer building and a rapid mix pumping plant. The polymer building under investigation in this study took place within 30 feet of the proposed Facility ID 3 where AGS was unable to perform a boring due to utility congestion.

Approximately three feet of overburden was documented as having been stripped from the area before the fill was placed circa 1964. The source of the fill was excavated bedrock that was broken down and placed at minimum relative compaction of 95 percent as determined by test designation ASTM D-698-58T.

The tests of record from the 1964 study were selected for review for the 1984 study. The tests revealed the material used as the broken-down bedrock that was used as fill in this location consists primarily of a silty sand and a silty, clayey sand. The silty sand was non-plastic, while the silty, clayey sand had a liquid limit of 30 and a plastic limit of 6. Both samples exhibited poor drainage qualities and unconsolidated, undrained triaxial tests produced results presented in **Table 6** below.

TABLE 6 – 1984 UNCONSOLIDATED, UNDRAINED TRIAXIAL RESULTS

Clearwell Embankment Fill (1964)	Cohesion (tsf)	Angle of Internal Friction (degrees)
Silty Sand	1.30	35.5
Silty, Clayey Sand	1.68	33.7

The fill overlies bedrock which slopes at approximately 1:1 at the location of the polymer building. It is therefore estimated that the area below the 2024 Proposed Facility ID 3 will be atop approximately 10 to 25 feet of fill which could cause a slight differential settlement in the future. Analysis performed during the 1964 investigation of “Composite A” settlement was reviewed to determine the approximate settlement expected within the fill at the 2024 Proposed Facility ID 3. For the polymer building, the maximum allowable soil bearing capacity recommended was 1500 psf and piping was recommended to accommodate the slight movement expected from very minor differential settlement. Site excavated soil was recommended for backfill to at least 95 percent relative compaction as determined by ASTM D-698.

The 1984 study also details which fill type was used across the site for various site uses. This information is presented below in **Table 7**.

TABLE 7 – FILL TYPES

Type	Material Source	Compaction Requirement	Use
A	Excavated Bedrock Formation Material	ASTM D-698-58T 95% min	Structural Fill and Embankment
B	Excavated Overburden Free of Vegetation	Calif. 216C 90% min	Access Road and Roadside Fills
C	Excavated Overburden Free of Vegetation	ASTM D-698-58T 95% min	Plant Site Road Fills
D	Excavated Overburden	ASTM D-698-58T 95% min	Overburden Spoil
E	Selected Excavated Overburden	ASTM D-698-58T 95% min	Topsoil

The 1984 Preliminary Layout project drawing SK-8277.1 shows that the location of the proposed 2024 Facility ID 17 is in Type D fill. The remaining proposed structures are not within the map bounds or study extent.

2.3.3 WC Filter Plant Expansion (EMBUD, 1986)

In 1986, a geotechnical investigation was conducted by EBMUD for a site expansion project. The report was not available to AGS, but AGS did review project drawings including site topography, boring locations, boring logs, and boundary of fill placement. This report revealed the following as presented in **Table 8**.

TABLE 8 – FILL TYPE MARKED OR INFERRED

2024 Proposed Facility ID	2024 Proposed Facility Description	1986 Area Use	Marked/Inferred from 1984 or 1986 Study	Type
1	Ballasted Flocculation	Structural Fill and Embankment	Inferred	A
2	Intermediate Ozone PP	Structural Fill and Embankment	Inferred	A
3	Intermediate Ozone Contactors	Waste Fill	Marked – “Waste fill”	D
4	Ozone Generator Building	Access Road	Marked – “Small embankment fill”	B
5	LOX Tanks and Vaporizers	Access Road	Marked – “Small embankment fill”	B
6 - east	Pre-Ozone PP – East	Waste Fill	Marked – “Waste fill”	D
6 – west	Pre-Ozone PP - West	Access Road	Inferred	B
7	Combined Reclaim Metering Vault	Access Road	Inferred	B
8 - east	Ozone Gas Destruct – East	Structural Fill and Embankment	Inferred	A
8 – west	Ozone Gas Destruct – West	Access Road	Inferred	B
9	Dewatering Building	Circa 2001 Site Expansion Grading	Inferred	D or E
9a	Truck Loading Canopy	Circa 2001 Site Expansion Grading	Inferred	D or E
10	Thickened Solids Blending Tanks	Circa 2001 Site Expansion Grading	Inferred	D or E
11	Gravity Thickeners	Circa 2001 Site Expansion Grading	Inferred	D or E
12	Thickened Solids PP	Circa 2001 Site Expansion Grading	Inferred	D or E
13	Solids Xfer PP	Structural Fill and Embankment	Inferred	A
14	Electrical Facilities	Waste Fill	Marked – “Waste fill”	D
15	Maintenance Building	Waste Fill	Marked – “Waste fill”	D
16[1]	Ozone Quenching Vault	-	-	-
17	Chemical Storage	Overburden Spoil	Marked – “Type D”	D
18 - east	Hydrogen Peroxide Station - east	Plant Site Road Fills	Inferred	C
18 – west	Hydrogen Peroxide Station - east	Access Road	Inferred	B

Notes:

1) Facility ID 16 is assumed to be not part of this study per communication with Carollo in March 2024 during on-site meeting with AGS on March 1, 2024.
2) Information from 1984 project drawing titled Walnut Creek Filter Plant Surface Wash Polymer Feed and Rapid Mix, Preliminary Layout, SK-8277.1 and 1986 project drawings titled Walnut Creek Filter Plant Expansion, Log of Borings, 7831-G-2.

In the 1986 investigation, borings were generally performed from the western side of the former Clearwell tank, westward. These borings were titled WC-51 to WC-56 and can be seen on **Plate 2**. Excluding a couple of minor access roads, this portion of the site was undeveloped. To create the access roads, a couple of drainage channels were leveled using fill materials.

An area marked “Small Embankment Fill” in the 1986 drawing titled Site Topography and Boring Locations was explored with a soil boring designated WC-52. The boring location is presented on **Plate 2**. WC-52 encountered fill composed primarily of moderate to high plasticity, stiff to very stiff silty clay to approximately 28.5 feet below existing ground surface (bgs) before encountering clayey siltstone with a dry density of 87 pounds per cubic foot (pcf) and specific gravity of 2.58.

Another area marked “Waste Fill” in the 1986 drawing titled Site Topography and Boring Locations was explored with a soil boring designated WC-54. The boring location is presented on **Plate 2**. WC-54 encountered fill composed primarily of medium dense clayey sand, stiff clayey silt, and moderate to high plasticity, stiff to very stiff silty or sandy clay to approximately 24 feet below existing ground surface (bgs) before encountering sandy siltstone with a dry density of 85 pcf.

Below **Table 9** summarizes the 1986 investigation borings results for bedrock.

TABLE 9 – 1986 BEDROCK LABORATORY RESULTS

1986 Boring ID	2024 Proposed Facility ID (within 100 feet)	Atterberg Limits[2]	Dry Density (pcf)	Moisture Content (%)	Bedrock Type
WC-52	4 & 5	-	87	34.5	Clayey Siltstone
WC-53	4	LL = 52 PI = 38	89 – 94	25.1 – 28.6	Sandy Siltstone
WC-54	15	-	85	35.3	Sandy Siltstone
WC-55	18 – east & 8 – east	-	82 – 88	31.8 – 40.5	Clayey Siltstone

Notes:
1) Information from 1986 project drawings titled Walnut Creek Filter Plant Expansion, Log of Borings, 7831-G-2 through 7831-G-5.
2) LL = Liquid Limit; PI = Plasticity Index

2.3.4 WCWTP Expansion Seismic Study (Geomatrix, 1998)

Geomatrix conducted a seismic investigation in 1998. This involved determining the Maximum Credible Earthquake on the Franklin Fault and performing a fault investigation to determine if any traces of the Franklin Fault run through the site, and if so, to determine whether they are active. The study was subsequently reviewed by William Lettis & Associates (WLA) in 1999. Results of the Geomatrix study and the WLA peer review are summarized in the below Section 2.4.1 – Fault Rupture.

2.3.5 WCWTP Improvements Project (EBMUD, 2001)

EBMUD conducted a geotechnical field investigation and engineering analyses to develop geotechnical recommendations for foundation design and construction of several structures proposed in 2001.

Of the borings performed, nine provide information relevant to the 2024 proposed facilities. **Table 10** below compiles geotechnical laboratory information at these nine borings.

TABLE 10 – 2001 GEOTECHNICAL LABORATORY RESULTS

2024 Proposed Facility ID(s)	Distance[1] (feet)	2001 Boring ID	Material Type / Depth (feet bgs)	Liquid Limit	Plasticity Index	Strength Results[2,3,4] (ksf)
18 east	80	MN-4	Claystone / 2	52	14	-
			Siltstone / 16	-	-	Su=4.4 (1.8)[2]
1 northeast	0	MN-8	Sandstone / 11	-	-	Su=9.9 (1.2)[2]
2 & 3	5	MN-9	Fill (CL) / 3	38	18	-
			Soil (ML) / 6	43	21	-
			Siltstone / 20	-	-	Su=0.4 (2.2)[2]
14	40	MN-15	Fill (SC) / 7	43	26	-
			Soil (CH) / 11	58	29	-
			Claystone / 26	68	43	-
			Siltstone / 36	-	-	Su=3.3 (4.2)[2]
			Siltstone / 47	-	-	Su=4.6 (5.4)[3]
15	10	MN-16	Claystone / 3	62	34	-
			Claystone / 6	65	36	-
			Claystone / 11	66	36	-
			Claystone / 16	-	-	Su=7.0 (1.8)[3]
			Claystone / 26	-	-	Su=3.4 (3.0)[2]
			Siltstone / 42	-	-	Su=5.0 (3.0)[3] Su=5.9 (4.0)[3] Su=7.1 (5.0)[3]
18 west	65	MN-17	Soil (CH) / 3	51	32	-
			Claystone / 6	-	-	Su=0.9 (0.5)[3] Su=1.0 (1.0)[3]
			Claystone / 11	79	41	-
			Claystone / 16	-	-	Su=1.9 (1.8)[3]
			Claystone / 26	-	-	Su=5.6 (3.0)[2]
			Siltstone / 42	-	-	Su=13.4 (5.0)[3]
15	50	MN-18	Fill (CL) / 3	40	20	-
			Fill (CL) / 6	38	13	-
			Fill (CL) / 16	45	24	-
			Claystone / 21	-	-	Su=2.0 (2.4)[3]
			Claystone / 26	64	30	-
			Claystone / 31	-	-	Su=1.5 (3.6)[2]
			Shale / 51	-	-	Su=0.9 (6.0)[2]

2024 Proposed Facility ID(s)	Distance[1] (feet)	2001 Boring ID	Material Type / Depth (feet bgs)	Liquid Limit	Plasticity Index	Strength Results[2,3,4] (ksf)
			Shale / 70	-	-	Su=2.5 (5.0)[3] Su=3.0 (6.0)[3] Su=3.3 (7.0)[3]
			Claystone / 82	-	-	Su=1.7 (8.0)[2]
4	90	MN-19	Fill (CH) / 3	85	54	-
			Siltstone / 6	-	-	Su=4.4 (0.6)[3]
			Claystone / 11	68	36	-
			Claystone / 16	-	-	Su=2.2 (1.8)[3] Su=4.2 (2.4)[3] Su=5.3 (3.6)[3]
			Claystone / 25	-	-	Su=6.8 (3.0)[2]
			Claystone / 40	-	-	Su=5.7 (4.8)[3]
17	0	MN-21	Soil (CH) / 3	78	52	-
			Siltstone / 6	48	27	-
			Claystone / 11	71	37	Su=2.5 (1.2)[2]
			Claystone / 16	64	29	-
			Siltstone / 21	-	-	Su=4.2 (2.4)[2]
			Siltstone / 31	-	-	Su=4.3 (3.5)[2]

Notes:
1) Approximate boring distance from the 2024 proposed facility footprint (EBMUD, 2020).
2) Ultimate strength unconsolidated undrained triaxial.
3) Ultimate strength consolidated undrained triaxial.
4) "Su" = undrained shear strength; "()" = confining stress.

Allowable bearing pressures calculated for shallow foundations in this investigation are as presented in **Table 11** below.

TABLE 11 – ALLOWABLE BEARING PRESSURES FOR SHALLOW FOUNDATIONS

Subsurface Material	Allowable Bearing Pressure (Dead and Live Loads; psf)	Allowable Bearing Pressure (Dead Load; psf)
Bedrock	5,000	3,300
Engineered Fill	3,000	2,250

Lateral resistive forces on structures were also calculated and recommendations for passive pressures are presented in **Table 12** below.

TABLE 12 – PASSIVE EARTH PRESSURE

Subsurface Material	Passive Earth Pressure[1] (pcf)
Bedrock	350
Engineered Fill	280

Note:
1) These values assumed a triangular distribution for passive pressure. Values were to be applied to the vertical face of footings or grade beams resisting lateral forces.

Relevant to proposed 2024 Facility ID 5 (LOX Tanks and Vaporizers) were recommendations for the chemical contact chamber. EBMUD determined that the northwest side of the contact chamber was going to be underlain by up to 10 feet of fill and colluvial materials and recommended that all fill and colluvial material be removed and replaced with lean concrete. A conventional shallow footing was recommended to support the tank, with the tank being partially buried by placement of fill around the tank. The area underlying this proposed fill area around the tank, which possibly includes the northeast side of Facility ID 5, was recommended to be replaced with engineered fill.

Relevant to proposed 2024 Facility IDs 4, 5, 7, 18, 8 – west, 6 – east, and 6 – west (Ozone Generator Building, LOX Tanks and Vaporizers, Combined Reclaim Vault, Hydrogen Peroxide Station Covered Canopy, Ozone Gas Destruct Covered Canopy, and Pre-Ozone PP) were recommendations for the 72-inch raw water pipeline. EBMUD determined the pipeline would predominantly be founded in claystone, shale, siltstone, and sandstone bedrock except where it crossed former drainage channels that had been filled in previously with silty, sandy clay. They noted that siltstone and sandstone bedrock would likely be suitable for pipe backfill. Groundwater was encountered in some borings performed along the pipeline alignment ranging from 4 to 25 feet below ground surface (bgs) in January 2001.

Relevant to proposed 2024 Facility IDs 9, 9a, 10, 11, and 12 (Dewatering Building, Truck Loading Canopy, Thickened Solids Blending Tanks, Gravity Thickeners, and Thickened Solids PP) were recommendations for the Waste Stream Treatment Facilities. EBMUD

determined that the foundation would be sandstone and could be supported by conventional shallow footings founded on bedrock.

Relevant to proposed Facility ID 17 (Chemical Storage Covered Canopy) were recommendations for the chemical storage building. EBMUD determined that the locations were underlain generally by existing old fill, which was noted in 1984 study as being Type D. The recommendation was that the structure be supported on 24- to 30-inch diameter reinforced concrete drilled piers extending at least 8 feet into bedrock with pier spacing not to be less than 3 pier diameters from center-to-center. It is not known to AGS whether this recommendation was implemented. Additionally, it was recommended that surface water collection systems be constructed to divert runoff from the building as the area served as a low point from slopes to the south.

2.3.6 WCWTP Improvements Project – Clearwell Tank (Geomatrix, 2001)

Geomatrix conducted a geotechnical field investigation and performed engineering analysis to provide recommendations for the Clearwell tank. This study estimated the differential settlement of a shallow foundation system for the Clearwell tank would be 2 to 2.5 inches in areas underlain by about 30 feet of fill. Settlement would predominantly be elastic settlement and rebound of the underlying fill in response to water level oscillation within the tank. It was decided that this was not an acceptable amount of settlement for the tank to tolerate. Geomatrix then developed alternative foundation systems that could mitigate the expected differential settlement initially calculated. These alternatives included: excavation and replacement of the fill, cement deep soil mixing (CDSM), hybrid designs that incorporate excavation, replacement and ground modification techniques, and drilled piers. EBMUD directed Geomatrix to perform their analysis and recommendations on CDSM. Analyses indicated that settlement of the Clearwell would be less than 0.35 inches for portions underlain by bedrock, 0.5 inches for portions underlain by CDSM and 0.5 inches for portions underlain by compacted aggregate base.

They additionally performed probabilistic ground motion analyses for the WCWTP. Their calculated peak horizontal ground acceleration was 0.73g for an equal hazard response spectra corresponding to 10% probability of exceedance in 50 years (475 years return period).

2.3.7 WCWTP – Geotechnical Interpretive Report (N&M, 2022)

A field investigation and performed engineering analyses for the proposed WCWTP Pretreatment Project in 2022. Their interpretive report analyzed concluded several different items from field data they reviewed and acquired, including borings, piezometers, and geophysical surveys.

Samples from the borings were submitted for geotechnical laboratory testing and the data is compiled below in **Table 13.**

TABLE 13 – 2022 GEOTECHNICAL LABORATORY RESULTS

2024 Proposed Facility ID(s)	Distance[1] (feet)	2022 Boring ID	Material Type / Depth (feet bgs)	Liquid Limit	Plasticity Index	Strength Results[2,3,4,5,6,7]	Other Results[8,9,10]
17	0	NMB-2	Sandstone / 0-5	-	-	-	EI=39
3	20	NMB-3	Fill (CH) / 6	59	36	Peak DS: c'=0.33; ϕ'=46 Ultimate DS: c'=0.20; ϕ'=36	-
			Fill (SC) / 15	-	-	UC: Su=1.0	-
			Fill (SM) / 20	43	14	UU: Su=2.2 (1.4); Su=2.6 (2.9); Su=2.8 (5.8)	-
4 & 5	15	NMB-4	Fill (SC) / 3	-	-	UC: Su=0.6	-
			Fill (SM) / 6	43	16	-	CN: CR=0.075; RR=0.005; σ,yield= 10.2; %clay=12
			Fill (CL) / 15	-	-	CU:	-

2024 Proposed Facility ID(s)	Distance[1] (feet)	2022 Boring ID	Material Type / Depth (feet bgs)	Liquid Limit	Plasticity Index	Strength Results[2,3,4,5,6,7]	Other Results[8,9,10]
						Su=3.5 (3.0); Su=4.9 (5.8); Su=7.1 (11.6); c'=0.65; ϕ'=29	
			Fill (GC) / 20	38	18	-	CN: CR=0.093; RR=0.005; σ,yield=6.2
			Fill (GC) / 25	38	19	CU: Su=2.8 (2.9); Su=3.8 (5.8); Su=6.1 (11.5); c'=0.95; ϕ'=23	-
			Fill (CL) / 35	-	-	-	CN: CR=0.120; RR=0.003; σ,yield=3.2
4	0	NMB-6	Fill (SC) / 0-5	-	-	-	EI=24
			Fill (SC) / 10	39	17	-	CN: CR=0.066; RR=0.003; σ,yield=10.4
			Fill (SC) / 15	-	-	-	CN: CR=0.088; RR=0.007; σ,yield=6.0
			Siltstone / 20	-	-	UU: Su=3.7 (1.4); Su=3.2 (2.9); Su=4.1 (5.8);	%OM=1.6
9,10,11,12	100	NMB-5	Fill (CL) / 0-5	-	-	-	pH=7.8;
			Fill (CL) / 6	46	25	-	CN: CR=0.109; RR=0.002; σ,yield=9.7; %OM=1.9; %clay=27
Staging Area 1 Retaining Wall	10	NMB-9	Soil (CL) / 11	-	-	UC: Su=4.9	-
			Siltstone / 16	76	58	Sat CU: Su=1.3 (0.6); Su=2.8 (2.7); Su=4.5 (5.6); c'=0.45; ϕ'=32;	%OM=1.3; %clay=50;
15	10	NMB-7	Fill (SC) / 6	45	27	-	CN: CR=0.091; RR=0.001; σ,yield=10.0

2024 Proposed Facility ID(s)	Distance[1] (feet)	2022 Boring ID	Material Type / Depth (feet bgs)	Liquid Limit	Plasticity Index	Strength Results[2,3,4,5,6,7]	Other Results[8,9,10]
			Fill (SC) / 10	-	-	Sat CU: Su=1.3 (0.7); Su=2.5 (2.9); Su=4.1 (5.8); c'=0.35; ϕ'=30;	-
			Fill (CL) / 15	-	-	-	CN: CR=0.117; RR=0.012; σ,yield=3.6;
			Soil (CH) / 20	54	41	-	CN: CR=0.101; RR=0.004; σ,yield=7.4; %OM=1.6; %clay=42
			Siltstone / 24.5	-	-	CU: Su=2.75; Su=3.78; Su=6.06; c'=0.95; ϕ'=23;	-
			Siltstone / 35	-	-	UU: Su=4.1 (4.2)	-

Notes:

1) Approximate boring distance from the 2024 proposed facility footprint (EBMUD, 2020)
2) Sat CU = saturated consolidated undrained triaxial (Su=ksf)
3) DS = direct shear (c'=ksf; ϕ'=degrees).
4) UC = unconfined compression (Su=ksf)
5) UU = unconsolidated undrained triaxial compression (Su=ksf)
6) CU = consolidated undrained triaxial compression (Su=ksf)
7) "Su" = undrained shear strength; "()" = confining stress
6) CN = consolidation; "CR" = compression ratio; "RR" = recompression ratio; "σ,yield" = yield stress (kips per square foot (ksf))
8) EI = expansion index
9) %OM = percent organic matter

2.3.7.1 Corrosivity

Corrosivity tests were run on bulk samples of the top five feet within the footprint of 2024 proposed Facility ID 18 (east) and within 100 feet of the footprints for 2024 proposed Facility IDs 9, 10, 11 and 12. Results from the 100% saturated resistivity measurements indicated that the subsurface material from existing ground surface to five feet bgs is corrosive to ferrous metals. Chloride ion concentrations are not high enough to attack steel embedded in a concrete mortar coating. Sulfate ion concentrations are not high enough to damage reinforced concrete structures and cement mortar-coated steel.

A corrosivity test was also run at a depth of 10 to 11 feet bgs within 10 feet of the proposed 2024 retaining wall for Staging Area 1. Results were consistent with the results discussed above.

2.3.7.2 Expansion Potential

Expansion index tests were run on bulk samples of the top five feet within the footprints of 2024 proposed Facility IDs 18 (east) and 4. Results from these samples indicated a low expansion potential.

2.3.7.3 Fill Suitability

In a previous study (EMBUD, 2001), the old fill in these areas was deemed unsuitable as a foundational material for facilities due primarily to the expected organic matter. Sonic cores denoted SB-1 and SB-2 were performed within two areas of the WCWTP known to contain old fill (N&M, 2022). Relevant 2024 proposed Facility IDs are 4, 5, and 15. The cores were reviewed and contained scattered rootlets, wood chips, and grasses but these layers were not continuous. The boundary between organic soil and mineral soil is 15 percent organic content, which includes any vegetation. All tested samples at the two sonic cores indicated a less than 3 percent organic content. It was therefore concluded that the old fill beneath Facility ID 4, 5, and 15 was suitable to support these structures on footings or mat foundations (N&M, 2022). There is potential for unsuitable fill to be present beneath Facility ID 3, 11, and 12 as well, but they were not included in an organic matter study as the understanding was that the old fill is going to be removed by excavation regardless of getting to final pad elevation.

Facility IDs 6, 9, 9a, 10, 14, 16, and 17 also have the potential for unsuitable old fill material to be present. An investigation would need to determine the suitability of the fill before deeming it sufficient to support the structures on footings or mat foundations. Otherwise, recommended alternatives included deep footings, drilled piers with a

structured slab or additional piers to support tanks or other equipment, or remove and replace with engineered fill.

2.4 SEISMICITY AND OTHER GEOLOGIC HAZARDS

Based on the WCWTP's proximity to major faults and historical seismicity in the region, the potential for strong ground shaking at the WCWTP is considered high. In this section, we have briefly reviewed the geological and seismic hazards and provide the following qualitative terms to describe the hazard potential: very low, low, moderate, high, or very high.

2.4.1 Fault Rupture

The Franklin fault (FF) lies approximately 400 to 600 feet east of the WCWTP and has several traces, named West, Central, and East, that run beneath and adjacent to the WCWTP as presented on **Plate 2**. A previous fault study was performed at the WCWTP by Geomatrix in 1998 and peer reviewed by WLA in 1999. The study and review concluded that per Division of Safety of Dams (DSOD) the FF is a dextral strike-slip fault and both the FF and the West fault are "active" (i.e. evidence of movement in the last 35,000 years), and the Central and East faults should be considered "conditionally active." It was noted that although the likelihood of surface rupture is less than rupture along the Hayward or Calaveras faults, the exact likelihood cannot be properly evaluated. Geomatrix and WLA determined that the Maximum Credible Earthquake (MCE) on the FF is between magnitude 6.5 and 6.75. Considering for the minimum and maximum coseismic displacements calculated by Geomatrix and WLA, the range of displacement on the FF assuming a magnitude 6.75 earthquake is 2.3 to 4.3 feet, with 0.0 to 2.5 feet of displacement occurring on the West, Central, and East faults.

The site is not located within an Alquist-Priolo earthquake fault zone and therefore the risk of surface fault rupture is low (CGS, 2021). CGS considers a fault active if it shows displacement that occurred within the last 11,000 years, and potentially active if between

11,000 and 1.6 million years. Geomatrix determined in their study that the FF and West fault showed evidence of movement in the last 31,000 years and they are therefore "potentially active" per CGS guidelines (CGS, 2018).

2.4.2 Liquefaction Hazard Zone

Based on the absence of saturated, clean, cohesionless soils encountered at the site in our investigation and previous investigations, this site is considered to have a low potential of liquefaction (Association of Bay Area Governments [ABAG], 2020).

2.4.3 Landslide Hazard Zone

A USGS database of landslide hazard areas in the San Francisco Bay Region was created in 1998 and includes existing rainfall-induced landslide locations. ABAG presents the database in the hazard viewer. A majority of the WCWTP falls within areas of either few or most landslides. Regional landslides were mapped by Nilsen (1975) on the eastern, western, and northern portions of the WCWTP. Previous site mapping and aerial photograph review by others identified the Nilsen (1975) landslides in the field that had not already been removed by site grading. These landslides as detected in the field or aerial imagery are presented on **Plate 2**. The landslides appear to entirely be shallow debris flows, mudflows, and soil slumps. We rank the potential of rainfall-induced landslide affecting the proposed structures at the WCWTP to be low to moderate.

The 2024 Seismic Hazard Zone Report for the Walnut Creek Quadrangle does not map any landslides within 1000 feet of the WCWTP.

2.4.4 Probabilistic Earthquake Shaking Hazard

Earthquakes in the San Francisco Bay Area could produce strong ground-shaking in the project area. Ground-shaking intensity is partly related to the size of an earthquake, the distance to the site, and the response of the geologic materials that underlie the site. As

a rule, the greater the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of ground-shaking. Violent ground-shaking is generally expected at and near the epicenter of a large earthquake; however, different types of geologic materials respond differently to earthquake waves. Deep unconsolidated materials amplify earthquake waves. Even when an earthquake epicenter is distant from a site, it can induce strong ground-shaking and wave amplification with severe hazards to people and property.

The Modified Mercalli Intensity (MMI) scale is commonly used to measure earthquake effects due to ground-shaking. **Table 14** below presents a description of the Modified Mercalli Intensity Scale. The MMI values for intensity range from I (earthquake not felt) to XII (damage nearly total). MMI intensities ranging from IV to X could cause moderate to significant structural damage. The damage, however, will not be uniform. Some structures will experience substantially more damage, and others will experience substantially less damage. Not all structures perform identically in an earthquake. The age, material, type, method of construction, size, and shape of a structure all affect its performance (ABAG, 2018).

Earthquake disaggregation identifies the Concord Fault as the seismic source responsible for the majority of the seismic hazard at the site (USGS, 2025).

The project area has a probabilistic seismic hazard to experience severe shaking (MMI VIII) that can cause damage to weak structures. Earthquake damage depends on the earthquake size, distance from causative fault, local soil conditions, source to site path effects, duration of shaking, and rupture directivity (USGS OFR 03-214, 2002).

TABLE 14 – MODIFIED MERCALLI INTENSITY SCALE (ABRIDGED)

Level	Description
I	Not felt except by a very few under especially favorable circumstances.
II	Felt by only a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing vehicles may rock slightly. Vibration similar to passing of truck. Duration estimated.
IV	During the day, felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, and doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing vehicles rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all; many are frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built, ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving vehicles.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Chimneys, factory stacks, columns, monuments, and walls fall. Heavy furniture overturned. Disturbs persons driving vehicles.
IX	Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed, along with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slums and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown upward into the air.

2.4.5 Historical Seismicity

The project area is located in a seismically active region which has been subjected to several strong earthquakes during historic time. To the east-northeast is approximately 7.8 kilometers is the Concord Fault, to southwest approximately 13.5 kilometers is the Hayward Fault, and to the southeast approximately 9.4 kilometers is the Calaveras fault. Further from the project site is another significant seismic source, the San Andreas Fault, which dominates the tectonics, geology, and geomorphology of the San Francisco Bay region and is situated about 44 kilometers southwest of the project site. Other major active faults which could cause significant shaking at the project site are the Green Valley, San Gregorio, Mount Diablo Thrust, Calaveras, Monte Vista-Shannon, and West Napa Faults. **Plate 4** – Earthquake Epicenters and Fault Map, shows active major faults and epicenters of recent earthquakes. Active faults that are pertinent to the project site and historic earthquakes attributed to each fault are listed below in **Table 15**.

TABLE 15 – HISTORICAL EARTHQUAKES (MAGNITUDE ≥ 6)

Date	Moment Magnitude (M_w)	Fault	Epicenter Area
June 24, 1808	6.0[4]	Unknown	Uncertain, San Francisco Bay Area
June 10, 1836	6.4[1], 6.8[4]	San Andreas	San Juan Bautista
June 1838	7.4[1]	San Andreas	San Juan Bautista
Nov. 26, 1858	6.25[4]	Calaveras	San Jose Area
February 26, 1864	6.0[4]	San Andreas	South Santa Cruz Mountains
March 26, 1864	6.0[4]	San Andreas	Santa Cruz Mountains
October 8, 1865	6.5[1]	San Andreas	South Santa Cruz Mountains
October 21, 1868	7.0[2,4]	Hayward	Berkeley Hills, San Leandro
February 17, 1870	6.0[4]	San Andreas	Los Gatos
April 12, 1885	6.25[4]	Unknown	South Diablo Range
May 19, 1889	6.25[4]	Concord-Green Valley	Antioch
April 24. 1890	6.25[4]	San Andreas	Pajaro Gap
April 19, 1892	6.6[1]	Great Valley	Vacaville
April 21, 1892	6.25[4]	Great Valley	Winters
June 20, 1897	6.25[4]	Calaveras	Gilroy
March 31, 1898	6.4[1]	Rodgers Creek	Mare Island
April 15, 1898	6.7[1]	San Andreas	Mendocino County
April 18, 1906	7.8[1]	San Andreas	Golden Gate
July 1, 1911	6.6[1]	Calaveras	Diablo Range, East of San Jose
October 22, 1926	6.1[4]	San Gregorio	Monterey Bay
April 24, 1984	6.2[1]	Calaveras	Morgan Hill
October 17, 1989	6.9[1]	San Andreas	Loma Prieta, Santa Cruz Mountains
August 24, 2014	6.0[5]	West Napa	South Napa, American Canyon

1. Toppozada, et al. (2000)
2. Thatcher (1975)
3. Toppozada and Branum (2004)
4. Ellsworth, W.L (1990)
5. Brocher et al. (2015)

2.4.6 Active Faulting

The primary source controlling the seismic hazard at the site at all structural periods was identified as the Concord Fault by the USGS Earthquake Disaggregation online tool (USGS, 2025). The Concord Fault is situated about 7.8 kilometers east-northeast of the project site and is calculated by WGCEP (Working Group on California Earthquake Probabilities) UCERF3 (Uniform California Earthquake Rupture Forecast, Version 3, as being capable of producing a magnitude 6.45 event. A summary of all seismic sources and activities are provided below in **Table 16**.

TABLE 16 – FAULT SEISMICITY

Distance to site[1] (km)	Fault Name[3]	M_{max} Earthquake[2]	Slip Rate[3] (mm/yr)	Dip[1] (degrees)	Dip Direction[1,2]	Fault Type[3]
0.2	Franklin[4]	6.75[3]	< 1.0[3]	90	V	strike slip
1.0	Southampton[5]	6.25	0.2 – 1.0	n/a	SW	reverse
5.0	Mount Diablo Thrust	6.72	2.0	38	NE	thrust
7.8	Concord	6.45	4.3	84	V	strike slip
9.4	Calaveras	7.43	6.0	80	V	strike slip
13.5	Hayward	7.58	9.0	82	V	strike slip
19.0	Green Valley	6.30	4.0	90	V	strike slip
19.7	Greenville (North)	6.86	3.0	84	V	strike slip
21.3	Great Valley 5, Pittsburg Kirby Hills	6.66	1.5	55-90	W-V	reverse
43.2	Great Valley 4b, Gordon Valley	6.77	1.3	20	W	reverse
43.8	West Napa	6.97	1.0	75	V	strike slip
44.0	N. San Andreas	8.04	17.0	90	V	strike slip
48.7	San Gregorio Connected	7.44	7.0	90	V	strike slip
53.4	Rogers Creek – Healdsburg	7.19	9.0	77	SE	strike slip
53.5	Monte Vista-Shannon	7.14	0.6	61	W	thrust
68.9	Great Valley 4a, Trout Creek	6.60	1.3	20	W	reverse
81.1	Maacama	7.55	9.0	63	V	strike slip
83.4	Zayante-Vergeles	7.48	0.1	90	V	reverse
87.5	Hunting Creek-Berryessa	6.69	4.0	90	V	strike slip

Notes:

1. 2008 National Seismic Hazard Map – Source Parameters at: earthquake.usgs.gov/cfusion/hazfaults_2008_search
2. USGS Earthquake Scenario Map (BSSC 2014), maximum magnitude eathquake presented from UCERF3 model.
3. WGCEP (2013), Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3), Appendix B1: geologic slip-rate data and geologic deformation model; UCERF3 Best Estimate Rate.
4. Geomatrix (1998), Last displacement determined to be 31,000 years from present day.
5. Kelson et al. (2005), Last displacement determined to be late Quaternary age.

There are other active faults in the region, but these are either farther from the project site or smaller and, therefore, would not be capable of causing shaking at the project site as strong as those caused by the faults listed in **Table 16**.

2.5 SUBSURFACE CONDITIONS

AGS summarized the soil conditions encountered in our borings and reviewed previous borings by others to provide the below summaries relevant to 2024 proposed facilities. Generalized subsurface profiles are presented on **Plates 5A to 5F**.

2.5.1 Ballasted Flocculation Basins (BFB) – Northeastern and Northwestern (Facility 1)

Both the northeast and northwest BFB facilities are mapped within Hambre Formation. From AGS 2024 and previous borings, the northeast BFB is underlain by approximately 0 to 3.5 feet of fill composed of sandy clay followed by severely to moderately weathered Hambre Formation sandstone and siltstone to the maximum depth explored. From AGS 2024 and previous borings, the northwest BFB is underlain by approximately 0 to 4 feet of fill composed of silty sand followed by severely to moderately weathered Hambre Formation siltstone, claystone, and moderately weathered sandstone to the maximum depth explored. The fill is documented as having been excavated bedrock from the site that was broken down into granular material per EBMUD 1964 study recommendations.

2.5.2 Intermediate Ozone PP Vaults (Facility 2)

This facility is mapped within Hambre Formation. From AGS 2024 and previous borings, the facility is underlain by approximately 7.5 to 13.5 feet of fill composed of very stiff sandy clay, stiff sandy silt, and medium dense clayey sand overlying severely to moderately weathered Hambre Formation sandstone, claystone, and siltstone to the maximum depth explored. The fill is documented as having been excavated bedrock from the site that was broken down into granular material per EBMUD 1964 study recommendations.

2.5.3 Intermediate Ozone Contactor Tanks (Facility 3)

In 2024, AGS was unable to perform a boring in the vicinity of Facility ID 3 due to utility

congestion. AGS bases recommendations for this building on a previous boring and the 1984 study which determined the bedrock was sloping approximately 1:1 in this area and fill was approximately 10 to 25 feet thick, composed of Type A, engineered fill composed of broken-down bedrock from the site. A previous boring within 25 feet of the facility encountered 28 feet of fill composed of medium dense to dense clayey sand, dense silty sand, and hard sandy clay overlying weathered Hambre Formation sandstone and siltstone to the maximum depth explored (N&M, 2022; NMB-3).

2.5.4 Ozone Generator Building (Facility 4)

This facility is mapped within embankment fill that was placed circa 1964 within the old drainage channel to construct the access road that is still utilized. From AGS 2024 and previous borings, the facility is underlain by approximately 18 to 39 feet of fill followed by Briones Formation. The encountered fill is composed of medium dense to very dense clayey sand, medium dense to dense clayey gravel, medium dense silty sand, hard gravelly silt with sand, and very soft to hard clay and sandy clay overlying severely to moderately weathered Briones Formation claystone and siltstone to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 20 feet bgs.

2.5.5 LOX Tanks and Vaporizers (Facility 5)

This facility is mapped within two artificial fill placements. The old drainage channel that crossed beneath the proposed facility was first infilled circa 1964 to construct the access road that is still utilized. Circa 2001, the construction of the smaller tank nicknamed “Rocky” required fill around the tank to be removed and replaced from the previously installed embankment fill to engineered fill. The exact extent of this placement is not well understood but we assume it possibly includes the northeast side of Facility ID 5.

From AGS 2024 and previous borings, the facility is underlain by approximately 30 to 39 feet of fill followed by Briones Formation. The encountered fill is composed of medium dense to very dense silty or clayey sand, medium dense to dense clayey gravel, and stiff to hard clay and sandy clay. Approximately 5 feet of stiff fat clay overlies Briones

Formation severely to moderately weathered claystone to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 22 feet bgs.

2.5.6 Pre-Ozone PPs - Eastern (Facility 6)

The northeast Facility ID 6 is mapped within Briones Formation and artificial fill that was classified as “Waste Fill” in the 1984 study that documented where overburden, deemed unsuitable for use as fill across the site, was deposited.

AGS 2024 boring encountered fill to approximately 20 feet, composed of medium dense to dense clayey sand and stiff to very stiff sandy clay and clay with sand. Beneath the fill is approximately 5 feet of alluvium, predominantly stiff to hard fat clay overlying severely to moderately weathered Briones Formation claystone and shale to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 11 feet bgs.

2.5.7 Combined Reclaim Metering Vault (Facility 7)

This facility is mapped within artificial fill that was placed between 1964 and 1984 as part of the access road from the aqueduct to the WCWTP. AGS 2024 boring encountered approximately 7.5 feet of fill composed of clayey sand and hard sandy clay underlain by 2.5 feet of very stiff fat clay followed by severely to moderately weathered Briones Formation claystone and shale to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 24.5 feet bgs.

2.5.8 Ozone Gas Destruct Canopy - Western (Facility 8)

This facility falls within the Briones Formation. AGS 2024 boring encountered approximately 5 feet of soil composed of clay with sand, underlain by 3 feet of very stiff fat clay with sand, followed by severely to moderately weathered Briones Formation claystone and siltstone to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 35 feet bgs.

2.5.9 Dewatering Building (Facility 9) and Truck Loading Canopy (Facility 9a)

This facility falls within the Hambre Formation. AGS 2024 boring encountered approximately 5 to 7.5 feet of fill composed of clayey sand and sandy clay underlain by moderately weathered Hambre Formation siltstone to the maximum depth explored.

2.5.10 Thickened Solids Blending Tanks (Facility 10)

This facility falls within the Hambre Formation. The AGS 2024 and previous borings encountered approximately 5 to 7.5 feet of fill composed of clayey sand and sandy clay underlain by moderately weathered Hambre Formation siltstone to the maximum depth explored.

2.5.11 Gravity Thickeners – Northeastern and Northwestern (Facility 11)

This facility falls within the Hambre Formation. The AGS 2024 and previous borings encountered approximately 4 to 6 feet of fill composed of hard sandy clay underlain by severely to moderately weathered Hambre Formation sandstone to the maximum depth explored.

2.5.12 Thickened Solids PP Vaults – Northern (Facility 12)

This facility falls within the Hambre Formation. The AGS 2024 and previous borings encountered approximately 4 to 6 feet of fill composed of hard sandy clay underlain by severely to moderately weathered Hambre Formation sandstone to the maximum depth explored.

2.5.13 Solids Transfer PP (Facility 13)

This facility falls within the Hambre Formation. AGS did not perform a boring to investigate this location. A previous boring performed in 1997, MN-33, encountered approximately 3.5 feet of fill composed of stiff sandy fat clay underlain by severely to moderately weathered siltstone and claystone of the Hambre Formation to the maximum depth explored.

2.5.14 Electrical Facilities (Facility 14)

This facility falls within the Briones Formation. AGS encountered approximately 25 feet of fill composed of sandy silt, very dense gravel with sand, medium dense clayey sand, very stiff sandy clay, and very dense clayey sand. Beneath the fill was approximately 5 feet of stiff sandy fat clay followed by severely to moderately weathered claystone and shale of the Briones Formation to the maximum depth explored.

2.5.15 Maintenance Building (Facility 15)

This facility falls within the Briones Formation. AGS encountered approximately 8.5 feet of fill composed of sandy clay, very stiff clay with sand, and medium dense clayey sand, underlain by approximately 4 feet of very stiff to hard fat clay with sand, followed by severely weathered claystone of the Briones Formation to the maximum depth explored.

2.5.16 Ozone Quenching Vaults (Facility 16)

This facility falls within the Hambre Formation. AGS did not perform a boring at this investigation per Carollo communication that the facility was removed from Phase I of the project.

2.5.17 Chemical Storage Canopy (Facility 17)

This facility falls within the Hambre Formation. AGS encountered approximately 8.5 feet of fill composed of hard sandy clay underlain by severely to moderately weathered siltstone and claystone of the Hambre Formation to the maximum depth explored. Historic grading plans indicate that there is approximately 15 to 25 feet of fill at the proposed Chemical Storage Canopy facility (EBMUD, 1964).

2.5.18 Hydrogen Peroxide Station Canopy - Eastern (Facility 18)

This facility falls within the Hambre Formation. AGS encountered approximately 3 feet of fill composed of silty sand with gravel followed by severely to moderately weathered siltstone of the Hambre Formation to the maximum depth explored.

2.5.19 Hydrogen Peroxide Station Canopy - Western (Facility 18)

This facility falls within the Briones Formation. AGS encountered approximately 5 feet of soil composed of clay with sand underlain by approximately 3 feet of very stiff fat clay with sand, followed by severely to moderately weathered claystone and siltstone of the Briones Formation to the maximum depth explored. AGS encountered a potential shear zone at a depth of approximately 35 feet bgs.

TABLE 17 – SUMMARY OF SUBSURFACE STRATIGRAPHY

Boring ID	Relevant 2024 Proposed Facility ID[1]	Relevant 2024 Proposed Facility Description[1]	Depth Below Existing Ground Surface[2] (feet)				
			Artificial Fill	Alluvium	Colluvium	Residual Soil	Bedrock
B-1	1	Ballasted Flocculation	0-3.5	-	-	-	3.5
B-2	2	Intermediate Ozone PP	0-7.5	-	-	-	7.5
B-3	1	Ballasted Flocculation	0-4	-	-	-	4
B-4	-[4]	-[4]	-	-	0-3.2	-	3.2
B-5	17	Chemical Storage	0-8.5	-	-	-	8.5
B-6B	9 & 9a	Dewatering Building & Truck Loading Canopy	0-7.5	-	-	-	7.5
B-7	-[4]	-[4]	-	-	0-2.8	-	2.8
B-8	11 & 12	Gravity Thickeners & Thickened Solids PP	0-6	-	-	-	6
B-9	14	Electrical Facilities	0-25	-	25-30	-	30
B-10	15	Maintenance Building	0-8.5	-	8.5-12.5	-	12.5
B-11	5	LOX Tanks & Vaporizers	0-30[5]	30-35	-	-	35
B-12	4	Ozone Generator Building	0-20	-	20-25[5]	-	25
B-13	8 - west & 18 - west	Ozone Gas Destruct & Hydrogen Peroxide Station	0-5	-	5-8	-	8[5]
B-14	6 - east	Pre-Ozone PP	0-20	20-25	-	-	25[5]
B-15	7	Combined Reclaim Metering Vault	0-7.5	-	-	7.5-10	10[5]
B-16	-[4]	-[4]	0-5	-	-	-	5
B-17	18 - east	Hydrogen Peroxide Station	0-3	-	-	-	3
B-18	-[4]	-[4]	-	0-4	-	-	4

Notes:
1) 2024 Proposed Facility ID within 40 feet of 2024 boring
2) Depths are approximate
3) "–" = not encountered
4) Boring was performed for slope stability analysis
5) Potential shear zone was encountered during drilling.

TABLE 18 – SUMMARY OF 2024 GEOTECHNICAL LABORATORY TESTS

AGS Boring ID	Depth[1] (feet)	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Liquid Limit	Plasticity Index	Strength Results[2,7,8,9]	Consolidation Results[3]	Additional Tests[4,5,6]
B-01	0-5	18	-	58	-	-	-	-	-
	5	19	99	77	35	3	-	-	-
	7.5	19	100	69	-	-	-	-	-
B-02	0-5	6	-	54	-	-	-	-	-
	6	15	100	28	-	-	-	-	-
	8.5	17	114	27	-	-	-	-	-
	10	20	-	24	-	-	-	-	-
	25	24	99	69	-	-	-	-	-
	30	37	-	81	43	11	-	-	-
	35	32	-	54	-	-	-	-	-
B-03	0-5	8	-	42	-	-	-	-	-
	5	9	109	-	-	-	-	-	-
	7.5	26	-	58	-	-	-	-	-
	10	23	-	61	-	-	-	-	-
	15	25	-	88	-	-	-	-	-
	23	-	-	-	-	-	PL: 1.9 (0.275) 2.2 (0.313)	-	-
B-04	0-2	6	-	58	-	-	-	-	-
	3	24	89	68	-	-	-	-	-
	5	25	-	-	-	-	-	-	-
	7.5	27	-	80	-	-	-	-	-
	10	25	-	-	-	-	-	-	-
B-05	0-5	12	-	65	-	-	-	-	-
	6	18	104	68	-	-	-	-	-
	8.5	27	-	94	-	-	-	-	-
	16	25	88	60	42	20	-	-	-
	25	18	109	66	-	-	-	-	-
	35	27	-	92	-	-	-	-	-
B-06A	0-5	14	-	75	-	-	-	-	-
B-06B	7.5	14	-	-	-	-	-	-	-
	10	-	-	-	-	-	US: 1006 E=248400	-	-

AGS Boring ID	Depth[1] (feet)	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Liquid Limit	Plasticity Index	Strength Results[2,7,8,9]	Consolidation Results[3]	Additional Tests[4,5,6]
	13	-	-	-	-	-	PL: 1.9 (0.295) 6.0 (0.88)	-	-
B-07	3.5	15	90	-	-	-	-	-	-
	6	19	92	-	-	-	-	-	-
B-08	0-5	24	-	61	-	-	-	-	-
	6	24	96	38	-	-	-	-	-
	7.5	23	97	24	-	-	-	-	-
	8	-	-	24	38	13	-	-	-
	8.5	22	101	46	40	14	-	-	-
	10	27	-	36	40	20	-	-	-
	26	-	-	-	-	-	PL: 5.0 (0.786)[9]	-	-
B-09	0-5	14	-	56	-	-	-	-	R=14 CC
	6	7	130	6	-	-	-	-	-
	10	25	-	48	-	-	-	-	-
	21	20	110	36	-	-	-	-	-
	25	29	-	62	-	-	-	-	-
	30.5	33	91	71	-	-	-	-	-
	31	-	-	-	42	26	-	-	-
	35.5	45	82	88	-	-	-	-	-
	41	42	96	79	-	-	-	-	-
B-10	0-2	-	-	-	-	-	-	-	R=14 CC
	3	17	98	84	46	26	-	-	-
	6	19	109	-	-	-	-	-	-
	8.5	29	95	-	-	-	-	-	-
	10	-	-	-	-	-	-	-	CR
	13	35	80	-	-	-	UU: Su=2.6 (0.52)	-	-
	13.5	32	86	-	76	43	-	-	EI=129
B-11	0-5	-	-	-	-	-	-	-	R=14 CC
	6	20	104	-	-	-	-	-	-
	8.5	23	99	48	-	-	-	-	-

AGS Boring ID	Depth[1] (feet)	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Liquid Limit	Plasticity Index	Strength Results[2,7,8,9]	Consolidation Results[3]	Additional Tests[4,5,6]
	16	19	103	34	-	-	-	-	-
	26	24	104	67	-	-	-	-	-
	30	29	-	76	60	37	-	-	-
	36	32	86	-	-	-	-	-	-
	41	31	84	95	-	-	-	-	-
	46	34	92	-	-	-	-	-	-
B-12	0-5	-	-	-	-	-	-	-	R=14 CC
	6	18	87	71	-	-	-	-	-
	7.5	29	-	36	-	-	-	-	-
	11	20	112	56	-	-	-	-	-
	15.5	28	95	-	-	-	-	-	-
	16	-	-	-	42	22	-	-	-
	26	23	101	-	-	-	-	-	-
	31	36	86	-	-	-	-	-	-
B-13	0-5	6	-	79	-	-	-	-	-
	5	-	-	-	-	-	UU: Su=4.6 (0.24);	-	-
	5.5	-	-	-	96	59	-	-	-
	6	27	91	77	-	-	-	-	-
	7.5	-	-	-	156	133	-	CN	-
	8	-	-	-	72	47	-	CN	-
	8.5	23	94	-	-	-	-	-	-
	10	31	-	94	-	-	-	-	-
	15	-	-	-	-	-	-	-	CR
	20	32	-	81	-	-	-	-	-
	25	-	-	-	79	51	-	-	EI=128
	35	24	100	-	-	-	-	-	-
B-14	6	11	106	24	-	-	-	-	-
	8.5	10	120	22	-	-	-	-	-
	10	22	-	64	-	-	-	-	-
	16	26	-	78	-	-	-	-	-
	26	29	98	-	-	-	-	-	-

AGS Boring ID	Depth[1] (feet)	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Liquid Limit	Plasticity Index	Strength Results[2,7,8,9]	Consolidation Results[3]	Additional Tests[4,5,6]
	31	24	104	-	-	-	-	-	-
B-15	0-5	4	-	49	-	-	-	-	-
	6	13	103	53	-	-	-	-	-
	7.5	-	-	-	59	32	-	-	-
	11	29	88	92	-	-	-	-	-
	20	32	-	98	77	25	-	-	-
	30	30	-	99	-	-	-	-	-
B-16	0-5	6	-	75	-	-	-	-	-
	5	6	-	14	-	-	-	-	-
B-17	6	18	109	54	-	-	-	-	-
	8	19	105	-	-	-	UU: Su=5.2 (0.32);	-	-
	8.5	24	98	51	44	18	-	-	-
	11	20	102	-	-	-	-	-	-
	16	19	111	-	-	-	-	-	-
B-18	5.5	12	93	77	-	-	-	-	-
	6	-	-	-	48	32	-	-	-
	8	-	-	77	50	31	-	-	-
	8.5	18	94	-	-	-	-	-	-
	11	28	94	-	-	-	-	-	-
	13	29	89	-	-	-	UU: Su=2.4 (0.54);	-	-
	13.5	32	94	-	-	-	-	-	-
	15	-	-	-	56	30	-	-	EI=109
	15.5	29	86	-	-	-	-	CN	-
	16.5	17	-	-	-	-	-	-	-

Notes:

1) Depth is approximate and below existing ground surface
2) UU = unconsolidated undrained triaxial test; Su = undrained shear strength (ksf); "()" = confining pressure (ksf);
3) CN = consolidation test
4) R = R-value (value from four composited bulk samples)
5) CC = compaction test
6) EI = expansion index
7) PL = point load strength index of rock core; corrected point load strength index; units = ksf; "()" = peak load, units = kN
8) US = unconfined strength of rock with Young's Modulus; units = ksf; E = Young's Modulus
9) Invalid test. Did not fail through both loading points.

10) "-" = test not run

2.6 GROUNDWATER

During our geotechnical field exploration program in August 2024, groundwater was either not encountered or not measured due to mud rotary drilling method. Locations where groundwater was not encountered when using Solid Flight Auger (SFA) the entire depth are included in **Table 19** below for informational purposes.

TABLE 19 – GROUNDWATER CONDITIONS DURING AGS 2024 FIELD EXPLORATION PROGRAM

Boring ID	Facility ID[1]	Date Drilled	Maximum Depth Explored (feet bgs)[2]	GW Level
B-01	1 - Northeast	8/19/2024	20.3	Dry
B-04	-[3]	8/29/2024	14	Dry
B-07	11 – Northeast	8/30/2024	8.25	Dry
B-10	15	8/29/2024	23.5	Dry
B-18	-[3]	8/30/2024	21.5	Dry

Notes:
1) Boring located within 20 feet of Proposed Facility ID.
2) Depths are approximate.
3) Performed downslope for slope stability analysis; distance exceeds 100 feet from nearest Facility ID.

Boring logs by others in the site vicinity show groundwater at depths ranging from 4 to 25 feet bgs in January 2001 relevant to proposed Facility ID 4, 5, 6, 7, 8, and 18 on the western side of the site. There is expected to be some variation in groundwater due to seasonal changes, temperature, precipitation, and other factors not evident at the time of this investigation.

Table 20 below shows groundwater elevations measured in piezometers installed by others in a 2001 study, with respect to the nearest 2024 proposed facility.

TABLE 20 – HISTORICAL GROUNDWATER DEPTHS

OCC[3] Boring ID	Nearest Facility ID	Nearest Facility Description	Distance from Nearest Facility ID[4] (feet)	GW Depth[1,2] (feet bgs)	Date of Measurement
MN-24	3	Intermediate Ozone Contactors	120	Dry (installed to 33.0)	1/2001 - 5/2001
MN-25	-	Staging Area 2	40	23.0	1/22/2001
MN-26	5	LOX Tanks and Vaporizors	10	4.4	4/5/2001
MN-27	4	Ozone Generator Building	25	9.3	4/5/2001
MN-28A	17	Chemical Building	30	24.8	4/5/2001
MN-29A	-	Staging Area 1	20	11.5	1/22/2001
MN-30	6	Pre-Ozone PP – West	20	Dry (installed to 30.5)	1/2001 - 5/2001

Notes:

1) Groundwater measured in monitoring well that was installed in 2001 field exploration by OCC.
2) Reported depth is shallowest recorded in 2001 and is approximate.
3) OCC = Olivia Chen Consultants
4) Distances are approximate.

The 2024 Seismic Hazard Zone Report (SHZR) for Walnut Creek presents the historical high of groundwater at the WCWTP as less than 10 feet bgs within the former drainage channels that were infilled between 1960 and 1984. The SHZR presents no groundwater information for the remainder of the site, likely due to exceedance of 50 feet bgs which is the deepest the map presents data. Variations in the groundwater level at the site are likely to occur due to changes in precipitation and temperature, and other factors not evident at the time of this study.

2.7 SOIL CORROSIVITY

Corrosivity testing was performed by Cooper Testing Laboratory for this project (see corrosivity test results presented in **Appendix B**) to evaluate the potential for adverse effects of the on-site soils on structural concrete and steel and on other metals in contact with soils. Two (2) soil samples were tested by ASTM Test Methods. A summary of the test results is presented in **Table 21**.

TABLE 21 – CORROSIVITY TEST RESULTS

Boring ID	Material Type	Depth (feet)	Resistivity (ohms-cm)	Chloride (mg/kg)	Sulfate (mg/kg)	pH	Moisture at test (%)	Sulfide
B-10	Sandy Fat Clay - Colluvium	10-11.5	519	11	305	7.5	35.3	Negative
B-13	Briones Formation - Claystone	15-16.5	868	23	54	7.4	29.8	Negative

Based on the soil resistivity classification presented by National Association of Corrosion Engineers (2000) and the results of AGS' 2024 corrosivity testing at the site, the Briones Formation Claystone and the colluvium tested within 100 feet of Facility ID 8, 15, and 18 – west is classified as "extremely corrosive" to ferrous metals. Corrosivity testing by others in 2022 on old fill, Briones Formation colluvium, and engineering fill over shallow Hambre Formation was classified as "corrosive" to ferrous metals.

According to ACI 318-19, the sulfate concentration measured in the above-mentioned Briones Formation claystone and colluvium corrosivity samples tested in this study indicates Soil Exposure Class S0. Sulfate concentrations measured in samples collected by others in 2022 of Briones Formation colluvium and on engineering fill over shallow Hambre Formation indicates Soil Exposure Class S0, while sulfate concentrations in the 2022 study of old fill indicates Soil Exposure Class S1. Current guidance for Soil Exposure Class S0 is that sulfate exposure is considered negligible to concrete structures and S1 is considered moderate to concrete structures.

AGS recommends that a Corrosion Engineer be consulted for the development of long-term site-specific corrosion protection measures.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 GENERAL

Based on our review and assessment of the existing geotechnical data, the results of our field exploration, laboratory testing, and geotechnical engineering analyses, it is AGS' opinion that the WCWTP Pretreatment Project is feasible from a geotechnical point of view, provided the recommendations presented in this report are incorporated in the design and construction of the project. Conclusions and recommendations for design of the project are presented in the following sections.

The primary geotechnical issues for this project site include:

- Suitability of undocumented fill (aka the "old fill");
- Shallow groundwater due to ephemeral groundwater seepage within old drainage ravine (near Facilities 4, 5, 14 and Staging Area 1);
- Presence of expansive soils and bedrock;
- Setback of proposed facilities from tops of existing slopes;
- Excavatability of bedrock for construction of below-grade structures;
- Cut/fill transition and soil/bedrock cut pads; and
- Presence of corrosive soils

3.2 SEISMIC DESIGN CONSIDERATIONS

3.2.1 Seismic Design Criteria

Seismic hazard analyses were performed based on the site-specific design criteria according to American Society of Civil Engineers (ASCE) 7-22 Standard and the 2022 California Building Code (CBC). Site class was determined based on the average Standard Penetration Resistance of the upper 100 feet per ASCE 7-22 Section 20.3. The measured blow counts (as recommended by Chapter 20 of ASCE 7-22) were used to

estimate shear wave velocity for each soil layer. The shear wave velocities of the soils below maximum depths of borings were assumed based on historically measured shear wave velocity. We estimated shear wave velocity for each layer using three commonly used relationships (Imai and Tonouch, Sykora and Stokoe, and Brandenberg). An average shear wave velocity of the upper 30 meters (Vs30) on the site was estimated about 836 ft/s (255 m/s) and therefore the site is categorized as Site Class “D” according to Section 20.2 of ASCE 7-22.

General acceleration parameters were evaluated for the site coordinates, including 37.91285° North latitude and 122.082939° West longitude, using online tool ASCE Hazard Tool (https://ascehazardtool.org/), following the general procedures outlined in Chapter 11 of ASCE 7-22 for 5 percent structural damping. At short periods (S_s) and at a period of 1 second (S_1) were determined as following:

S_s = 2.67 g, S_1 = 1.05 g

Per Section 11.4.7 of ASCE 7-22, a site-specific ground motion hazard analysis was performed in accordance with Section 21.2 of ASCE 7-22 for Site Class D as below.

3.2.2 Ground Motion Analysis

Risk-targeted maximum considered earthquake (MCE_R) ground motion hazard analysis was performed. Per ABAG, the primary source controlling the seismic hazard at the site at all structural periods is the Concord Fault, calculated by WGCEP (Working Group on California Earthquake Probabilities) as being capable of producing a magnitude 6.45 event, approximately 7.8 kilometers east-northeast of the site. A summary of all seismic sources and activities were provided above in **Table 16**.

Ground motion prediction equations (GMPEs) were used to estimate horizontal ground accelerations at the site. AGS selected the Next Generation Attenuation West-2 (NGA-West2) relationships, a unified series of seismic models for site specific ground motion

estimation. These predictive relationships are pertinent to shallow crustal earthquakes in active tectonic regions such as the project area.

Probabilistic Seismic Hazard Analysis (PSHA) was performed at the site to estimate the ground accelerations with 5 percent probability that the ground motion will be exceeded over a 50-year period (975-year return period) and 2 percent probability that the ground motion will be exceeded over a 50-year period (2,475-year return periods). PSHA was performed in OpenSHA "Hazard Spectrum Application" (version 1.5.2) using Boore, Stewart, Seyhan and Atkinson (2014), Campbell and Bozorgnia (2014), Abrahamson, Silva and Kamai (2014), and Chiou and Youngs (2014), equally weighted. Probabilistic spectral accelerations of 5% structural damping ratio were calculated and rotated to ROTD100 maximum direction using correction factors published in Shahi and Baker (2014). In developing Probabilistic spectral accelerations, the ordinates of the probabilistic ground motion response spectrum were determined by Section 21.2.1 of ASCE 7-22.

Deterministic ground motion accelerations of 84th-percentile level were calculated for the maximum earthquake (Mw = 6.45 and distance = 7.8 km from Concord). The Pacific Earthquake Engineering Research (PEER) Center 2014 NGA West2 GMPEs Spreadsheet (Version 5.7) was used based on Boore, Stewart, Seyhan and Atkinson (2014), Campbell and Bozorgnia (2014), Abrahamson, Silva and Kamai (2014), and Chiou and Youngs (2014), equally weighted. Structural damping ratios of 5% were also used for calculation of the deterministic spectral accelerations and rotated to ROTD100 maximum direction using correction factors published in Shahi and Baker (2014).

In ASCE 7-22, the deterministic lower limit values of risk-targeted maximum considered earthquake (MCE_R) response spectra are provided in Table 21.2-1 of Chapter 21. The spectral accelerations for structure damping ratios of 5% are shown in **Table 22A** for 975-year event and **Table 22B for** 2475-year event. **Plate 12** shows the 975-year and 2475-year 5% damping site-specific design response spectra.

TABLE 22A – RECOMMENDED 975-YEAR SITE-SPECIFIC DESIGN RESPONSE SPECTRA

(5% DAMPING)

Structural Period (sec)	Probabilistic 975-year event[1] S_a (g)	Deterministic[1,2] S_a (g)	Minimum Deterministic and Probabilistic (MCE_R)[3] S_{aM} (g)	ASCE 7-22 Lower Limit (MCE_R)[4] S_a	Recommended Design Earthquake[4] S_a (g)
0.01	0.948	0.700	0.832	0.832	0.555
0.02	0.952	0.700	0.824	0.824	0.549
0.03	0.964	0.700	0.832	0.832	0.555
0.05	1.083	0.760	0.912	0.912	0.608
0.075	1.344	0.900	1.104	1.104	0.736
0.10	1.578	1.040	1.272	1.272	0.848
0.15	1.888	1.270	1.512	1.512	1.008
0.20	2.094	1.440	1.680	1.680	1.120
0.25	2.234	1.580	1.840	1.840	1.227
0.30	2.336	1.710	2.024	2.024	1.349
0.40	2.331	1.800	2.184	2.184	1.456
0.50	2.216	1.800	2.152	2.152	1.435
0.75	1.813	1.570	1.888	1.888	1.259
1.00	1.586	1.390	1.664	1.664	1.109
1.50	1.169	1.090	1.208	1.208	0.805
2.00	0.909	0.880	0.920	0.920	0.613
3.00	0.617	0.630	0.617	0.584	0.412
4.00	0.454	0.470	0.454	0.400	0.303
5.00	0.342	0.360	0.342	0.296	0.228
7.50	0.184	0.190	0.184	0.160	0.123
10.00	0.105	0.110	0.105	0.104	0.070

Notes:

1) Corrected to ROTD100 maximum direction by factors by Shahi and Baker (2014)
2) Deterministic was checked by deterministic lower limit response spectrum section 21.2.2 of ASCE 7-22
3) MCE_R (S_{aM}) spectral response acceleration calculated according to Section 21.2.3 of ASCE 7-22
4) Lower Limit MCE_R obtained from 80% of the MCE_R response spectrum from the USGS Seismic Design Geodatabase
5) Design response spectrum calculated according to Section 21.3 of ASCE 7-22

TABLE 22B – RECOMMENDED 2475-YEAR SITE-SPECIFIC DESIGN RESPONSE SPECTRA

(5% DAMPING)

Structural Period (sec)	Probabilistic 2475-year event[1] S_a (g)	Deterministic[1,2] S_a (g)	Minimum Deterministic and Probabilistic (MCE_R)[3] S_{aM} (g)	ASCE 7-22 Lower Limit (MCE_R)[4] S_a	Recommended Design Earthquake[4] S_a (g)
0.01	1.207	0.700	0.832	0.832	0.555
0.02	1.214	0.700	0.824	0.824	0.549
0.03	1.230	0.700	0.832	0.832	0.555
0.05	1.395	0.760	0.912	0.912	0.608
0.075	1.747	0.900	1.104	1.104	0.736
0.10	2.040	1.040	1.272	1.272	0.848
0.15	2.389	1.270	1.512	1.512	1.008
0.20	2.628	1.440	1.680	1.680	1.120
0.25	2.821	1.580	1.840	1.840	1.227
0.30	2.985	1.710	2.024	2.024	1.349
0.40	3.043	1.800	2.184	2.184	1.456
0.50	2.940	1.800	2.152	2.152	1.435
0.75	2.454	1.570	1.888	1.888	1.259
1.00	2.193	1.390	1.664	1.664	1.109
1.50	1.643	1.090	1.208	1.208	0.805
2.00	1.294	0.880	0.920	0.920	0.613
3.00	0.896	0.630	0.630	0.584	0.420
4.00	0.663	0.470	0.470	0.400	0.313
5.00	0.506	0.360	0.360	0.296	0.240
7.50	0.275	0.190	0.190	0.160	0.127
10.00	0.155	0.110	0.110	0.104	0.073

Notes:

1) Corrected to ROTD100 maximum direction by factors by Shahi and Baker (2014)
2) Deterministic was checked by deterministic lower limit response spectrum section 21.2.2 of ASCE 7-22
3) MCE_R (S_{aM}) spectral response acceleration calculated according to Section 21.2.3 of ASCE 7-22
4) Lower Limit MCE_R obtained from 80% of the MCE_R response spectrum from the USGS Seismic Design Geodatabase
5) Design response spectrum calculated according to Section 21.3 of ASCE 7-22

Site-specific design acceleration parameters developed following procedures outlined in Chapter 21.4 of ASCE 7-22. The short periods (S_{DS}) and at a period of 1 second (S_{D1}) were determined as follows:

For 975-year return period, S_{DS} = 1.31 g, S_{D1} = 1.11 g

For 2475-year return period, S_{DS} = 1.31 g, S_{D1} = 1.13 g

3.2.3 Horizontal and Vertical Peak Ground Accelerations

Horizontal and vertical peak ground accelerations (PGA_H and PGA_V) were calculated in accordance with Section 3.2.2 Ground Motion Analysis. The design-level horizontal PGA is 0.555 g for both 975-year and 2475-year event. AGS recommends that the peak vertical PGA be taken as equal to the peak horizontal PGA. The geometric mean of peak ground accelerations (PGA_M) of 0.688g was calculated in accordance with Sections 21.5.3 ASCE 7-22.

The value of design PGA is used in design dynamic seismic lateral earth pressures according to ASCE 7-22 section 11.8.3. The value of PGAm is used for evaluation of liquefaction, lateral spreading and seismic settlements, as referred in section 3.4 and 3.5 (ASCE 7-22 Chapter 11). The value of design PGA is used in pseudo-static slope stability analysis as referred to section 3.6.

3.3 DESIGN GROUNDWATER LEVEL

Based on the groundwater monitoring data from twelve piezometers (MN-23, 23A, 24 through 27, 28A, 29A and 30 through 33) installed by Olivia Chen Consultants in January to May 2001 at various locations distributed across the WCWTP site, the depth to groundwater may vary from less than 10 feet (including MN-27 near Facilities 4 and 14, MN-26 near Facility 5 and MN-29A near Staging Area 1) to more than 40 feet (including MN-23A to the east of Facility 17). In the solid flight auger borings drilled for the previous and current geotechnical studies (where the presence or absence of groundwater was detectable during drilling), no groundwater was encountered to the maximum explored depth, which was up to approximately 40 feet below the existing ground surface. Groundwater was not measured in the rotary wash borings because the drilling method used did not allow for groundwater level measurement.

The shallow groundwater observed near Facilities 4, 5, 14 and Staging Area 1 (ranging from approximately 4 to 9½ feet below the existing ground surface) was apparently due

to ephemeral groundwater seepage (measured in January to May 2001), which occurred within an old drainage ravine that ran through the site prior to the construction of the existing WCWTP facilities and directed surface runoff from the hills south of the site. The old drainage ravine was filled after construction of the existing WCWTP facilities. Beyond this area, the depth of groundwater was mostly more than 23 feet below the existing ground surface. For design purposes, we recommend that the design groundwater levels presented on **Plate 6** - Summary of Major Findings and Recommendations be considered.

3.4 LIQUEFACTION ASSESSMENT

3.4.1 Liquefaction Potential

Soil liquefaction is a phenomenon in which saturated (submerged) loose to medium dense cohesionless soils lose their strength due to the build-up of excess pore water pressure, especially during cyclic loadings such as those induced by earthquakes. In the process, the soils acquire mobility sufficient to permit both horizontal and vertical movements, if not confined. Soils most susceptible to liquefaction are loose, clean sands. Silty sands and low-plasticity silts may also liquefy during strong ground shaking. Based on the assessment of Youd and Perkins (1978) on different soil susceptibilities to liquefaction, Pleistocene age (11,000 to 2 million years ago) sedimentary deposits such as the Late Pleistocene Terrace Deposits (Qt), which covers the area of Facilities 9, 9A, 10, 11 and 12 plus the area to the north, generally have very low to low susceptibility to liquefaction.

The WCWTP site is, for the most part, not located within a State-Designated Liquefaction Hazard Zone (Walnut Creek Quadrangle, 2024) as shown on **Plate 7** – Seismic Hazard Map, except for the following two areas with artificial fill (historical) placed in old drainage ravines:

- Area of Facilities 4, 5 and 14

- Area of Facilities 8 and 16

Based on the soil conditions encountered in our borings performed for the current study and previous borings within these two areas, the soils below groundwater mostly consisted of dense or stiff fill and, in general, their potential for liquefaction is low. The soils encountered elsewhere within the WCWTP site generally consisted of medium to very dense silty and clayey sand, and stiff to hard clay as well. The liquefaction susceptibility map prepared by the Association of Bay Area Governments (ABAG, 2023) also indicates that the WCWTP site is located within an area of “very low” susceptibility. Based on these findings, the potential for liquefaction at the WCWTP site is considered to be low.

3.4.2 Lateral Spreading

Lateral spreading is lateral movement of surficial soil mass toward a free face (such as hillside slopes, ravines and shorelines) during earthquakes. It typically occurs when a continuous layer of sand liquefies during a major earthquake and the overlying non-liquefiable crust slides as large blocks over the liquefied soils, creating fissures and scarps. As discussed above, the potential for liquefaction at the WCWTP site is considered to be low. Therefore, the potential for lateral spreading hazard at the WCWTP site is considered to be low.

3.5 SEISMIC SETTLEMENT IN DRY SAND

Loose, unsaturated sandy soils tend to compress and settle during strong ground shaking from a major earthquake (called “seismic settlement in dry sand”). As discussed in the “Subsurface Conditions” section, the unsaturated sandy soils encountered at the WCWTP site are generally medium dense to very dense. Therefore, the potential for any significant seismically-induced total and differential settlements at the WCWTP is considered to be low.

3.6 SLOPE STABILITY ANALYSES

The WCWTP site is located on the northeastern flank of a northwest trending ridge. The treatment plant is surrounded by hillsides (on the southwest and east sides) and undulating spurs (on the northwest side) separated by two major drainage ravines sloping toward the north. Most of the proposed facilities are within areas that are relatively flat, except for the following proposed facilities that are adjacent to the top of existing slopes:

- Ballasted Flocculation (Facility 1) approximately 30 feet from the top of an existing graded slope that descends at a gradient of approximately 2 horizontal to 1 vertical (2H:1V) to the northeast.
- Intermediate Ozone Pumping Plant (Facility 2) approximately 30 feet from the top of an existing graded slope that descends at a gradient of approximately 3H:1V to the southwest.
- Pre-Ozone Pumping Plant – east (Facility 6) at the top of a ravine fluvial slope that descends at a gradient of approximately 3H:1V to the north.
- Electrical Facilities (Facility 14) and Consolidated Maintenance Building (Facility 15) approximately 50 to 60 feet from the top of a ravine fluvial slope that descends at a gradient of approximately 2H:1V to the north-northeast.
- Hydrogen Peroxide Station – east (Facility 18) approximately 20 feet from the top of a natural slope that descends at a gradient of approximately 2½H:1V to the northeast.

The finish pads of the Ballasted Flocculation (Facility 1) and the Intermediate Ozone Pumping Plant (Facility 2) are anticipated to be located at a depth of approximately 24 and 14 feet, respectively, and underlain by bedrock. The Hydrogen Peroxide Station – east (Facility 18) is an on-grade structure, which is also anticipated to be underlain by bedrock. Therefore, our slope stability analyses were focused on the Pre-Ozone Pumping

Plant – east (Facility 6), the Electrical Facilities (Facility 14) and the Consolidated Maintenance Building (Facility 15).

Based on the topographic survey data shown in the Walnut Creek WTP (Master) Plan by Carollo Engineers dated February 10, 2017, Cross Section (A-A') has been developed at the locations as shown on **Plate 2** – Boring Location Map. Cross-Section A-A' represents the existing slope below the Electrical Facilities (Facility 14) and the Consolidated Maintenance Building (Facility 15). Slope stability analysis was performed to assess the potential impact of the existing slopes on these proposed facilities.

3.6.1 Method of Analyses

Our slope stability analyses were performed with the computer program SLIDE2 (Version 9.031, Rocscience 2023) using the Spencer's method. Randomly generated non-circular failure surfaces were used for the analyses. The unit weights and shear strength parameters used in our slope stability analyses are summarized in the following **Table 23**.

TABLE 23 – SOIL PARAMETERS FOR SLOPE STABILITY ANALYSES

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)
Existing Fill	120	500	32
Engineering Fill	125	200	25
Alluvium	120	900	0
Colluvium	123	1400	0
Briones Formation	114	0	40
Hambre Formation	118	0	40

Our selection of shear strength parameters was generally based on the guidelines given in the California Geological Survey Special Publication 117A "Guidelines for Evaluating and Mitigating Seismic Hazards in California" (CGS, 2008) and the Southern California Earthquake Center "Recommended Procedures for Implementation of DMG Special

Publication 117 Guidelines for Analyzing and Mitigating Landslide Hazards in California" (SCEC, 2002). The shear strengths of the existing fill, consisting primarily of sandy soils, were estimated by correlation with SPT blow counts based on Terzaghi et al. (1996). The shear strengths of the alluvium, colluvium and weathered bedrock were obtained from the results of triaxial shear strength tests as well as the published correlation of fully softened strength with liquid limit, clay-size fraction and effective normal stress by Stark (2023).

3.6.2 Static Condition

Our slope stability analyses for static condition have considered the high groundwater conditions that may occur during heavy rains. A summary of the results of our slope stability analyses under static condition is presented below in **Table 24**. Plots of our static slope stability analyses are presented in **Appendix D**.

TABLE 24 – RESULTS OF STATIC SLOPE STABILITY ANALYSES CROSS SECTION A-A'

Cross Section	Calculated Minimum Factor of Safety
A-A'	1.74

The results of our static slope stability analyses indicate that the minimum factors of safety for Cross Section A-A' is above the commonly required factor of safety of 1.5 for long-term slope stability. Therefore, the stability of the analyzed slope is considered to be adequate for static condition.

3.6.3 Seismic Condition

The seismic slope stability was analyzed using the pseudo-static approach as advised in CGS Note 48 (November 2022), which recommends using the procedure available from CGS Special Publication 117A together with the design-level ground motion based on geometric mean and without risk coefficient (i.e. $PGA_M/1.5$). The PGA_M at the WCWTP site is 0.688g as discussed in the "Seismic Design Considerations" section. The design-level ground motion is $PGA_M/1.5$ = 0.46g. The pseudo-static coefficient (k_{eq}) is f_{eq} (= 0.52) x 0.46g = 0.24g based on 5 cm threshold displacement as shown on Figure 1 of CGS Special Publication 117A, page 30. Based on CGS Special Publication 117A, a minimum

factor of safety of 1.0 is required for the seismic (pseudostatic) condition.

The results of our seismic slope stability analysis indicate that the calculated seismic (pseudo-static) factors of safety for Cross Section A-A' is above 1.0. Therefore, the existing slopes at Cross Section A-A' is expected to experience only minor seismic slope displacements (< 5 cm threshold) during a major earthquake. According to CGS Special Publication 117A, seismic slope displacements of 0 to 15 cm are unlikely to correspond to serious landslide movement and damage. Plots of the seismic slope stability analyses are included in **Appendix D**.

3.7 SUITABILITY OF OLD FILL

Based on our review of past reports, the finish pads of the following proposed facilities will be underlain by old fill, which was previously considered to be unsuitable as foundation material due to the potential for organic material in the old fill:

- Ozone Generation Building (Facility 4)
- Liquid Oxygen Storage Area (Facility 5)
- Pre-Ozone Pumping Plant – east (Facility 6)
- Solids Dewatering Building (Facility 9)
- Truck Loading Canopy (Facility 9a)
- Thickened Solids Blending Tanks – north & south (Facility 10)
- Electrical Facilities (Facility 14)
- Consolidated Maintenance Building (Facility 15)
- Chemical Storage Building (Facility 17)

For the Ozone Generation Building (Facility 4), the Liquid Oxygen Storage Area (Facility 5) and the Consolidated Maintenance Building (Facility 15), subsurface exploration was performed and it was concluded that the organic content of the old fill they encountered was not significant and that the old fill at these proposed facilities are considered as

suitable foundation material (N&M, 2022).

For the Pre-Ozone Pumping Plant – east (Facility 6), the Solids Dewatering Building (Facility 9), the Truck Loading Canopy (Facility 9a), the Thickened Solids Blending Tanks – north & south (Facility 10), the Electrical Facilities (Facility 14) and the Chemical Storage Building (Facility 17), additional subsurface exploration was performed by AGS for the current study. The results also indicate that the organic content of the old fill we encountered was not significant and that the old fill at these proposed facilities are considered as suitable foundation material.

3.8 EXPANSIVE SOILS AND BEDROCK

Based on the results of Expansion Index and Atterberg limits tests performed on soil and bedrock samples for the current and previous studies, the soils and bedrock on site generally have moderate to very high expansion potential. Typically, expansive soils and bedrock are sensitive to moisture changes and, therefore, subjected to swelling and shrinking as a result of seasonal changes in moisture content. This phenomenon can cause heaving and cracking of pavements, exterior concrete flatwork (such as sidewalks, patios, driveways and other similar concrete slabs that are exposed outdoors) and structures founded within a few feet from the ground surface, where seasonal changes in moisture content is anticipated. For structures that are embedded deep below the ground surface, the risk of damage from swelling and shrinking is not a concern.

To reduce the potential impacts of swelling and shrinking of the expansive soils to the proposed facilities, special measures should be performed. We anticipated that the special measures would include the following:

1. Conditioning the expansive soils to higher moisture content (approximately 2 to 4 percent above optimum moisture content) during site preparation and grading.

2. Capping the finish pads, which should extend at least 5 feet beyond the perimeters of the proposed facilities, with at least 24 inches of import fill with low expansion potential (see the “Fills and Backfills” Section) or lime-treated on-site soils (at least 4 percent lime by dry soil weight and compacted to at least 95 percent relative

compaction). It should be noted that lime-treated soils are not suitable for vegetation growth and must be removed from the landscaping areas.

3. Deepening the footings, where applicable.

4. Conditioning the subgrade soils in exterior concrete flatwork areas to higher moisture content immediately prior to the placement of aggregate base.

5. Providing surface drainage away from the foundations and draining the rainwater collected on the roof through pipes connecting to the adjacent storm drain system.

6. Where landscaping strips may be located next to the proposed facilities, perimeter subdrains should be installed adjacent to the outside of the exterior foundations. Consideration should be given to the use of a drip irrigation system. The roof drains and the subdrains should be two separate pipes to avoid backflow into the subdrains.

3.9 EXCAVATION AND EARTHWORK

3.9.1 Site Preparation

Prior to construction, the existing structures, slabs and pavements, if any, should be removed, and debris should be disposed of outside the construction limits. The existing underground utilities located within the proposed construction areas, if affected by construction activities, should be relocated prior to excavations. Debris generated from the demolition of underground utilities, including abandoned pipes, should be removed from the site as construction proceeds. If pipes are abandoned in-place, they should be filled completely with lean grout to mitigate the potential for their collapse and subsurface settlements in the future.

3.9.2 Fills and Backfills

Fills and backfills may either be structural or nonstructural. Structural fills and backfills (also commonly referred to as “engineered fill”) are those defined as providing support to foundations, slabs, and pavements. Nonstructural fills and backfills include all other fills such as those placed for landscaping, and not planned for future structural loads. Structural fills and backfills should be compacted to at least 95 percent of the maximum dry density as determined per ASTM D1557-12R21 (Reapproved 2021). Nonstructural fills and backfills should be compacted to at least 90 percent of the maximum dry density as determined per ASTM D1557-12R21.

Structural fill and backfill materials should be placed in lifts not exceeding approximately 8 inches in loose thickness, brought to near-optimum moisture content and compacted using mechanical compaction equipment. Nonstructural fills and backfills may be placed in lifts not exceeding 12 inches in loose thickness and compacted in a similar manner.

Material to be used as compacted fill and backfill should be predominantly granular, less than 3 inches in any dimension, free of organic and inorganic debris, and contain less than 20 percent of mostly non-plastic fines passing the No. 200 sieve. The fill and backfill soils should have a liquid limit less than 35 and plasticity index less than 12. Samples of fill and backfill materials should be submitted to the geotechnical engineer prior to use for testing to establish that they meet the above criteria. It is anticipated that the on-site soils meeting the above requirements may be used as structural fill and backfill provided that it is not contaminated.

3.9.3 Dewatering

Based on the groundwater conditions discussed above, it is anticipated that the excavations for a majority of the WCWTP site would be above groundwater, provided that stormwater runoff is controlled in such a manner that is not allowed to flow into open excavations. However, shallow groundwater may be encountered near Facilities 4, 5, 14 and Staging Area 1. There is also a possibility that locally higher perched groundwater level may occur during construction at locations where subsurface water percolating

downward is held by a bed or lens of low-permeability material (such as dense or cemented sand, silty clay or clayey silt). Furthermore, existing utility trenches might potentially direct groundwater from upstream and, where these existing utility trenches cross the excavation for the proposed facilities, water collected along the existing utility trenches might flow into the excavation for the proposed facilities.

The contractor should make an independent evaluation of the groundwater levels at the site and be responsible for providing an adequate dewatering system during construction. A properly designed, installed, and operated dewatering system should accomplish the following:

- Lower the groundwater table inside the excavation or intercept seepage which will emerge from the sides or the bottom of the excavation;
- Improve the stability of the excavation and prevent disturbance of the bottom of the excavation;
- Provide a reasonably dry working area in the bottom of the excavation; and
- Provide for collection and removal of surface water and rainfall.

It is recommended that the groundwater level, if encountered, be maintained at least 2 feet below the bottoms of the excavations until the below grade structures are placed and backfilled. Selection of the equipment and methods of dewatering should be left up to the contractor, and the contractor should be aware that modifications to the dewatering system may be required during construction, depending on the conditions encountered.

3.9.4 Temporary Excavations

Excavations must comply with the current requirements of OSHA or Cal-OSHA, as applicable. Additionally, all cuts deeper than five (5) feet should be sloped or shored. According to California Occupational Safety and Health Administration, Title 8, California Code of Regulations, Construction Safety Orders, Sections 1504, 1539-1547, the soil material to be excavated is classified as Type C based on the laboratory and boring data.

It is AGS' opinion that temporary excavations may be sloped at 1.5H:1V below groundwater and 1H:1V or flatter above the groundwater level. Heavy construction equipment, building materials, excavated soils, and vehicle traffic should not be allowed within six (6) feet of the top of excavations. The recommendations above apply to all temporary excavations carried out during construction, irrespective of how long they last.

3.9.5 Excavation Characteristics

As discussed in Section 2, Hambre and Briones Formation bedrock ranging from very soft and plastic, to moderately hard and moderately strong claystone, siltstone, sandstone, and shale was encountered in most of our borings at various depths below the existing ground surface.

Based on our review of the previous seismic refraction survey data (N&M, 2022), seismic compressional wave (p-wave) velocities at the site range between 950 to 4,200 feet per second from the ground surface to depths of approximately 20 to 40 feet. Based on those results and the bedrock encountered in our borings, we anticipated that it would be possible to rip much of the near-surface bedrock with heavy duty conventional grading equipment, such as Caterpillar D9 or larger bulldozer. However, it should be expected that localized zones of more resistant strong rock that might be difficult or impractical to rip and heavier equipment such as jack hammer might be necessary for excavation. If needed, the contractor may conduct additional field investigation to confirm bedrock excavatability and assess their suitable means and methods for excavation with bedrock conditions.

In other areas where shallow bedrock is not anticipated, it is AGS' opinion that most of the proposed excavations can be made using conventional equipment. However, in some locations, obstructions may be encountered. The fill may include localized areas of rock fragments, construction debris, and wood. Due to the results of AGS' subsurface exploration, the contractor should be prepared for and familiar with excavation and drilling in soils containing rock, and boulders.

3.9.6 Shoring

Based on the anticipated depth of excavations for the proposed facilities, it is expected that braced shoring or shield will be required for most of the planned excavations due to constraints on space, and abundance of existing utilities in the vicinity of the proposed facilities. As mentioned above, all cuts deeper than five feet should be sloped or shored. The sheet piles or soldier piles should extend below the excavation bottom as determined by the shoring designer to provide the required lateral support and minimize seepage from the bottom of the excavation. In some areas, shoring may be required in order to dewater the excavation.

Preliminary shoring design criteria are presented in Section 3.14.1. The design of the shoring system should consider the surcharge forces from construction equipment, building materials, excavated soils, and vehicle traffic adjacent to the excavation. Consistent with the state-of-practice, seismic loads are not included in shoring design, and thus, have not been addressed. The shoring installation program may require grouting of voids behind the shoring if such voids are created during installation or removal. Only thus can large strains be prevented at the time of, and long after, installation or removal of the shoring structure.

3.9.7 Construction-Induced Settlements and Effects on Adjacent Structures

A monitoring program should be set up and carried out by the contractor to determine the effects of the construction on the adjacent structures and utilities. Reference points should be set and read prior to the start of construction and/or dewatering activities to establish the pre-existing conditions, and points should be set on the shoring as soon as initial installations are made. Surveys should be made periodically, but more often during construction activities. Surveys of sensitive structures and utilities in close proximity to the proposed excavations require special attention with shorter periods of surveying.

Additional shoring will be required if large movements are recorded during the surveying program.

Caution should be exercised to minimize deflection of the shoring system and settlements of the ground surface surrounding the excavations as a result of construction activities such as excavation, dewatering, and shoring installation and removal. It is suggested that the magnitude of surface settlement be estimated by the Shoring Designer based on the actual shoring methods and construction procedures. If measurements exceed the predetermined limits, AGS should be consulted for recommendation of appropriate alternative construction techniques.

3.9.8 Excavation Base Stability

It is anticipated that excavations for the majority of the WCWTP site would be mostly above groundwater except near Facilities 4, 5, 14 and Staging Area 1. Also, it is possible that groundwater may be encountered locally due to perched groundwater conditions or inflow through adjacent utility trenches as noted earlier.

Where groundwater is encountered, stability of the base of excavations will be dependent upon the success of the groundwater control system, and the dimensions of the excavation. It is recommended that the groundwater level be maintained a minimum of two feet beneath the bottom of the excavation throughout construction in order to minimize the chance of base failure due to high seepage gradients.

It is the responsibility of the shoring contractor to design and install an adequate shoring system (if needed) to prevent excessive soil deformation and failure; however, in order to minimize the potential for base instability and to keep ground and support system movement to a minimum, the following should be considered:

- The excavation width should be kept to a minimum;
- Excavations should be performed in segments;

- The first level of the bracing system should be installed before the excavation reaches a depth of about five feet; and
- Surcharge loading should be minimized or avoided at the ground surface near the edge of the excavation and the shoring system should be designed for anticipated surcharge loading.

3.10 MINOR CUT AND FILL SLOPES

Minor cut and fill slopes may be required for the project. In general, cut and fill slopes less than 10 feet in height should be constructed at gradients no steeper than 2H:1V. Cut and fill slopes greater than 10 feet in height, if any, should be constructed at gradients no steeper than 3H:1V. All fill slopes should be keyed into firm soils or bedrock.

Also, these cut and fill slopes should be protected from erosion, especially during the first winter season after grading. We typically recommend that fast growing vegetation be planted prior to the first winter to reduce erosion. The landscaping plan may limit the type of vegetation planted to species that are not necessarily best suited for erosion protection. Consideration should be given to the use of erosion control mats to protect slopes during the first winter if the landscaping planting will not provide adequate protection.

3.11 CUT/FILL TRANSITION AND SOIL/BEDROCK CUT PADS

As shown on **Plate 5A to 5F**, the cut/fill transition or soil/bedrock cut (part soil, part bedrock) conditions will likely occur in the finish pads for some of the proposed facilities in this project. Such conditions can be detrimental to the proposed facilities' performance due to differing material properties across the finish pads. For cut/fill conditions, we recommend that the cut portions of the finish pads be over excavated to a depth of at least 3 feet and replaced with compacted engineered fill to finish pad elevation. For soil/bedrock cut pad conditions, we recommend that the entire finish pads be overexcavated to a depth of at least 2 feet and replaced with compacted engineered fill to finish pad elevation.

3.12 FOUNDATIONS

3.12.1 General

Based on our review of the available data as described in Section 2 of this report, it is our opinion from a geotechnical engineering standpoint that most of the proposed facilities can be supported on footings or mat foundations. Footings may be used for support of light buildings or appurtenant structures. Mat foundations may be used for support of facilities with a bottom slab that extends across their entire footprint (such as tanks or vaults), pumps or other equipment installed on a concrete pad, or heavy buildings or structures that would otherwise require large, closely-spaced column footings.

Facilities 8, 9A, 17 and 18 are covered canopies with steel support pillars. We recommend that the proposed covered canopies be supported on drilled piers. For the proposed Pre-Ozone Pumping Plant – east (Facility 6) that is located at the top of a ravine fluvial slope, we also recommend utilizing drilled piers for foundation support.

Our currently anticipated types of foundations for the proposed facilities are summarized on **Plate 6A**. Geotechnical recommendations for footings, mat foundations and drilled piers (where applicable) are presented below.

3.12.2 Footings

In general, all footings should have a minimum width of 18 inches (for continuous footings) and 24 inches (for rectangular/square footings). The bottoms of footings should extend at least 24 inches below the lowest adjacent finish grade. For footings that are located within 10 feet from the top of slope or on sloping ground, the footing embedment depth should be increased to provide a horizontal distance of at least 10 feet to the nearest downhill slope face.

Footings, where they are used, should be designed for the allowable bearing pressures summarized on **Plate 6A**, based on the foundation materials anticipated under their respective facilities. The allowable bearing pressures presented on **Plate 6A** are for dead plus sustained live loads with a factor of safety of 3, which may be increased by one-third for short-term loading due to wind or seismic forces.

Based on the allowable bearing pressures presented on **Plate 6A**, the total settlement of footings under static loads is estimated to be generally less than about 1 inch. In general, differential settlement on the order of about ½ inch is expected to occur over a distance of 30 feet.

3.12.3 Mat Foundations

Mat foundations, where they are used, should be designed for the allowable bearing pressures summarized on **Plate 6A**, based on their embedment depths and foundation materials anticipated under their respective facilities. The allowable bearing pressures presented on **Plate 6A** are for dead plus sustained live loads with a factor of safety of 3, which may be increased by one-third for short-term loading due to wind or seismic forces.

Based on the allowable bearing pressures presented on **Plate 6A**, the total settlement of mat foundations under static loads is estimated to be generally less than about 1 inch. At the corners or perimeters of the mat foundations, the estimated settlement is about 1/3 of the total settlement at the center. In general, differential settlement on the order of about ½ inch is expected to occur over a distance of 30 feet.

The modulus of subgrade reaction, Kv_1, values presented on **Plate 6A** may be used for mat foundation slab design.

The Kv_1 values are based on a unit square foot area and should be adjusted for the size of the mat foundation using the following relationship:

$K_b = Kv_1 \times [(b+1)/2b]^2$

Where: K_b = modulus of subgrade reaction adjusted for mat foundation width (pci).
b = Mat foundation width (feet)

3.12.4 Drilled Piers

The proposed covered canopies with steel support pillars (Facilities 8, 9a, 17 and 18) can generally be supported on drilled piers, which should have a minimum diameter of 18 inches and a minimum center-to-center spacing of 3 pier diameters. The proposed Pre-Ozone Pumping Plant - east (Facility 6) can also be supported on drilled piers, which should have a minimum diameter of 24 inches and a minimum center-to-center spacing of 3 pier diameters.

The drilled piers should extend through the old fill (if any), native soils (including colluvium, alluvium or residual soils) and into bedrock, which was encountered at a depth of approximately 8 to 8½ feet at Facilities 8, 17 and 18. We recommend that the drilled piers extend at least 5 feet into bedrock. An allowable skin friction of 500 pounds per square foot (psf) in native soils below the old fill and an allowable skin friction of 1,000 psf in bedrock may be used in design for dead plus live loads with a factor of safety of 2.0, which may be increased by one-third for short-term loading due to wind or seismic forces with a factor of safety of 1.5. Skin friction should be disregarded in the upper 2 feet of the drilled piers.

Resistance to uplift loads can be developed from skin friction along the drilled pier shafts. We recommend that an allowable skin friction of 350 psf in native soils and 700 psf in bedrock be used in design for uplift resistance.

To resist lateral loads, the passive resistance from native soils and bedrock can be used for the preliminary design. For passive resistance in native soils, an equivalent fluid pressure of 250 pounds per cubic foot (pcf) in a triangular distribution can be used for the

portion below a depth of 2 feet. For passive resistance in bedrock, an equivalent fluid pressure of 380 pcf in a triangular distribution can be used. The passive pressures can be applied over an effective width equal to two times the drilled pier diameter from a depth of 2 feet to the bottom of the drilled piers. When the actual size and location of the drilled piers and soil profiles are determined, AGS recommends that L-Pile analyses be conducted to evaluate the lateral deformation, shear force, and bending moment along the drilled piers.

The drilled piers should be drilled and poured on the same day. The drilled pier holes should not be left open overnight or through the weekend. When water is encountered during drilling, the water should be removed prior to concrete placement. Alternatively, the concrete may be placed using tremie method.

Provided that the drilled piers are designed according to the recommendations presented above and properly constructed with no significant defects, the total and differential settlements of the drilled piers are estimated to be on the order of ½ and ¼ inch, respectively. It should be noted that the drilled pier design recommendations presented above are minimum requirements from a geotechnical engineering perspective. The required drilled pier diameter and depth should be determined by the project structural engineer.

3.13 PIPELINES

3.13.1 General

AGS understands that Phase 1 Improvements include large diameter buried pipelines with diameters up to 78 inches.

3.13.2 Earth Loads

The earth loads on the proposed pipelines will depend on the depth of placement, width of the trench at the top of the pipe, the backfill type and placement, and the type of pipe used. The earth loads on the proposed pipelines may be calculated using the Prism Method Formula (Moser and Folkman 2008) as shown below for pipes placed in vertically cut trenches:

$$W = D \times \gamma \times H$$

where: W = Vertical soil load on the pipe per unit length (lbs/ft)

D = Outside diameter of the pipe (ft)

γ = Unit weight of backfill material in pounds per cubic foot (pcf)

The unit weight of the trench backfill material, γ, can be estimated at 130 pcf.

3.13.3 Composite Modulus of Subgrade Reaction

The composite modulus of soil reaction (E'c) is a function of width of the trench (B), depth of cover (H), outside diameter of the pipe (D), modulus of trench backfill (E'b), and modulus of trench wall soil (E'w). For trench backfill consisting of clean sand, an E'b of 1,600 psi may be used (Hartley and Duncan 1988). Based on data from the project borings and existing borings, we recommend an E'w of 1,000 psi (Howard, 1977). The composite modulus of soil reaction (E'c) may be calculated using the following equation:

$$E'_c = S_c \times E'_b$$

where: S_c = Soil support combining factor as shown in **Table 25**.

TABLE 25 – SOIL SUPPORT COMBINING FACTOR (S_C)

E'_w / E'_b Existing Fill	S_c for various B/D ratios[1,2]					
	B/D =1.5	B/D=2.0	B/D=2.5	B/D=3.0	B/D=4.0	B/D=5.0
0.1	0.15	0.30	0.60	0.80	0.90	1.00
0.2	0.30	0.45	0.70	0.85	0.92	1.00
0.4	0.50	0.60	0.80	0.90	0.95	1.00
0.6	0.70	0.80	0.90	0.95	1.00	1.00
0.8	0.85	0.90	0.95	0.98	1.00	1.00
1.0	1.00	1.00	1.00	1.00	1.00	1.00
1.5	1.30	1.15	1.10	1.05	1.00	1.00
2.0	1.50	1.30	1.15	1.10	1.05	1.00
3.0	1.75	1.45	1.30	1.20	1.08	1.00
≥ 5.0	2.00	1.60	1.40	1.25	1.10	1.00

Notes:
1. Jeyapalan and Watkins (2004). Modulus of Soil Reaction (E') Values for Pipeline Design.
2. Values between those shown in the table above can be determined by linear interpolation.

For example, with E'_b = 1,600 psi, E'_w = 1,000 psi, D = 12 inches, B = 36 inches, and S_c = 0.95 from **Table 25**:

$$E'_c = S_c \times E'_b = 0.95 \times 1{,}600 \text{ psi} = 1{,}520 \text{ psi}.$$

3.13.4 Surcharge Pressures

Permanent surcharge loading pressures should be considered when elevated load conditions associated with any structures or grade changes fall within a one to one (1:1) projection from the base of the proposed pipelines. For any surcharge applied, **Plate 8** may be used to calculate vertical surcharge pressures under the corner of a uniformly loaded rectangular area. **Plates 9 and 10** can be used to determine lateral surcharge pressures from point and line loads and areal loads, respectively. For other shapes of loading, the loading diagram may be divided into a number of rectangular surcharge areas.

3.13.5 Thrust Resistance

Resistance to thrust forces may be provided by mobilizing frictional resistance between the pipe circumference and the surrounding earth material, and also through the use of a thrust block.

The frictional resistance can be calculated by utilizing a coefficient of friction between the pipe and adjacent backfill of 0.30 for the proposed pipeline. The pipe segments may be connected by tension joints that are capable of transmitting the required thrust forces.

Passive resistance at a thrust block may be used instead of, or in conjunction with, frictional resistance to resist pipe thrust. Normal frictional resistance may be insufficient wherever the proposed pipeline changes direction abruptly (where there is a sharp angle joint of 22.5 degrees or more), in which case use of a thrust block is recommended. Thrust block design should consider the weight of the filled pipeline, and the internal fluid pressures within the pipeline when it is operating at peak capacity. To calculate passive resistance for thrust blocks, equivalent fluid weights of 300 pcf (above groundwater) and 150 pcf (below groundwater) are recommended for use in design based on thrust blocks located above and below the groundwater level, respectively.
The thrust blocks may be designed for an allowable static bearing pressure of 2,000 pounds per square foot (psf) for dead loads plus sustained live load. For all loads including transient loads, the allowable bearing capacity may be increased by one-third.

3.13.6 Trench Width, Pipe Bedding and Trench Backfill

Our recommendations below are provided from a geotechnical standpoint; notwithstanding the EBMUD established requirements on material quality, placement procedures, and compaction for utility bedding and shading materials that should be met as well.

Minimum trench widths should be provided in order to ensure uniform support for the

pipelines. We recommend that the trench be a minimum of two feet wider than the outside diameter of the pipe at each side of the pipe. The minimum clear width of trench at the top of the pipe is recommended to be not more than the outside diameter of the pipe plus four feet.

The proposed pipelines should be completely surrounded with bedding material to provide uniform support and protection. The bedding should consist of medium to coarse grained sand, or crushed rock of less than ¾ inch in maximum size. The material should be of uniform gradation.

Pipe bedding should be placed beneath the pipe with a minimum thickness of 9 inches, and should extend 12 inches above the spring line of the pipes. All bedding material should be placed carefully to achieve uniform contact with the pipe and a minimum relative compaction of 90 percent as determined by standard test method ASTM D1557-12R21. Compaction by jetting or flooding should not be permitted.

Trench backfill materials within pipe zone (extending from the trench bottom to a minimum of 9 inches above the pipe) should conform to the requirements of fill and backfill materials presented in Section 3.9.2. Trench backfill should be compacted in layers not exceeding eight inches in uncompacted thickness and should be compacted to 90 percent relative compaction as determined by ASTM D1557-12R21, except for trenches under pavements or slabs. The material used for pipe bedding (the area from bottom of the pipe to 9 inches below the pipe) and the pipe zone should be the same and receive the same compaction effort. Under the pavement or slab areas, the upper 3 feet of the backfill measured from the top of the pavements. The pipe bedding materials should also be compacted to 95 percent relative compaction as determined by ASTM D1557-12R21.

Trench dams should be constructed along the proposed pipelines to prevent lateral flow of groundwater within granular trench backfill at every 100 feet spacing and at least 2 in sloping ground. Backfill materials consisting of either lean concrete or controlled low strength material (CLSM), may be used as trench dams that should be at least 12 inches

thick. Lean concrete or CLSM, if used as trench dams, should have a 28-day unconfined compressive strength of no less than 50 psi and no more than 150 psi. Trench dams should be placed in the trench, around the pipe, and extend at least 12 inches below the trench bottom, at least 12 inches laterally beyond the trench walls and at least 12 inches above the pipe.

3.14 LATERAL EARTH PRESSURES

3.14.1 Temporary Shoring

Preliminary geotechnical shoring design parameters for temporary excavations are presented on **Plate 11** – Preliminary Shoring Design Data. These design parameters include apparent, active, and hydrostatic pressures, lateral surcharge loads, and passive soil resistance. Groundwater levels as discussed in Section 3.3 may be considered for design of temporary excavations. Seismic loads are not included in the preliminary shoring design data on **Plate 11**. Special cases such as a combination of slope and shoring, or additional loads on retained soils may require an increase in the recommended design values. The design of the shoring system should take into consideration lateral surcharge pressures induced by construction equipment and stockpiles of excavated materials. It is recommended to avoid stockpiling excavated materials close to the excavations.

3.14.2 Permanent Below-Grade Walls

Our recommended lateral earth pressures on below-grade walls are presented in **Table 26** below. Passive pressure is discussed under “Lateral Resistance” in Section 3.15.

TABLE 26 – LATERAL EARTH PRESSURES ON BELOW GRADE WALLS

Lateral Earth Pressures	Above Water[2]	Below Water[3]
Static Condition (At-Rest)	70 pcf (EFP)[1]	100 pcf (EFP)[1]
Static Condition (Active)	45 pcf (EFP)[1]	90 pcf (EFP)[1]
Seismic Condition	92 pcf (EFP)[1]	

Notes:
1. At-rest and active earth pressures are expressed as equivalent fluid pressures (EFP) each with a triangular distribution and the resultant force acting 1/3 times the height of that triangular distribution above the base of that triangular distribution. The triangular distribution below groundwater is added on top of the deepest pressure value of the triangular distribution above groundwater.
2. Design groundwater level is as discussed in Section 3.3.
3. Hydrostatic pressure has been included.
4. Additional surcharge loads adjacent to the top of the below-grade wall may impose an increase to the lateral earth pressures presented above. For design purposes, we recommend an additional lateral earth pressure of 240 psf be applied to the upper 10 feet of the below-grade wall to account for traffic load.

3.14.3 Site Retaining Walls

As shown on Plate 2 – Boring Location Map, five new site retaining walls will be required to accommodate the following proposed facilities:

- Ozone Gas Destruct – west & Hydrogen Peroxide Station -west (Facilities 8 & 18)
- Electrical Facilities & Consolidated Maintenance Building (Facilities 14 & 15)
- Ozone Generation Building (Facility 4)
- Liquid Oxygen Storage Area (Facility 5)
- Gravity Thickeners & Thickened Solids Pumping Plants (Facilities 11 &12)

Based on our review of the available data as described in Section 2 of this report, we understand that soil nail wall (soil nails with shotcrete facing) may be used at the Ozone Gas Destruct – west & Hydrogen Peroxide Station -west (Facilities 8 & 18). Semi-gravity retaining walls may be used at the Electrical Facilities & Consolidated Maintenance Building (Facilities 14 & 15), the Ozone Generation Building (Facility 4), the Liquid Oxygen Storage Area (Facility 5) and the Gravity Thickeners & Thickened Solids Pumping Plants (Facilities 11 &12).

New retaining walls will also be required at the three staging areas (Staging Areas 1, 2 and 3) for cut to match the grade on the adjacent roadway. We understand that soil nail walls may be used for the new retaining walls at the three staging areas.

Our geotechnical recommendations for these new retaining walls (including recommended lateral earth pressures and foundation design criteria for semi-gravity retaining walls and geotechnical design parameters for soil nail walls at the various locations) are summarized on **Plate 6B**. The recommended lateral earth pressures presented on **Plate 6B** do not include any surcharges. Therefore, the designer should include the appropriate surcharge loads to the retaining wall design.

The lateral earth pressures recommended for semi-gravity retaining walls on **Plate 6B** are based on drained conditions. To reduce hydrostatic pressure build-up, the retaining walls should be provided with permanent backdrains consisting of a 4-inch diameter perforated PVC pipe (SDR 35) encapsulated in a drainage blanket of granular material. The drainage blanket of granular material may consist of either free draining gravel wrapped in a filter fabric (Mirafi 140N or approved equivalent) or Class 2 permeable material. The Class 2 permeable material should be in conformance with Section 68 of the Caltrans "Standard Specifications." The drainage blanket should be at least 12 inches thick and should be placed from the bottom of the retaining wall to about 1 foot below the finish grade behind the retaining wall. Alternatively, a geo-composite drain, such as Miradrain 6200 or an approved equivalent, may be used in lieu of a drainage blanket of granular material. The perforated pipe should be placed near the bottom of the wall to carry collected water to the storm drain. Direct discharge into the bioretention planter should be avoided to prevent backflow of water into the backdrains.

For soil nail walls, it is recommended that concrete V-ditches be provided along the top of the walls to intercept surface runoff from the hillside areas above. To prevent hydrostatic pressure buildup, the soil nail walls should also be provided with permanent backdrains. The backdrains should consist of geocomposite drains, such as Meldrain 7012 together with Total-Drain or approved equivalent. The geocomposite drains should

be approximately 4 feet wide (for full wall drainage) and be placed from about 24 inches below the top of the walls to about 12 inches below the finish grade in front of the walls. Two inches diameter perforated PVC pipes (Schedule 40) should be installed at the wall base to discharge water from the geocomposite drains to a suitable gravity discharge.

To verify the as-built carrying capacity, at least 5 percent of the soil nails should be proof loaded to 150 percent of the design load. The load test schedule and acceptable criteria should be determined by the soil nail wall designer and submitted for review by AGS. The load testing should be performed under the observation of the project geotechnical engineer.

3.15 LATERAL RESISTANCE

Lateral resistance can be obtained from:

- passive pressure acting against the below-grade walls;
- friction between the bottom of the structures and the underlying bearing material; and
- friction between the below-grade walls and the adjacent soils.

The allowable passive pressure acting against the below-grade walls should be calculated using equivalent fluid pressure of 300 pcf above the design groundwater level and 150 pcf below the design groundwater level. Hydrostatic pressure can be added, where applicable below groundwater table. The upper 1 foot of soils should be neglected when calculating passive pressures, if the adjacent ground surface is not confined by pavement or slab.

Friction at the bottom of the structures and the below-grade walls can be estimated by using an allowable coefficient of friction of 0.30.

The ultimate passive pressure can be assumed to be mobilized at a lateral displacement of approximately 6 percent of the height of below-grade walls. At lateral displacement less than 6 percent of the height of below-grade walls, **Table 27** below may be used to calculate mobilization of passive pressure:

TABLE 27 – MOBILIZATION OF PASSIVE PRESSURES

δ/H	P/P_{ult}
0.00	0.00
0.0025	0.39
0.005	0.45
0.01	0.55
0.02	0.70
0.03	0.83
0.04	0.91
0.05	0.96
$\geq$ 0.06	1.00

where: P = Mobilized Passive Pressure

P_{ult} = Ultimate Passive Pressure

δ = Lateral Displacement

H = Height of Below-Grade Wall

(from ground surface to bottom of wall)

3.16 RESISTANCE TO HYDROSTATIC UPLIFT

The proposed below-grade structures and pipelines should be designed to resist anticipated hydrostatic uplift forces when the pipe is empty. As discussed in the "Design Groundwater Level" section, we recommend that the design groundwater level presented on **Plate 6** be considered.

Resistance to hydrostatic uplift forces may be provided by the weights of the structures

and backfill. The recommended total unit weight (above groundwater) and buoyant unit weight (below groundwater) for backfill are 120 and 58 pcf, respectively. If required, additional uplift resistance may be provided through incorporation of a slab foundation with an extended slab collar to mobilize the soil weight above (vertical projection) of the extended slab collar.

3.17 PAVEMENT RECOMMENDATIONS

AGS performed R-value test on a composite soil sample obtained from the upper 5 feet of Borings 9, 10, 11 and 12 located at the western part of the site. The composite soil sample consisted of brown sandy clay with gravel and the R-value obtained from the test was 14. Considering that the R-value at other parts of the site could be lower, especially where old fill may be encountered at the pavement areas, a design R-value of 5 was assumed in our pavement analyses.

Pavement analyses have been performed based on the latest Caltrans Flexible Pavement Design Method with Traffic Index (TI) ranging from 5 to 7 as presented in **Table 28**. For pedestrian asphalt concrete paving, we recommend that the flexible pavement section for the minimum traffic index of 4.0, as presented in **Table 28**, be considered, if confirmed by the Civil Engineer to allow for occasional light vehicular traffic. Compaction of the pavement components should be at least 95 percent relative compaction, in accordance with the ASTM D 1557-12R21 procedure.

TABLE 28 – FLEXIBLE PAVEMENT RECOMMENDATIONS

Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base Class II (inches)
4.0	3	7
4.5	3	8
5.0	3	10
5.5	3	12
6.0	4	12
6.5	4	14
7.0	4	16

Notes: Caltrans Highway Design Manual, Chapter 630:
GE = Gravel Equivalent for Pavement Section;
AB = Aggregate Base (Min.R-Value = 78);
AC = Hot Mix Asphalt Concrete;
Factor of safety included. Section thickness rounded to the nearest inch. Aggregate subbase or recycled baserock meeting Caltrans subbase requirements could be substituted for Caltrans Class 2 AB using a GE factor of 1.1 times that of AB for a slightly thicker section.

The uppermost 9 inches of all pavement subgrade soils should be moisture conditioned to near optimum moisture content and recompacted to at least 95 percent relative compaction (as determined by ASTM D1557-12R21) to provide a smooth, unyielding surface.

The Class 2 aggregate base should be placed in thin lifts in a manner to prevent segregation; uniformly moisture conditioned; and compacted to at least 95 percent relative compaction to provide a smooth, unyielding surface.

3.18 CONSTRUCTION CONSIDERATIONS

The geotechnical engineer should review project plans and specifications prior to construction to ascertain that the geotechnical aspects of the project are consistent with the intent of the recommendations presented herein. The geotechnical engineer or his/her representatives should observe the following items and perform required tests during the construction:

- Site grading;
- Footing and mat foundation construction;
- Drilled pier installation;
- Retaining wall construction;
- Pavement and concrete slab-on-grade construction;
- Underground utility installation;
- Placement and compaction of fill, backfill and pipe bedding;
- Shoring and construction dewatering (if any);
- Observe the excavation of facilities and pipelines;
- Observe the bottom of excavation prior to placement and compaction of fills and backfill; and
- Observe the bottom of excavations prior to construction of facilities and pipelines.

The geotechnical engineer should observe the soil conditions encountered during construction, verify the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures, if the conditions differ from those described herein.

4.0 CLOSURE

This report has been prepared in accordance with generally accepted professional geotechnical engineering practice for the exclusive use of the East Bay Municipal Utilities District's Walnut Creek Water Treatment Plant Pretreatment Project in Walnut Creek, California. No other warranty, express or implied, is made.

The analyses and recommendations submitted in this report are based upon the data obtained from the borings conducted for this project. The nature and extent of variations between the borings may not become evident until construction. In the event variations occur it will be necessary to reevaluate the recommendations of this report.

It is the responsibility of the owner and its representatives to ensure that the applicable provisions of this report are incorporated into the plans and specifications and that the necessary steps are taken to see that the contractor carry out such provisions.

Respectfully submitted,
AGS, Inc.

Steve Tsang Geotechnical Engineer 2162	Chloe Gednov Project Geologist 10235
Keyvan Fotoohi, Ph.D. Geotechnical Engineer 2774	Bahram Khamenehpour, Ph.D. Geotechnical Engineer 2104

5.0 REFERENCES

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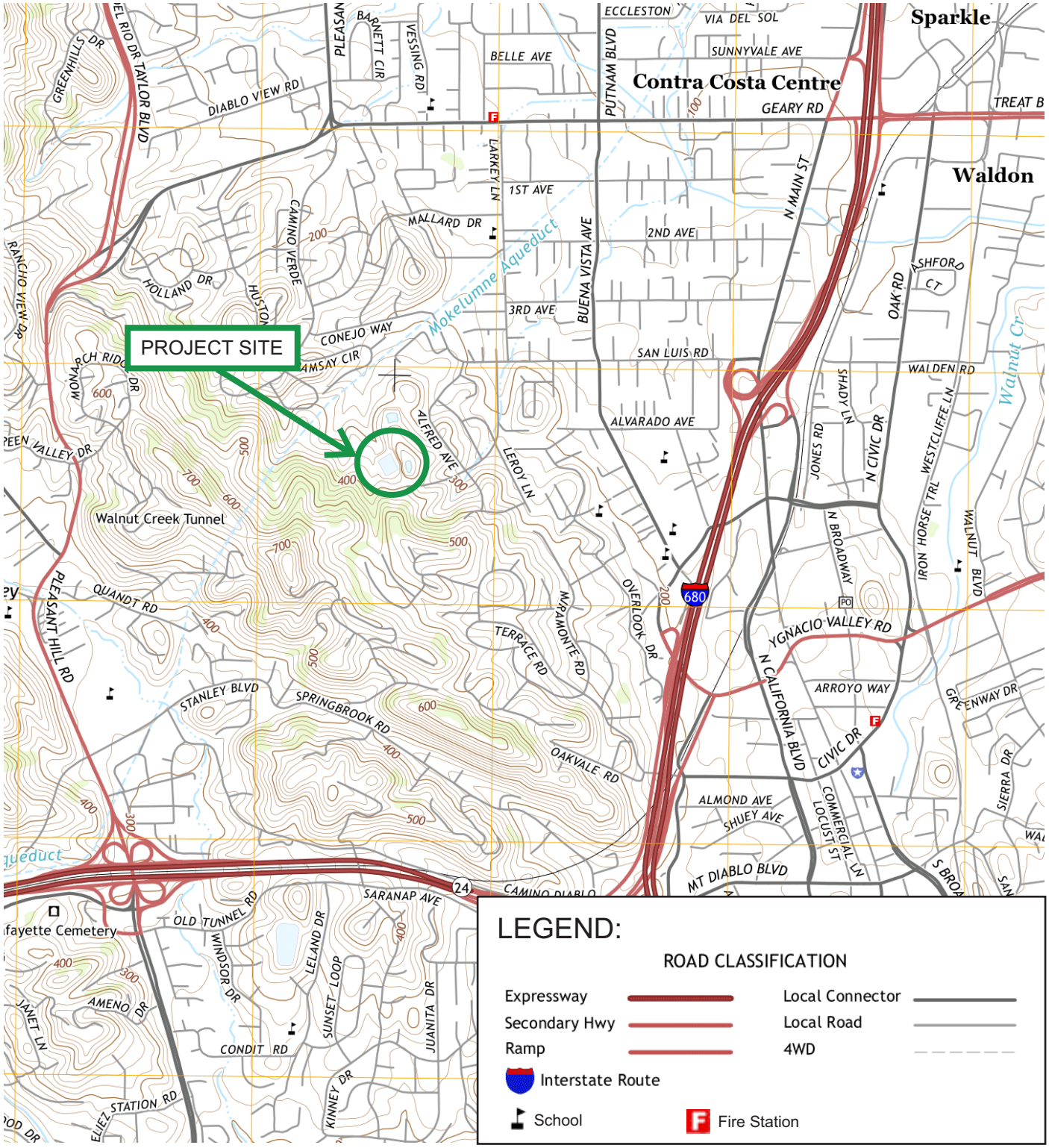
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PLATES



Source: USGS, 7.5 Minute Topographic Map of Walnut Creek (2015) Quadrangle

0 500 1000 2000 ft

APPROXIMATE SCALE

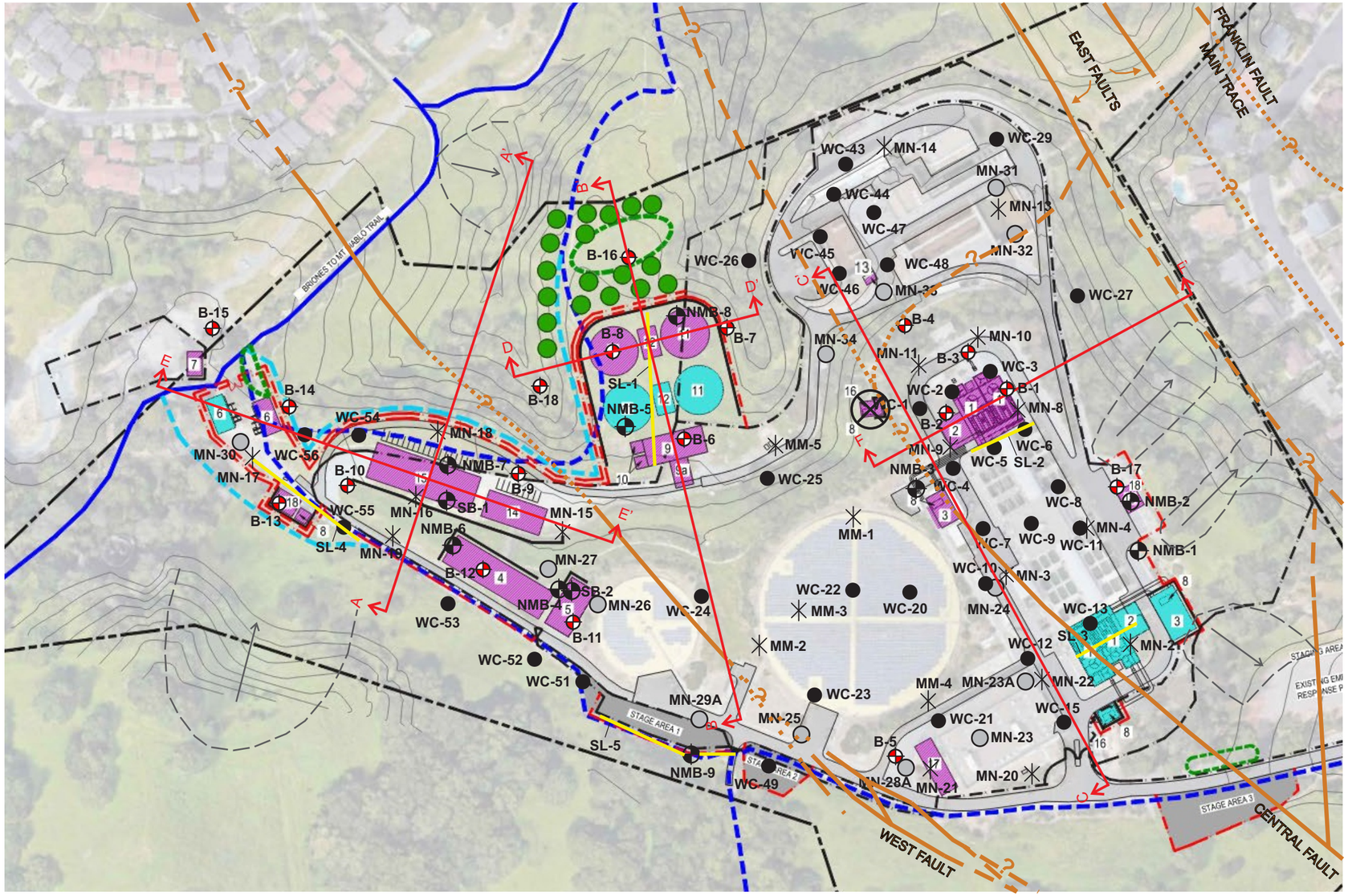
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SITE VICINITY MAP

WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 1



PROPOSED FACILITIES					
ID	NAME	QTY	AREA (SF)	TYPE	DIMENSIONS LxWxD (FT)
1	BALLASTED FLOCCULATION	4	2592	CONC,BURIED	81x32x27
2	INTERMEDIATE OZONE PP	2	2000	CONC,BURIED	50x40x20
3	INTERMEDIATE OZONE CONTACTORS	2	3520	CONC,BURIED	80x44x26
4	OZONE GENERATOR BUILDING	1	10000	CONC	200x50x15
5	LOX TANKS AND VAPORIZERS	1	3320	CONC	83x40x27
6	PRE-OZONE PP	2	1500	CONC	50x30x20
7	COMBINED RECLAIM METERING VAULT	1	1000	CONC,BURIED	40x25x18
8	OZONE GAS DESTRUCT	5	200	COVERED CANOPY	20x10x12
9	DEWATERING BUILDING	1	4500	CONC	100x45x27
9A	TRUCK LOADING CANOPY	1	1350	PREFAB	45x30x20
10	THICKENED SOLIDS BLENDING TANKS	2	400	CONC	20'x20'x16
11	GRAVITY THICKENERS	4	5026	CONC	80'DIAx17
12	THICKENED SOLIDS PP	2	1500	CONC	50x30x27
13	SOLIDS XFER PP	1	300	CONC	20x15x17
14	ELECTRICAL FACILITIES	1	4500	PREFAB	100x45x18
15	MAINTENANCE BUILDING	1	7200	CONC	120x60x27
16	OZONE QUENCHING VAULT	2	750	CONC,BURIED	30x25x20
17	CHEMICAL STORAGE	1	2139	COVERED CANOPY	93x23x20
18	HYDROGEN PEROXIDE STATION	2	1200	COVERED CANOPY	40x30x15
19	POTENTIAL LAFAYETTE PP LOCATION (NOT IN PROJECT)	1	3940	CONC	109x36x17

FAULT LOCATIONS: GEOMATRIX 1998, NINYO & MOORE 2022
LANDSLIDE LOCATIONS: NINYO & MOORE 2022, GEOMATRIX 1998

BASE AND PROPOSED FACILITIES TABLE: WALNUT CREEK WTP PRETREATMENT SITE PLAN - LOCATION AND PHASING OF PROPOSED FACILITIES (EBMUD 7/27/2022)

LEGEND

- Approximate Boring Location (AGS, 2024)
- Approximate Boring Location (N&M, 2022)
- Approximate Boring Location (OCC, 2001)
- Approximate Boring Location (EBMUD, 1997)
- Approximate Boring Location (EBMUD, 1964 & 1986)
- Approximate Proposed Retaining Wall (EBMUD, 2020)
- Approximate Seismic Line Location (N&M, 2022)
- Approximate Landslide Location
- Approximate Fault Location
- Concealed Fault Location
- Inferred Fault Location
- Geologic Cross Section (A – A')
- Facility Removed from Study

N

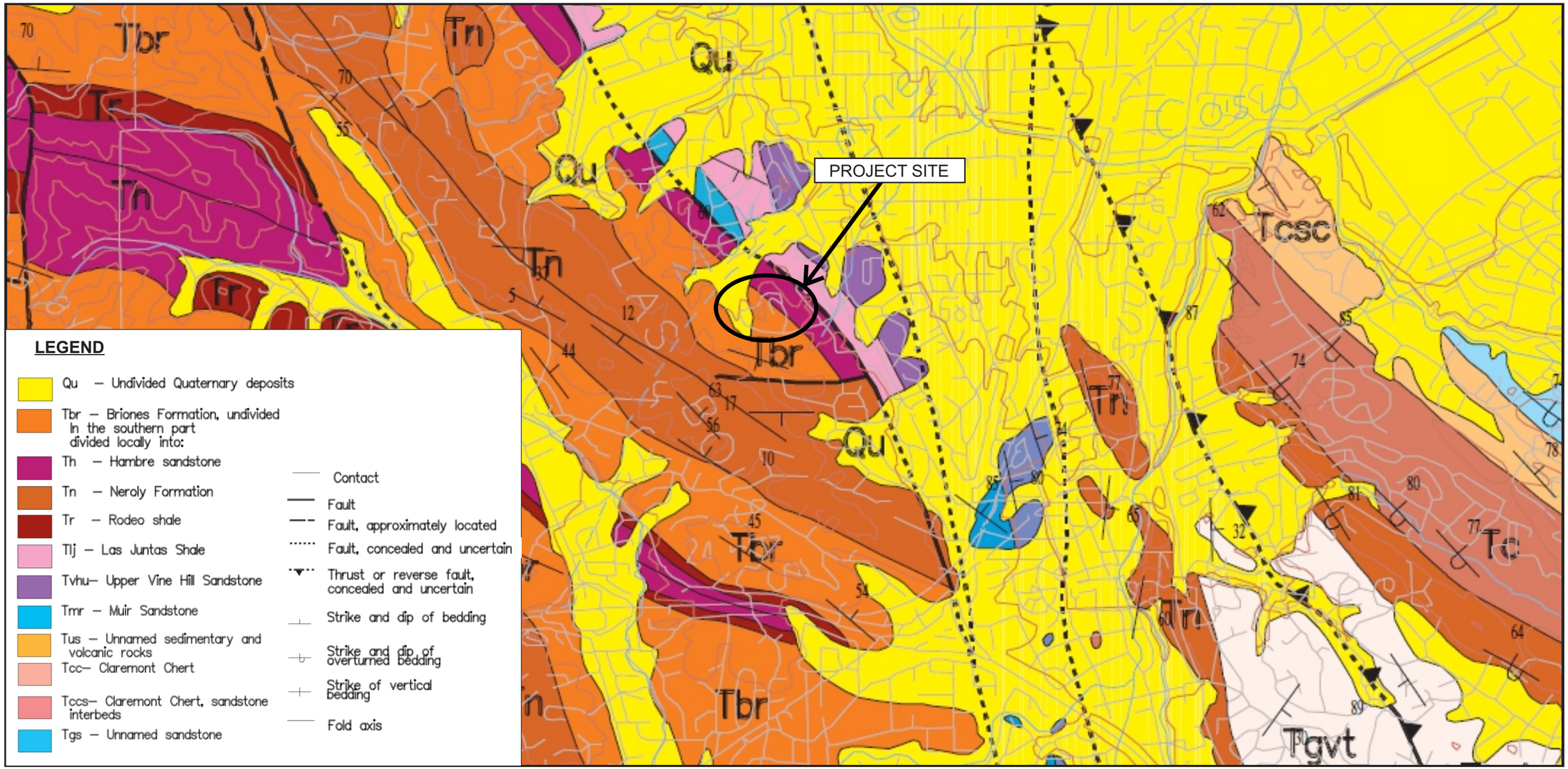
0 200 400 ft
APPROXIMATE SCALE

BORING LOCATION MAP

WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006 | DATE: JUN 2025 | PLATE 2



BASE MAP SOURCE: PRELIMINARY GEOLOGIC MAP EMPHASIZING BEDROCK FORMATIONS IN CONTRA COSTA COUNTY, CALIFORNIA (GRAYMER ET AL, 1994)

N

0 2000 4000 ft

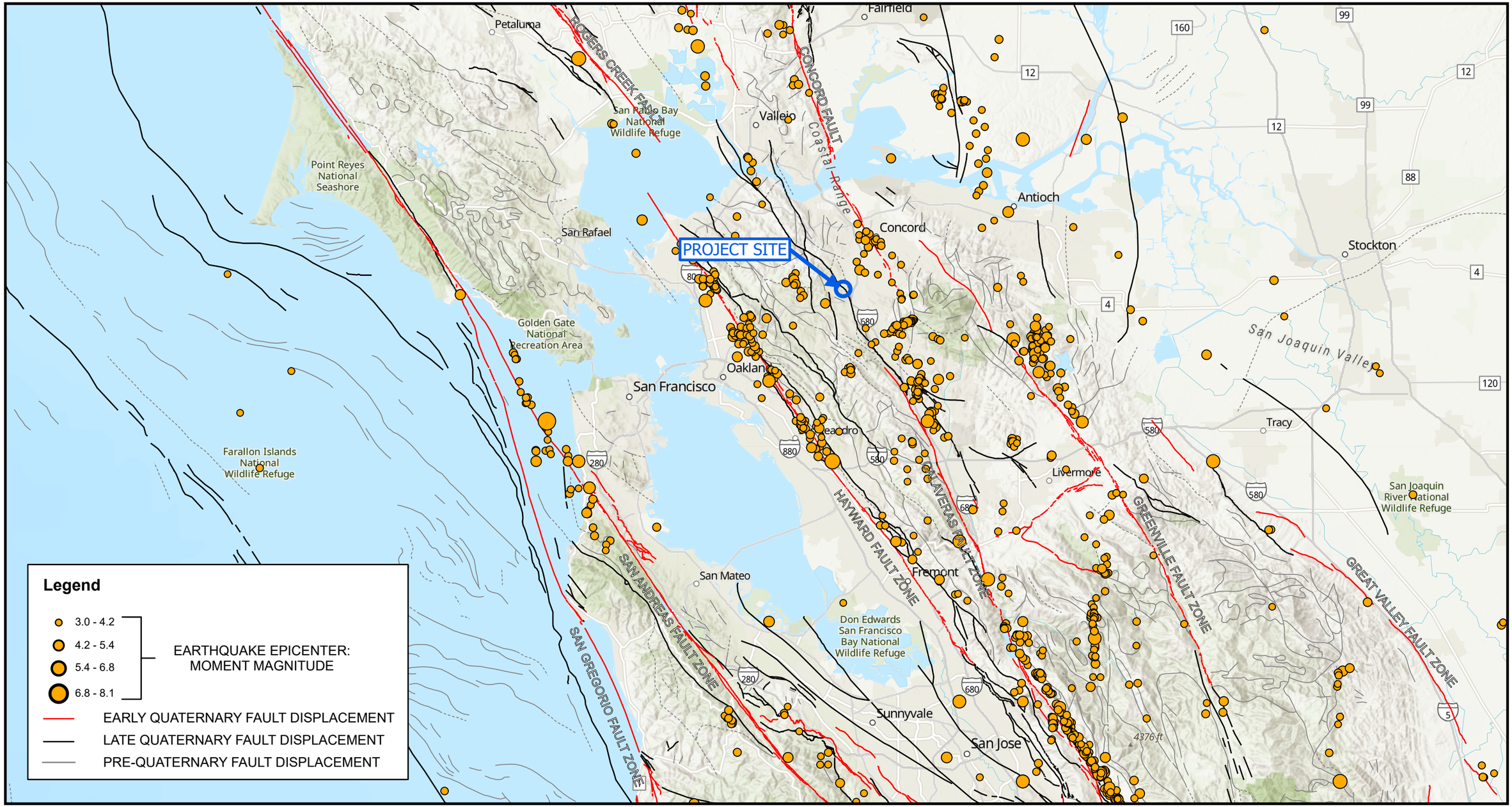
APPROXIMATE SCALE

REGIONAL GEOLOGIC MAP

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 3



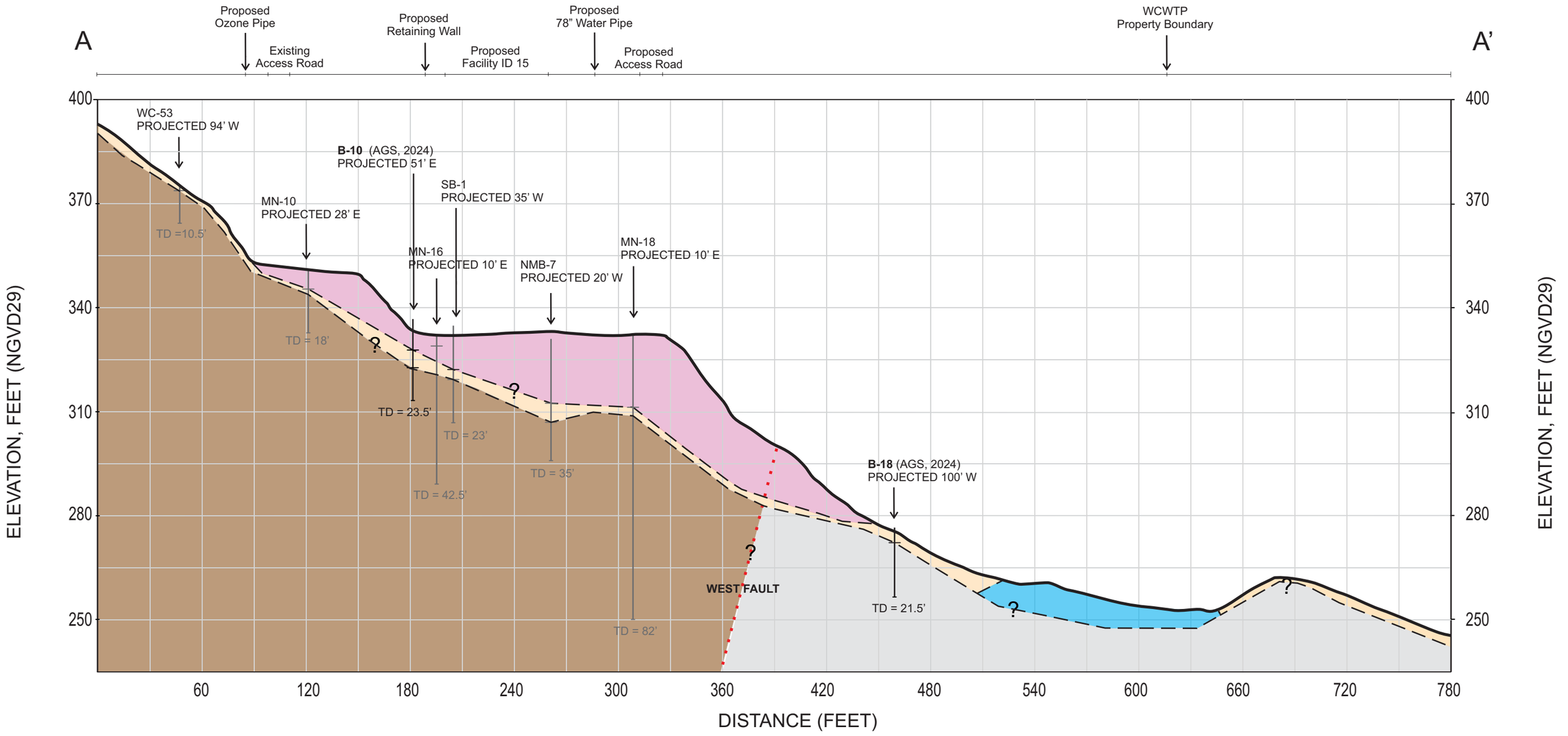
Sources:
1) C. Jennings and W. Bryant, 2010, Fault Activity Map of California.
2) USGS Earthquake Catalog: Magnitude 3.0+ from 1860 - 2024.
3) Basemap compiled in 2023 from: Esri, CGIAR, USGS, California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS

EARTHQUAKE EPICENTERS AND FAULT MAP

WALNUT CREEK WATER TREATEMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 4



LEGEND

- af — FILL
- Qc — COLLUVIUM
- Qa — ALLUVIUM
- Tmb — BRIONES FORMATION
- Tmh — HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)

TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION (DIP INFERRED)[3]

SCALE

VERT.: 1"=30'
HOR.: 1"=60'

DISCLAIMER: THE SUBSURFACE CONDITIONS WERE INTERPOLATED, THE INTERPOLATION AND EXTRAPOLATION OF THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS ARE BASED ON WIDELY SPACED BORINGS. VARIATION IN THE ACTUAL CONDITIONS FROM THOSE DEPICTED SHOULD BE ANTICIPATED. NEITHER BORING LOGS NOR THE GENERALIZED SOIL PROFILES ARE STAND-ALONE DOCUMENTS; AND THEY SHOULD ONLY BE USED WITHIN THE FULL CONTEXT OF THE SOILS REPORT. THIS PROFILE WAS PREPARED FOR THE SOLE PURPOSE OF DEVELOPING GEOTECHNICAL RECOMMENDATIONS. IT IS NOT INTENDED FOR USE IN ESTIMATING QUANTITY OF VARIOUS SOIL TYPES.

NOTES:
1. LOCATIONS OF PROFILES ARE PRESENTED ON PLATE 2.
2. ELEVATIONS SHOWN ABOVE ARE TAKEN FROM THE DWG FILE PROVIDED BY CAROLLO VIA EMAIL ON AUGUST 28, 2024 TITLED ACAD-CEZ000DTM.
3. APPROXIMATED FROM NINYO & MOORE 2022 FIGURE 5.

GENERALIZED SUBSURFACE PROFILE A-A'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5A

B

B'

Existing Paved Roadway

Proposed Facility ID 9a

Proposed Facility ID 9

Proposed Facility ID 12

Proposed Facility ID 12

Proposed Retaining Wall

WCWTP Property Boundary

MN-29A
PROJECTED 62' E

MM-2
PROJECTED 60' W

TD = 30.3'

TD = 33'

WEST FAULT

B-6 (AGS, 2024)
PROJECTED 20' W

TD = 14'

NMB-5
PROJECTED 68' E

TD = 38.8'

B-8 (AGS, 2024)
PROJECTED 61' E

TD = 30'

NMB-8
PROJECTED 56' W

TD = 10.8'

B-16 (AGS, 2024)

TD = 14.5'

ELEVATION, FEET (NGVD29)

370
340
310
280
250

60 120 180 240 300 360 420 480 540 600 660 720 780 840 900

DISTANCE (FEET)

LEGEND

- af — FILL
- Qc — COLLUVIUM
- Qa — ALLUVIUM
- Tmb — BRIONES FORMATION
- Tmh — HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)

TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION [3]

SCALE

VERT.: 1"=30'
HOR.: 1"=60'

DISCLAIMER: THE SUBSURFACE CONDITIONS WERE INTERPOLATED, THE INTERPOLATION AND EXTRAPOLATION OF THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS ARE BASED ON WIDELY SPACED BORINGS. VARIATION IN THE ACTUAL CONDITIONS FROM THOSE DEPICTED SHOULD BE ANTICIPATED. NEITHER BORING LOGS NOR THE GENERALIZED SOIL PROFILES ARE STAND-ALONE DOCUMENTS; AND THEY SHOULD ONLY BE USED WITHIN THE FULL CONTEXT OF THE SOILS REPORT. THIS PROFILE WAS PREPARED FOR THE SOLE PURPOSE OF DEVELOPING GEOTECHNICAL RECOMMENDATIONS. IT IS NOT INTENDED FOR USE IN ESTIMATING QUANTITY OF VARIOUS SOIL TYPES.

NOTES:
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3. APPROXIMATED FROM NINYO & MOORE 2022 GIR FIGURE 5.

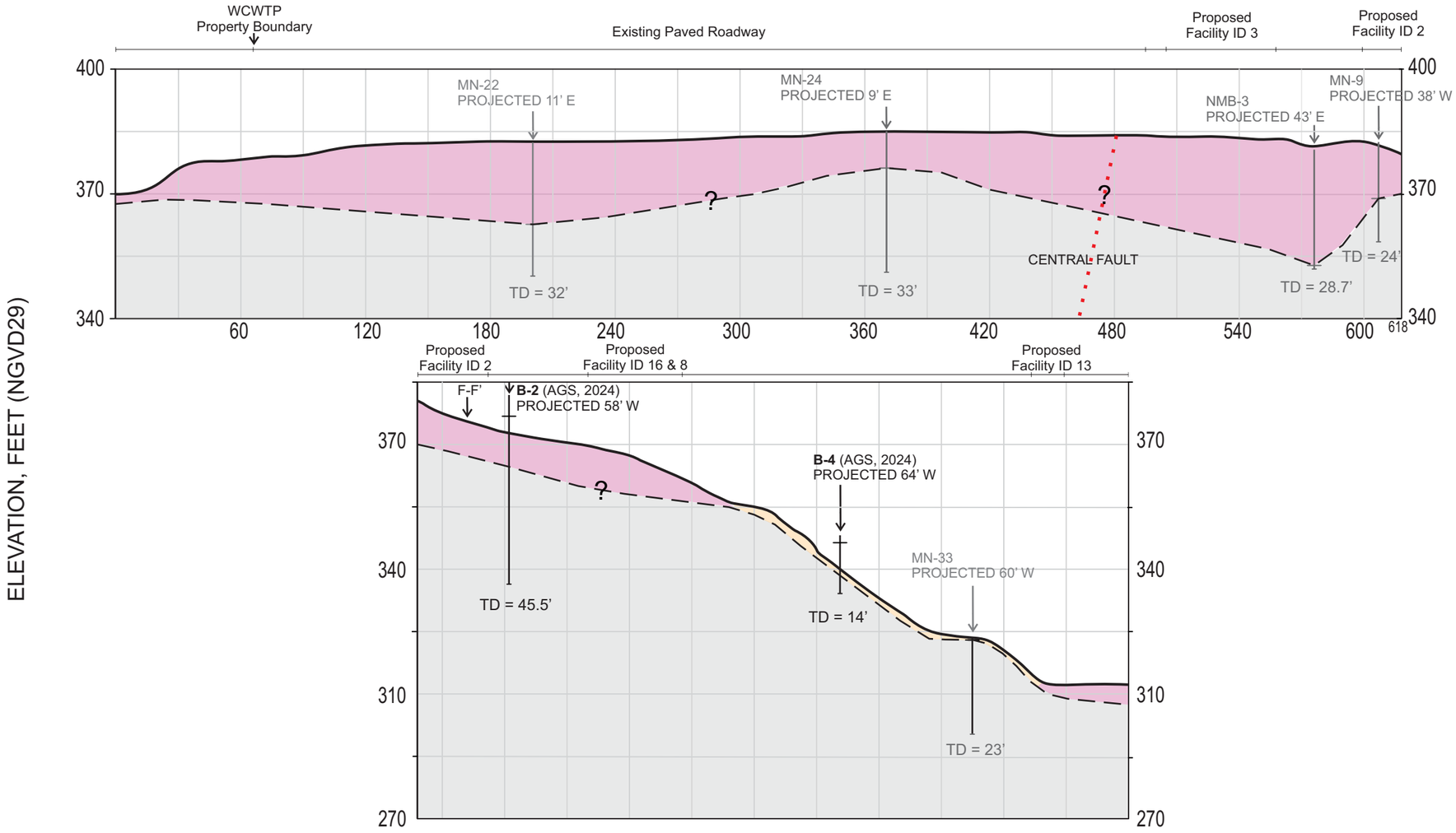
GENERALIZED SUBSURFACE PROFILE B-B'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5B

C

C'



LEGEND

- af — FILL
- Qc — COLLUVIUM
- Qa — ALLUVIUM
- Tmb — BRIONES FORMATION
- Tmh — HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)
TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION (DIP INFERRED)[3]

SCALE

VERT.: 1"=30'
HOR.: 1"=60'

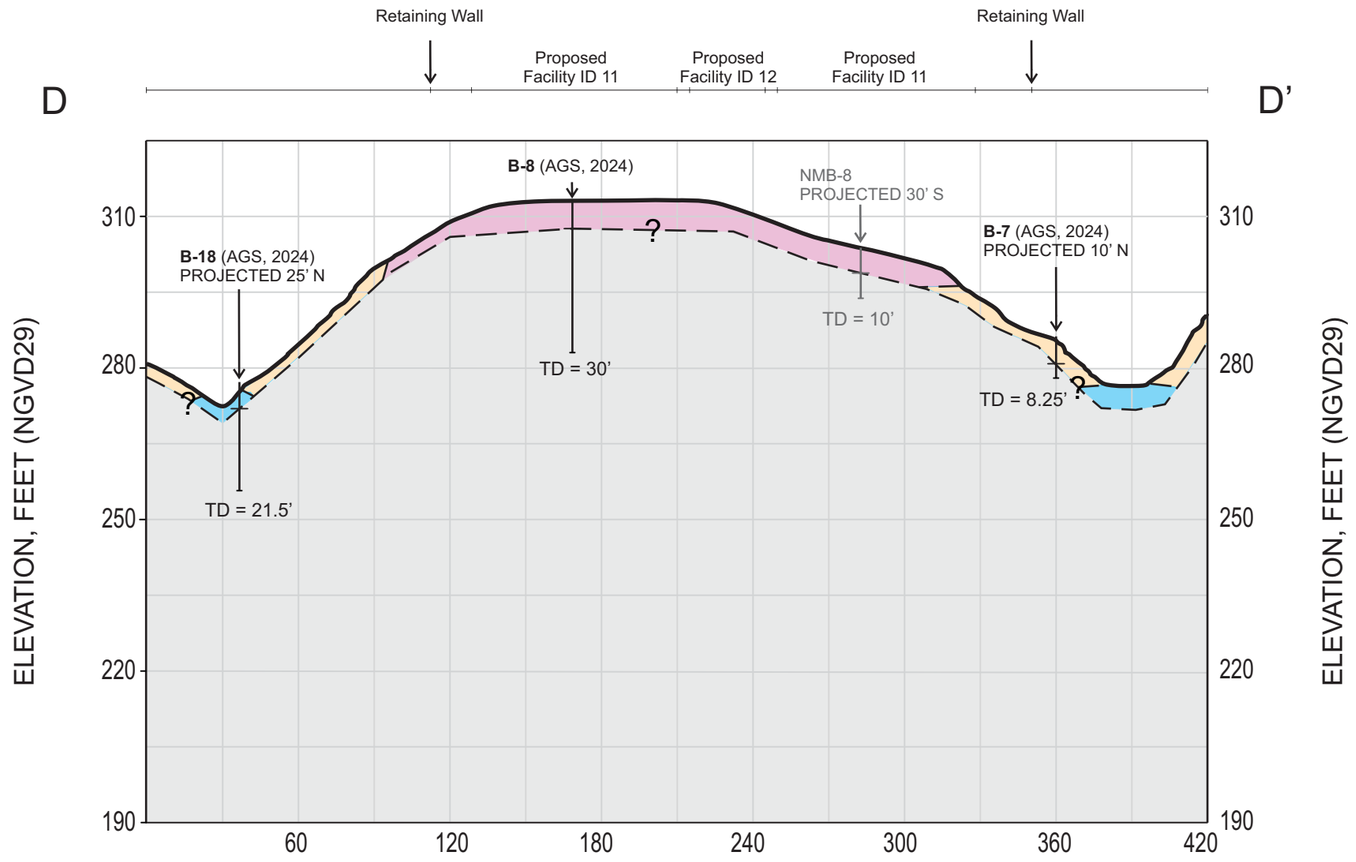
NOTES:
1. LOCATIONS OF PROFILES ARE PRESENTED ON PLATE 2.
2. ELEVATIONS SHOWN ABOVE ARE TAKEN FROM THE DWG FILE PROVIDED BY CAROLLO VIA EMAIL ON AUGUST 28, 2024 TITLED ACAD-CEZ000DTM.
3. APPROXIMATED FROM NINYO & MOORE 2022 FIGURE 5.

DISCLAIMER: THE SUBSURFACE CONDITIONS WERE INTERPOLATED, THE INTERPOLATION AND EXTRAPOLATION OF THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS ARE BASED ON WIDELY SPACED BORINGS. VARIATION IN THE ACTUAL CONDITIONS FROM THOSE DEPICTED SHOULD BE ANTICIPATED. NEITHER BORING LOGS NOR THE GENERALIZED SOIL PROFILES ARE STAND-ALONE DOCUMENTS; AND THEY SHOULD ONLY BE USED WITHIN THE FULL CONTEXT OF THE SOILS REPORT. THIS PROFILE WAS PREPARED FOR THE SOLE PURPOSE OF DEVELOPING GEOTECHNICAL RECOMMENDATIONS. IT IS NOT INTENDED FOR USE IN ESTIMATING QUANTITY OF VARIOUS SOIL TYPES.

GENERALIZED SUBSURFACE PROFILE C-C'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5C



LEGEND

af	FILL
Qc	COLLUVIUM
Qa	ALLUVIUM
Tmb	BRIONES FORMATION
Tmh	HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)

TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION (DIP INFERRED)[3]

SCALE

VERT.: 1"=30'
HOR.: 1"=60'

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NOTES:
1. LOCATIONS OF PROFILES ARE PRESENTED ON PLATE 2.
2. ELEVATIONS SHOWN ABOVE ARE TAKEN FROM THE DWG FILE PROVIDED BY CAROLLO VIA EMAIL ON AUGUST 28, 2024 TITLED ACAD-CEZ000DTM.
3. APPROXIMATED FROM NINYO & MOORE 2022 FIGURE 5.

GENERALIZED SUBSURFACE PROFILE D-D'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5D

E

E'

WCWTP Property Boundary

Proposed Facility ID 6

Proposed Facility ID 6

Proposed Facility ID 15

Proposed Facility ID 14

Proposed Retaining Wall

B-15 (AGS, 2024) PROJECTED 118' S

MN-30 PROJECTED 40' N

B-14 (AGS, 2024) PROJECTED 38' S

B-10 (AGS, 2024) PROJECTED 53' N

NMB-7 PROJECTED 31' S

MN-16 PROJECTED 33' N

SB-1 PROJECTED 25' N

B-09 (AGS, 2024) PROJECTED 56' S

MN-15 PROJECTED 10' N

TD = 47''

TD = 31.5'

TD = 41'

TD = 23.5'

TD = 42.5'

TD = 35'

TD = 28'

TD = 50.3'

TD = 47.5'

ELEVATION, FEET (NGVD29)

370

340

310

280

250

60 120 180 240 300 360 420 480 540 600 660 720 780

DISTANCE (FEET)

LEGEND

af	FILL
Qc	COLLUVIUM
Qa	ALLUVIUM
Tmb	BRIONES FORMATION
Tmh	HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)

TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION (DIP INFERRED)[3]

SCALE

VERT.: 1"=30'

HOR.: 1"=60'

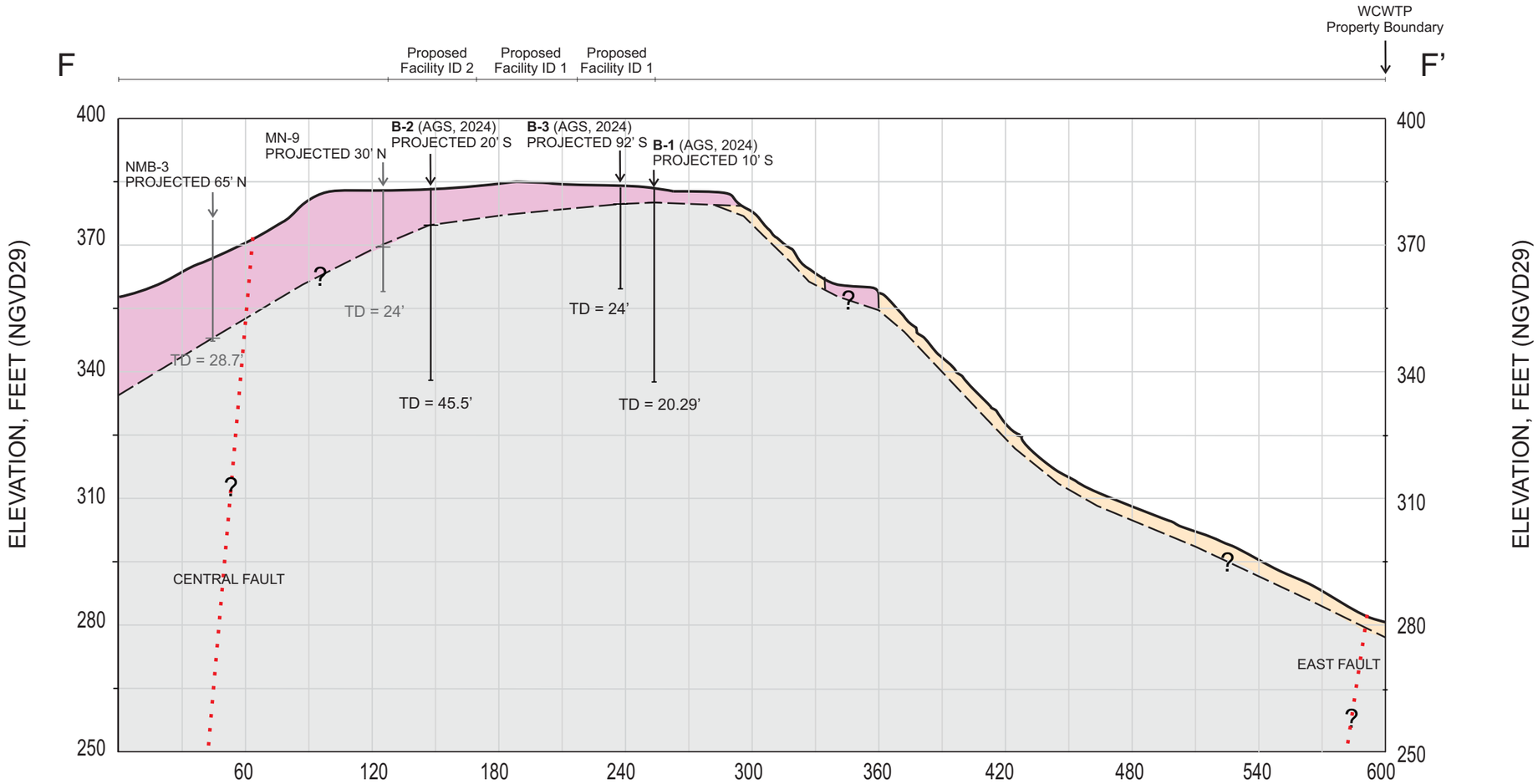
DISCLAIMER: THE SUBSURFACE CONDITIONS WERE INTERPOLATED, THE INTERPOLATION AND EXTRAPOLATION OF THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS ARE BASED ON WIDELY SPACED BORINGS. VARIATION IN THE ACTUAL CONDITIONS FROM THOSE DEPICTED SHOULD BE ANTICIPATED. NEITHER BORING LOGS NOR THE GENERALIZED SOIL PROFILES ARE STAND-ALONE DOCUMENTS; AND THEY SHOULD ONLY BE USED WITHIN THE FULL CONTEXT OF THE SOILS REPORT. THIS PROFILE WAS PREPARED FOR THE SOLE PURPOSE OF DEVELOPING GEOTECHNICAL RECOMMENDATIONS. IT IS NOT INTENDED FOR USE IN ESTIMATING QUANTITY OF VARIOUS SOIL TYPES.

NOTES:
1. LOCATIONS OF PROFILES ARE PRESENTED ON PLATE 2.
2. ELEVATIONS SHOWN ABOVE ARE TAKEN FROM THE DWG FILE PROVIDED BY CAROLLO VIA EMAIL ON AUGUST 28, 2024 TITLED ACAD-CEZ000DTM.
3. APPROXIMATED FROM NINYO & MOORE 2022 FIGURE 5.

GENERALIZED SUBSURFACE PROFILE E-E'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5E



LEGEND

- af — FILL
- Qc — COLLUVIUM
- Qa — ALLUVIUM
- Tmb — BRIONES FORMATION
- Tmh — HAMBRE FORMATION

B-18
(PROJECTED FEET & DIRECTION)

TD = TOTAL DEPTH (FEET)

— ? — GEOLOGICAL CONTACT APPROXIMATELY LOCATED

UNSTABILIZED GROUNDWATER LEVEL (ENCOUNTERED DURING DRILLING)

FAULT LOCATION (DIP INFERRED)[3]

SCALE

VERT.: 1"=30'
HOR.: 1"=60'

DISCLAIMER: THE SUBSURFACE CONDITIONS WERE INTERPOLATED, THE INTERPOLATION AND EXTRAPOLATION OF THE SUBSURFACE SOIL AND GROUNDWATER CONDITIONS ARE BASED ON WIDELY SPACED BORINGS. VARIATION IN THE ACTUAL CONDITIONS FROM THOSE DEPICTED SHOULD BE ANTICIPATED. NEITHER BORING LOGS NOR THE GENERALIZED SOIL PROFILES ARE STAND-ALONE DOCUMENTS; AND THEY SHOULD ONLY BE USED WITHIN THE FULL CONTEXT OF THE SOILS REPORT. THIS PROFILE WAS PREPARED FOR THE SOLE PURPOSE OF DEVELOPING GEOTECHNICAL RECOMMENDATIONS. IT IS NOT INTENDED FOR USE IN ESTIMATING QUANTITY OF VARIOUS SOIL TYPES.

NOTES:
1. LOCATIONS OF PROFILES ARE PRESENTED ON PLATE 2.
2. ELEVATIONS SHOWN ABOVE ARE TAKEN FROM THE DWG FILE PROVIDED BY CAROLLO VIA EMAIL ON AUGUST 28, 2024 TITLED ACAD-CEZ000DTM.
3. APPROXIMATED FROM NINYO & MOORE 2022 FIGURE 5.

GENERALIZED SUBSURFACE PROFILE F-F'
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 5F

ID	Building/Structure Description	Existing Ground Surface Elev. (ft)		Finish Pad Elev. (ft)	Finish Pad Depth, bgs (ft)		Design Groundwater Elev. (ft)	Foundation Type	Foundation Material	Allowable Bearing[1] Presssure (psf)	Subgrade Modulus[2] Kv_1 (pci)	Allowable Skin[3] Friction (psf)
		Minimum	Maximum		Minimum	Maximum						
1	Ballasted Flocculation	384	384	360	24	24	350	Mat	Bedrock	5,000	300	N/A
2	Intermediate Ozone Pumping Plant	384	384	370	14	14	350	Mat	Bedrock	5,000	300	N/A
3	Intermediate Ozone Contactors	378	383	357	21	26	350	Mat	Bedrock	5,000	300	N/A
4	Ozone Generation Building	344	362	361	(17)	1	330	Mat or Footings	New Fill/Old Fill	3,000	120	N/A
5	Liquid Oxygen Storage Area	360	367	365	(5)	2	330	Mat or Footings	New Fill/Old Fill	3,000	120	N/A
6	Pre-Ozone Pumping Plant - east	336	340	339	(3)	1	310	Drilled Piers	New Fill/Old Fill	N/A	N/A	500 in Soils 1,000 in Bedrock
7	Combined Reclaimed Metering Vault	341	341	323	18	18	310	Mat	Bedrock	5,000	300	N/A
8	Ozone Gas Destruct - west[4]	351	360	346	5	14	310	Drilled Piers[5]	Colluvium/Bedrock	3,000 [5]	120 [5]	500 in Soils 1,000 in Bedrock
9	Solids Dewatering Building	320	324	317	3	7	280	Mat or Footings	Old Fill/Bedrock	3,000	120	N/A
9a	Truck Loading Canopy	323	326	322	1	4	280	Drilled Piers [5]	Old Fill	3,000 [5]	120 [5]	500 in Soils 1,000 in Bedrock
10	Thickened Solids Blending Tanks - north & south	319	325	319	0	6	280	Mat	Old Fill/Bedrock	3,000	120	N/A
11	Gravity Thickeners - northeast & northwest	294	315	290	4	25	280	Mat	Bedrock	5,000	300	N/A
11	Gravity Thickeners - southeast & southwest	301	320	293	8	27	280	Mat	Bedrock	5,000	300	N/A
12	Thickened Solids Pumping Plant - north	308	314	286	22	28	280	Mat	Bedrock	5,000	300	N/A
12	Thickened Solids Pumping Plant - south	316	319	290	26	29	280	Mat	Bedrock	5,000	300	N/A
13	Solids Transfer Facility	319	321	320	(1)	1	317	Mat or Footings	New Fill/Bedrock	3,000	120	N/A
14	Electrical Facilities	327	331	333	(6)	(2)	310	Mat or Footings	New Fill	3,000	120	N/A
15	Consolidated Maintenance Building	329	338	336	(7)	2	310	Footings	New Fill/Old Fill	3,000	120	N/A
17	Chemical Storage Building	379	381	380	(1)	1	350	Drilled Piers[5]	New Fill/Old Fill	3,000 [5]	120 [5]	500 in Soils 1,000 in Bedrock
18	Hydrogen Peroxide Station - east	383	383	382	1	1	374	Drilled Piers[5]	Bedrock	3,000 [5]	120 [5]	500 in Soils 1,000 in Bedrock
18	Hydrogen Peroxide Station - west	347	360	346	1	14	310	Drilled Piers[5]	Colluvium/Bedrock	3,000 [5]	120 [5]	500 in Soils 1,000 in Bedrock

Notes:

1. The allowable bearing pressures for mat and footing foundations are for dead plus sustained live loads with a factor of safety of 3.0, which may be increased by one-third for short-term loading due to wind or seismic forces with a factor of safety of 1.5.
2. The modulus of subgrade reaction, Kv_1 values are for mat foundations.
3. The allowable skin frictions for drilled piers are for dead plus live loads with a factor of safety of 2.0, which may be increased by one-third for short-term loading due to wind or seismic forces with a factor of safety of 1.5.
4. Ozone Gas Destruct - east will be constructed over the Intermediate Ozone Contactors (Facility 3)
5. Facility 8, 9a, 17, and 18 (east and west) are canopies. We recommend that canopy structures be supported on drilled piers due to their ability to handle uplift and lateral loads efficiently, especially in areas prone to high seismic activity or expansive soils. Facilities 8, 9a, 17, and 18 (east and west) may be supported on mat or footing foundations if they can be designed for their respective uplift and lateral loads efficiently with costs comparable to drilled piers.

SUMMARY OF MAJOR FINDINGS AND RECOMMENDATIONS (PROPOSED FACILITIES)

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006 | DATE: JUN 2025 | PLATE 6A

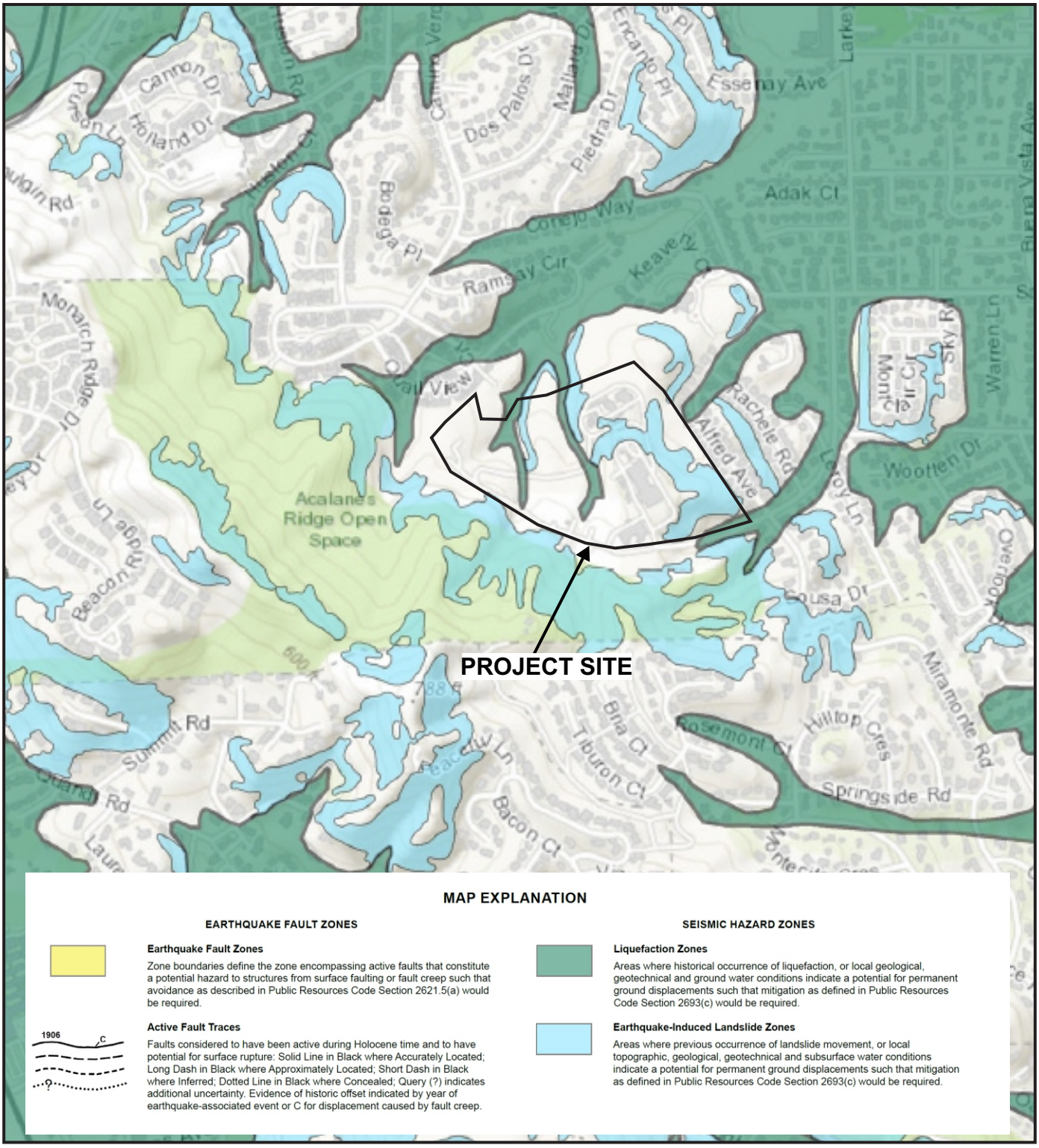
Retaining Walls	Maximum Retained Height (ft)	Backslope	Foreground	Site Conditions[1] above Wall	Retained Materials	Foundation[2] Material	Retaining Wall Type	Active Pressure[3] (pcf)	Passive Pressure[3] (pcf)	Seismic Increment[3] (pcf)	Minimum Footing[4] Depth (in)	Allowable Bearing Presssure (psf)	Allowable Coeff. of Friction	Soil Nail Design Parameters
Ozone Gas Destruct – west & Hydrogen Peroxide Station -west (Facilities 8 & 18)	18	2.4H:1V	Level	Hillside	Soil & Shale	N/A	Soil Nail Wall	N/A	N/A	N/A	N/A	N/A	N/A	See Note 5
Electrical Facilities & Consolidated Maintenance Building (Facilities 14 & 15)	8	Level	Level	Facilities 14 & 15 (On-Grade)	Backfill	Old Fill	Semi-Gravity Wall	45	300	50	24	3,000	0.3	N/A
Ozone Generation Building (Facility 4)	22	Level	Level	Facility 4 (On-Grade)	Backfill	Old Fill	Semi-Gravity Wall	45	300	50	24	3,000	0.3	N/A
Liquid Oxygen Storage Area (Facility 5)	10	Level	Level	Facility 5 (On-Grade)	Backfill	Old Fill	Semi-Gravity Wall	45	300	50	24	3,000	0.3	N/A
Gravity Thickeners & Thickened Solids Pumping Plants (Facilities 11 &12)	22	Level	2H:1V	Facilities 11 & 12 (Below-Grade)	Backfill	Siltstone/Sandstone	Semi-Gravity Wall	45	300*	50	24	5,000	0.3	N/A
Staging Area 1	18	2.5H:1V	Level	Hillside	Soil & Siltstone	N/A	Soil Nail Wall	N/A	N/A	N/A	N/A	N/A	N/A	See Note 5
Staging Area 2	12	3.5H:1V	Level	Hillside	Soil & Shale	N/A	Soil Nail Wall	N/A	N/A	N/A	N/A	N/A	N/A	See Note 5
Staging Area 3	10	2H:1V	Level	Hillside	Soil & Sandstone	N/A	Soil Nail Wall	N/A	N/A	N/A	N/A	N/A	N/A	See Note 5

1. Additional surcharge loads above the retaining wall may impose an increase to the lateral earth pressures presented above. For traffic load, an additional lateral earth pressure of 240 psf may be considered for the upper 10 feet of the retaining wall. For areal sucharges from Facilities 4, 5, 14 & 15, Plate 10 can be used to determine lateral surcharge pressures.
2. For the proposed retaining walls at Facilites 4, 5, 14 & 15, we recommend that their footings be supported on a minimum 2 feet of compacted engineered fill to provide uniform support.
3. Active and passive pressures and seismic increment are expressed as equivalent fluid pressures (EFP) each with a triangular distribution and the resultant force acting 1/3 times the height of that triangular distribution above the base of that triangular distribution.
4. All retaining wall footings at Facilities 11 & 12 should extend through soils and bear on bedrock. For footings located within 10 ft from the top of slope or on sloping ground, the footing embedment depth should be increased to provide a horizontal distance of at least 10 feet to the nearest downhill slope face. Depths refer to bottoms of footings.
5. Min. drill hole diameter: 6 inches; min. soil nail length: at least 15 ft or 1 times designed excavation height, whichever is greater; soil nail inclination: 10 to 15 degress from horizontal; soil nail spacing: 5 ft for both horizontal and vertical; nail bar diameter and grade: No. 8 and Grade 75 bar; allowable bond strength (FOS=2): 450 psf in soils and 1,000 psf in rock; horizontal seismic coeff.= 0.29 based on 5cm wall displacement.

SUMMARY OF MAJOR FINDINGS AND RECOMMENDATIONS (RETAINING WALLS)
WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006 | DATE: JUN 2025 | PLATE 6B



Source: California Geological Survey, Official Seismic Hazard Zones, Walnut Creek Quadrangle Contra Costa County, 2024

0 500 1000 2000 ft

APPROXIMATE SCALE

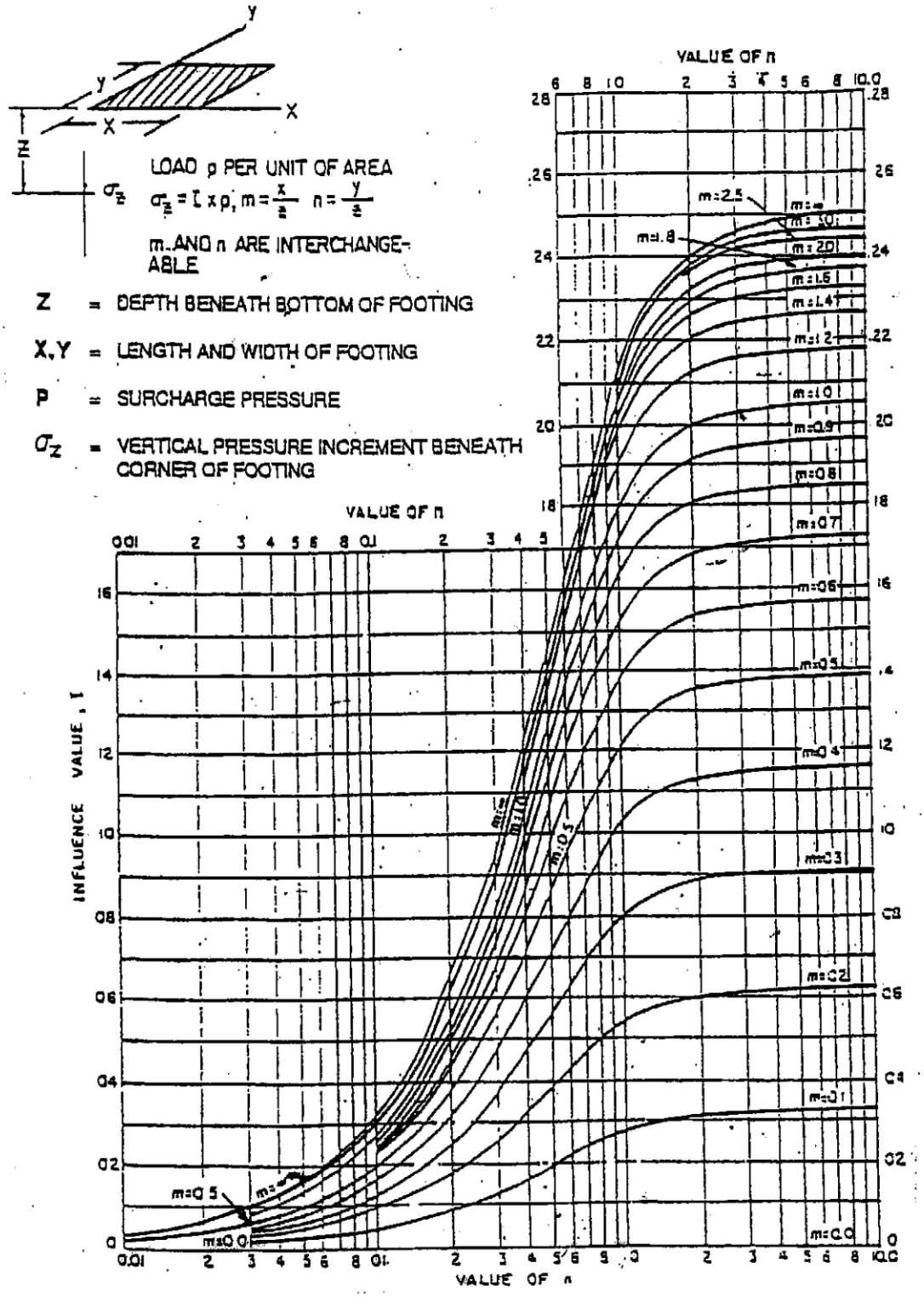
N

SEISMIC HAZARD MAP

WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 7



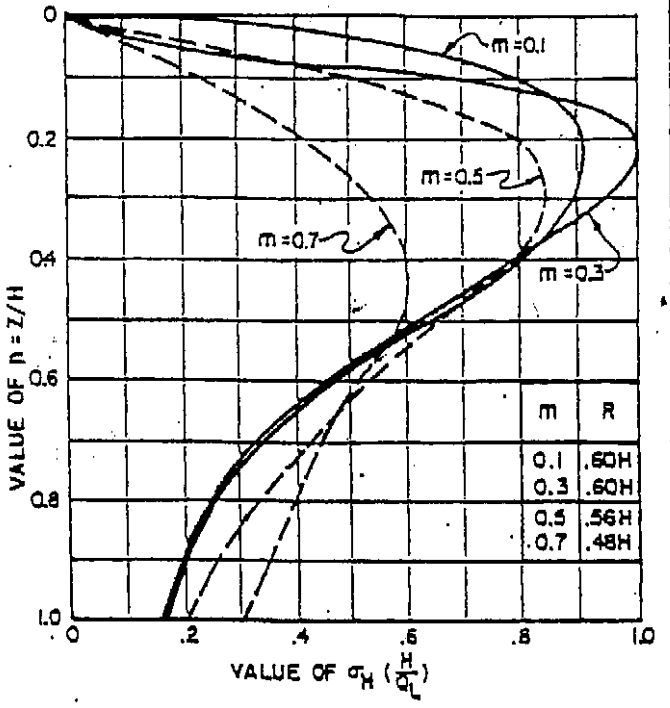
Reference: NAVFAC DM -7.1

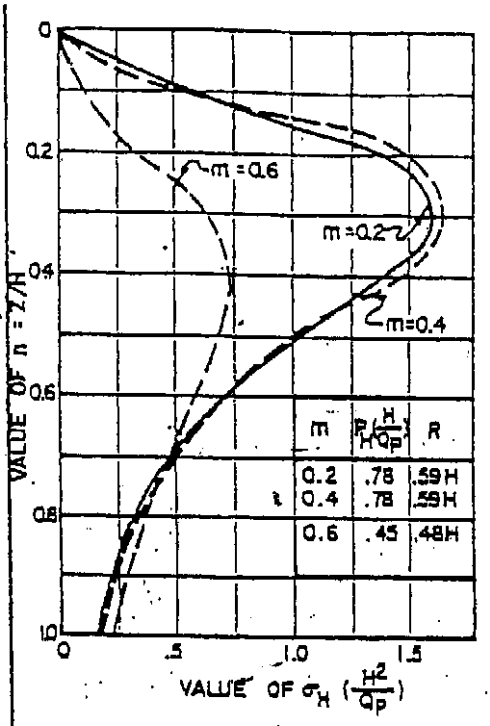
VERTICAL SURCHARGE PRESSURES

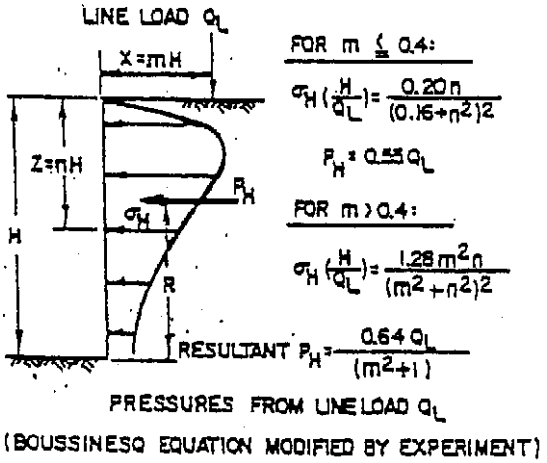
WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

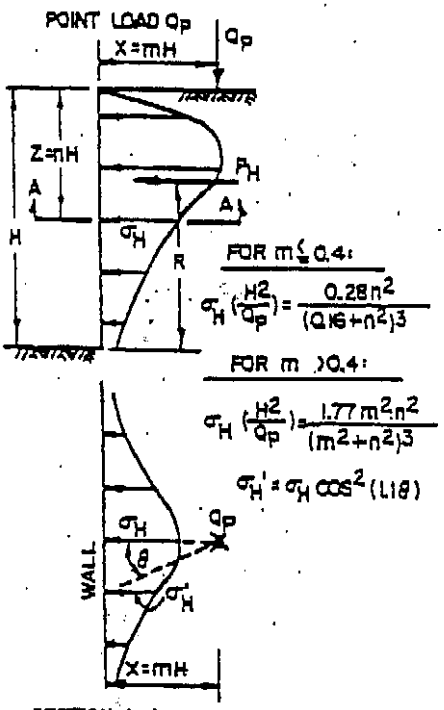
JOB NO.: AGS-23-006	DATE: JUN 2025	PLATE 8







PRESSURES FROM LINE LOAD Q_L
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)



SECTION A-A
PRESSURES FROM POINT LOAD Q_P
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)

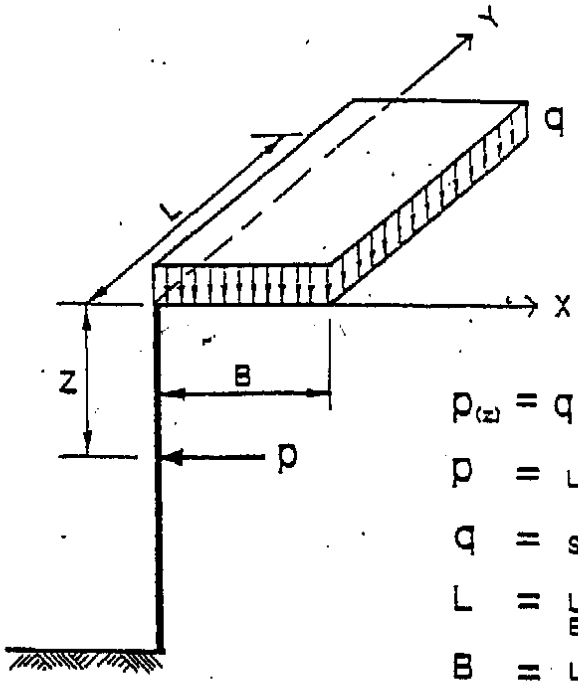
Reference: MARSTON, N. 1930

LATERAL SURCHARGE PRESSURES POINT AND LINE LOADS

WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO.: AGS-23-006	DATE: JUN 2025	PLATE 9



$p_{(z)} = q \times I_p$

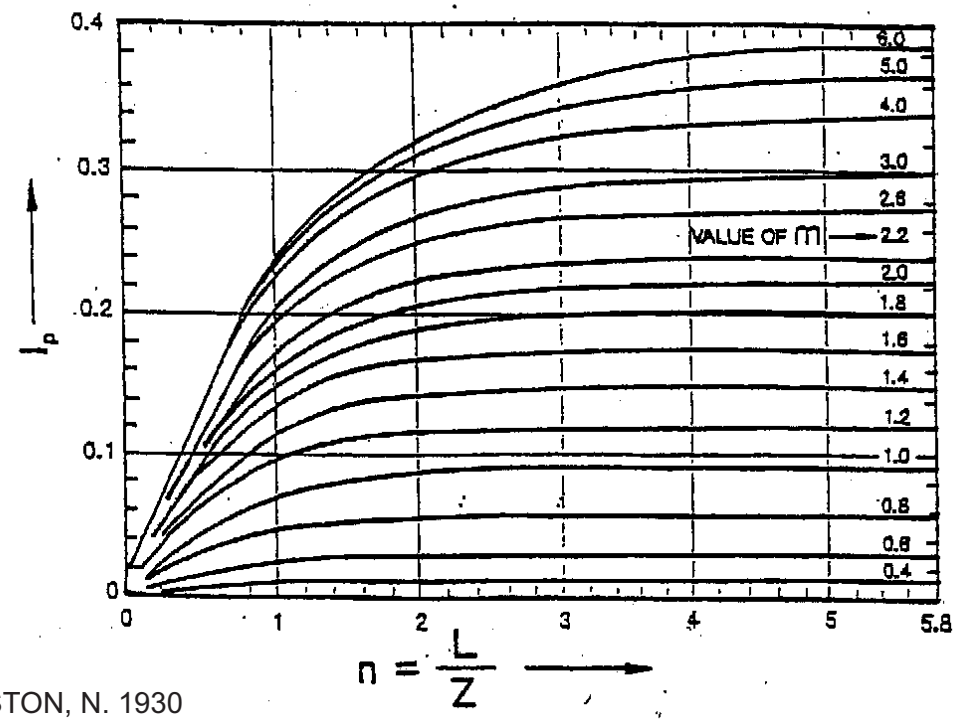
p = LATERAL PRESSURE

q = SURCHARGE

L = LENGTH PARALLEL TO EXCAVATION

B = LENGTH PERPENDICULAR TO EXCAVATION

$$m = \frac{B}{Z}, \quad n = \frac{L}{Z}$$



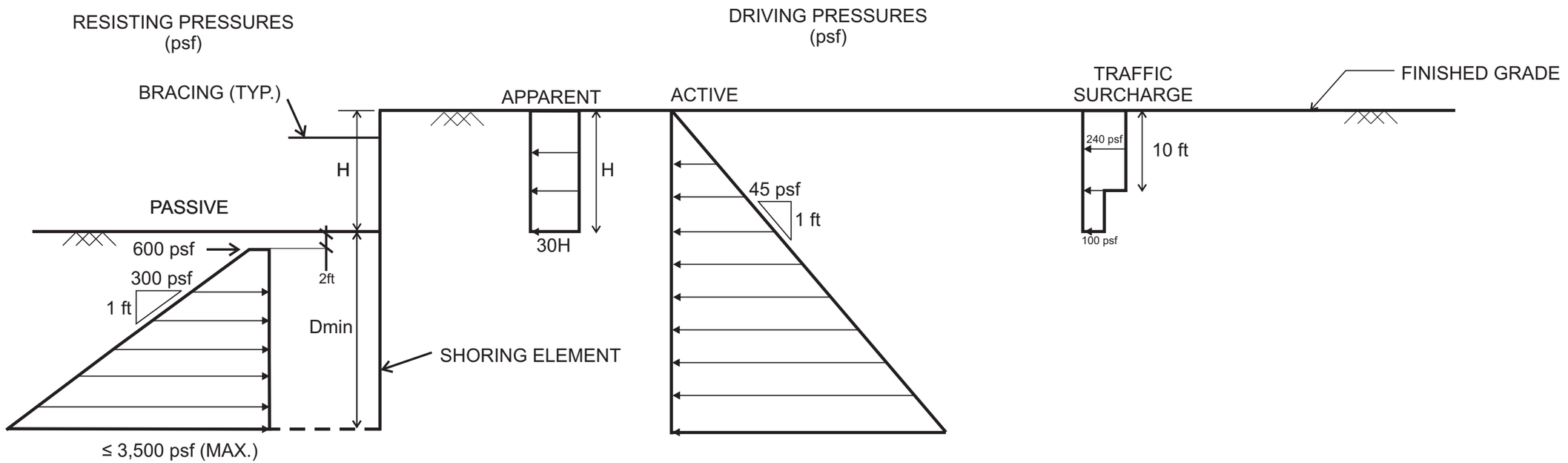
Reference: MARSTON, N. 1930

LATERAL SURCHARGE PRESSURES AREAL LOADS

WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO.: AGS-23-006	DATE: JUN 2025	PLATE 10



NOTES:

1. Use apparent pressure for bracing design (if bracing is used) above excavation bottom, and active pressure below it.

2. Add surcharge pressure to apparent and active pressures. If surcharge is kept “H” feet behind shoring, lateral surcharge will be negligible.

3. Minimum shoring penetration (Dmin) for stability purposes only should be determined by balancing driving and resisting pressures.

4. Lateral surcharge pressure is a nominal value for traffic only. Actual values should be based on anticipated surcharges. Additional lateral surcharge pressures should be added to the nominal value shown above, as appropriate.

5. The lateral earth pressures presented above are based on dry subsurface conditions. Where groundwater is encountered within the shoring depth, hydrostatic pressures should be added in consultation with AGS.

LEGEND:

H = EXCAVATION DEPTH, IN FEET

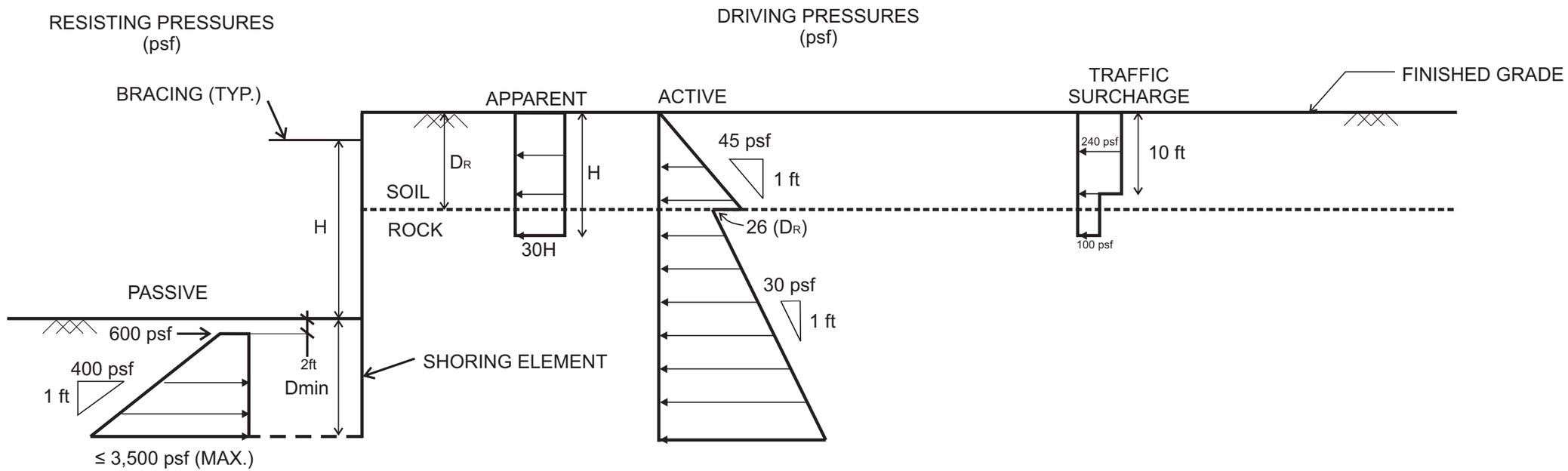
Dmin = DEPTH TO BOTTOM OF SHORING, IN FEET

PRELIMINARY SHORING DESIGN CRITERIA - ALL SOIL

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 11A



NOTES:

1. Use apparent pressure for bracing design (if bracing is used) above excavation bottom, and active pressure below it.
2. Add surcharge pressure to apparent and active pressures. If surcharge is kept “H” feet behind shoring, lateral surcharge will be negligible.
3. Minimum shoring penetration (Dmin) for stability purposes only should be determined by balancing driving and resisting pressures.
4. Lateral surcharge pressure is a nominal value for traffic only. Actual values should be based on anticipated surcharges. Additional lateral surcharge pressures should be added to the nominal value shown above, as appropriate.
5. The lateral earth pressures presented above are based on dry subsurface conditions. Where groundwater is encountered within the shoring depth, hydrostatic pressures should be added in consultation with AGS.

LEGEND:

H = EXCAVATION DEPTH, IN FEET

D_R = DEPTH TO BEDROCK, IN FEET

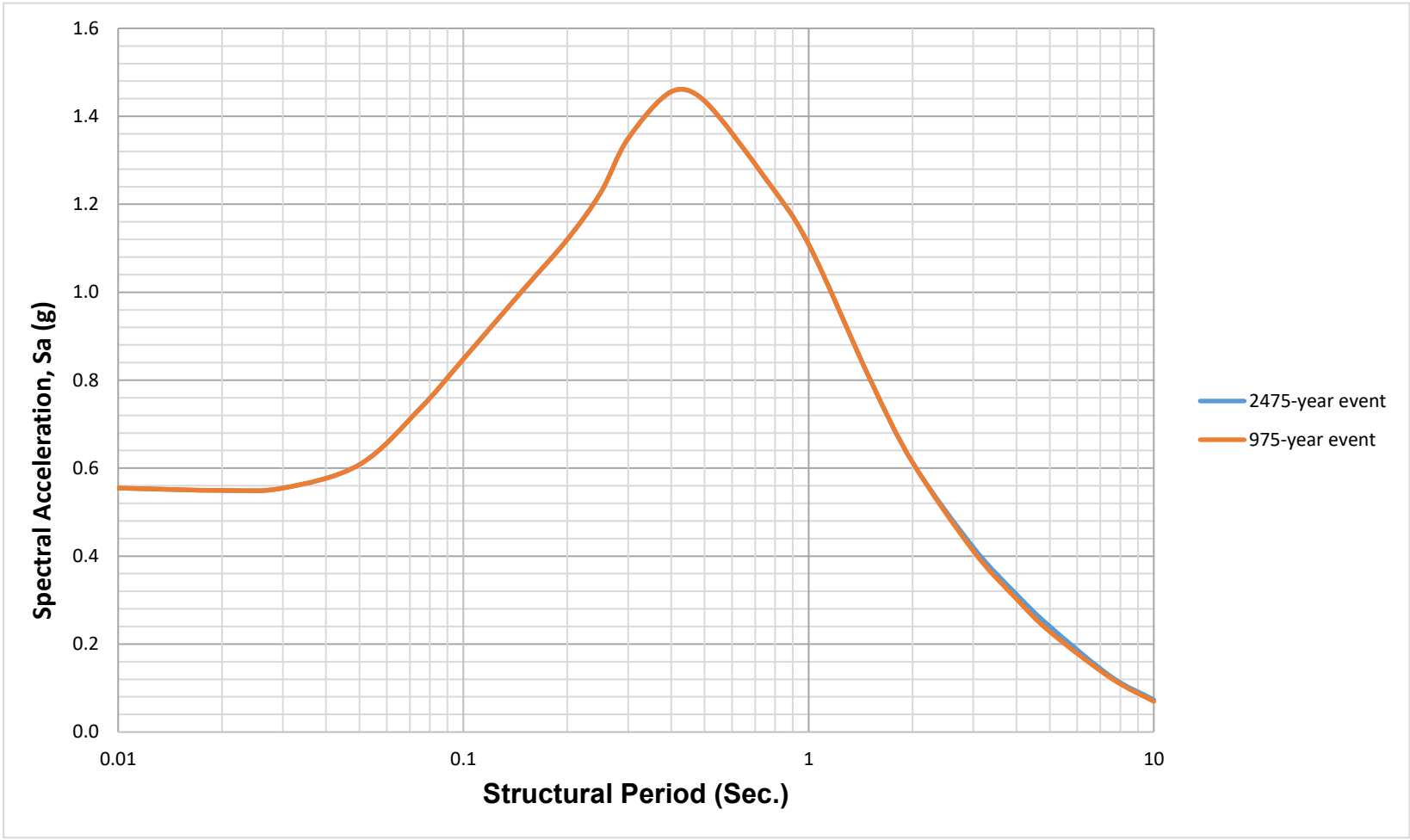
Dmin = DEPTH TO BOTTOM OF SHORING, IN FEET

PRELIMINARY SHORING DESIGN CRITERIA - SHALLOW BEDROCK

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: JUN 2025	PLATE 11B



AGS

975-YEAR and 2475-YEAR SITE-SPECIFIC DESIGN RESPONSE SPECTRA (5% DAMPING)
WALNUT CREEK WTP PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

Plate No.: 12

JOB NO.: AGS-23-006

DATE: JUNE 2025

APPENDIX A

AGS BORING LOGS AND BEDROCK CORINGS

LOG OF BORING B-01

DRILLING DATE: 8/19/24-8/19/24
DRILLING METHOD: Solid Flight Auger (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 382.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					ASPHALTIC CONCRETE, ~5" thick						
					AGGREGATE BASE, ~3" thick						
					SANDY CLAY (CL), light olive brown to dark olive gray, moist, exhibits plasticity, some fine- to coarse-grained sand, few fine angular to subrounded gravel, trace brick. [FILL]						
	B	BULK					18				SA [58]
					SILTSTONE, olive brown to dark grayish brown, very soft to soft, friable, severely weathered, crushed. [HAMBRE FORMATION]						
5		1A	19			99	19	35	3		
		1B	50/3"								WA [77]
		2A	50/6"		-change to soft, intensely fractured with moderate iron oxide staining	100	19				WA [69]
10		3	9 15 27		-change to very soft, plastic to friable, crushed to intensely fractured with extensive iron oxide staining						
15		4	50/5"		-change to soft to moderately hard, weak, severely to moderately weathered, intensely fractured						
20		5	50/3.5"								
					End of boring at approximately 20.29 feet. No groundwater encountered. Immediately backfilled with neat cement grout.						
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-02

DRILLING DATE: 8/20/24-8/20/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 383.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					ROCK PLANTER						
					SANDY CLAY (CL), brown, dry to moist, exhibits plasticity, little to some fine- to coarse-grained sand, few fine subangular gravel. [FILL]						
	B	BULK					6				WA [54]
5		1A	15		**CLAYEY SAND (SC)**, dark grayish brown, moist, medium dense, fine- to coarse-grained sand, some clay, exhibits plasticity, trace to few fine subangular to subrounded gravel. [FILL]						
		1B	17								
		1C	13			100	15				WA [28]
					-driller notes harder material						
		2A	19		**SANDSTONE**, olive brown, very soft, friable, severely weathered, crushed. [HAMBRE FORMATION]						
		2B	30								
		2C	32			114	17				WA [27]
10		3	15		-change to grayish brown		20				WA [24]
			17								
			22								
15		4	23		-change to intensely fractured with extensive iron oxide staining						
			25								
			28								
20		5	10		**CLAYSTONE**, grayish brown, very soft, plastic, severely weathered, crushed. [HAMBRE FORMATION]						
			13								
			18								
25		6A	14			99	24				WA [69]
		6B	26								
		6C	24		**SILTSTONE**, grayish brown, soft, friable to weak, severely weathered, crushed. [HAMBRE FORMATION]						
30											

LOG OF BORING B-02

DRILLING DATE: 8/20/24-8/20/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 383.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7	17 16 23				37	43	11		WA [81]
35		8	8 9 13		**CLAYSTONE**, grayish brown, very soft, plastic, severely weathered, crushed. [HAMBRE FORMATION]		32				WA [54]
40		9	12 17 22		-driller notes harder material, loud grinding noise, truck rocking back and forth **SILTSTONE**, olive brown, soft to moderately hard, weak to moderately strong, moderately weathered, intensely to closely fractured with extensive iron oxide staining. [HAMBRE FORMATION]						
45		10	50/6"		End of boring at approximately 45.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
50											
55											
60											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-03

DRILLING DATE: 8/20/24-8/20/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 381.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					ASPHALTIC CONCRETE, ~4 1/2" thick						
					AGGREGATE BASE, ~3 1/2" thick						
					SILTY, CLAYEY SAND (SC-SM), light olive brown, dry, fine- to coarse-grained sand, little to some fines, trace to few fine subangular gravel. [FILL]						
	B	BULK					8				SA [42]
					-driller notes very hard material hand augering						
5					**SILTSTONE**, light olive brown to light gray, soft, friable, severely weathered, crushed to intensely fractured. [HAMBRE FORMATION]						
		1A	14								
		1B	37			109	9				
		1C	50/5.5"								
		2	29 50/6"		-change to light olive brown with moderate to extensive iron oxide staining in fractures		26				WA [58]
10		3	25 50/6"				23				WA [61]
15		4	19 22 32		-change to plastic to friable		25				WA [88]
					-driller notes very hard material						
		5	50/6"		**SANDSTONE**, light olive brown to light gray, moderately hard, moderately strong, moderately weathered, intensely to closely fractured with moderate iron oxide stainning. [HAMBRE FORMATION] RQD= 42%						
		RUN 1									
20											PL
					End of boring at approximately 24 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.3**

LOG OF BORING B-04

DRILLING DATE: 8/29/24-8/29/24
DRILLING METHOD: Solid Flight Auger (Hand Auger to 2')
DRILL RIG TYPE: Little Beaver Superman Rig
HAMMER TYPE: Manual Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 348.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
	B	BULK			**SANDY CLAY (CL)**, light yellowish brown, dry to moist, some fine- to coarse-grained sand, little to some silt, few fine subangular to subrounded gravel, trace organics.		6				SA [58]
		1A	10								
		1B	18								
		1C	20		**SILTSTONE** grayish brown, very soft to soft, friable, severely to moderately weathered, intensely fractured with extensive iron oxide staining. [HAMBRE FORMATION]	89	24				WA [68]
5		2	10				25				
			15								
			18								
		3	16				27				WA [80]
			20								
			22								
10		4	18				25				
			28								
			50/6"		-driller notes harder material						
		5	18								
			32		-change to intensely to closely fractured with moderate thin clay and iron oxide coating						
			50/6"								
15					End of boring at approximately 14 feet. No groundwater encountered. Immediately backfilled with neat cement grout.						
20											
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.4**

LOG OF BORING B-05

DRILLING DATE: 8/21/24-8/21/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 380.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					ASPHALTIC CONCRETE, ~3.5" thick						
					AGGREGATE BASE, ~4" thick						
					SANDY CLAY (CL), brownish yellow, moist, some fine- to coarse-grained sand, trace to few fine subangular to subrounded gravel. [FILL]						
	D	BULK					12				SA [65]
5		1A	20		-change to olive gray, hard						
		1B	19								
		1C	20			104	18				SA [68]
		2A	10								
		2B	11								
		2C	17				27				WA [94]
					CLAYSTONE, grayish brown, very soft to soft, plastic to friable, severely weathered, crushed. [HAMBRE FORMATION]						
10		3	7								
			11								
			11								
15		4A	12		-change to severely to moderately weathered, crushed to intensely fractured with extensive iron oxide staining						
		4B	20								
		4C	25			88	25	42	20		SA [60]
20		5	5		-change to dark grayish brown, plastic, severely weathered, crushed						
			6								
			8								
					-driller notes harder material (22' to 23')						
					SILTSTONE, grayish brown, soft to moderately hard, weak to moderately strong, severely to moderately weathered, crushed to intensely fractured with extensive iron oxide staining. [HAMBRE FORMATION]						
25		6A	17								
		6B	46			109	18				WA [66]
		6C	25								
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 2** | **PLATE A-1.5**

LOG OF BORING B-05

DRILLING DATE: 8/21/24-8/21/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 380.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7	13 25 37								
35		8	22 28 42				27				WA [92]
40		9	50/5.5"		-change to soft to moderately hard, intensely to closely fractured End of boring at approximately 40.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
45											
50											
55											
60											

LOG OF BORING B-06A

DRILLING DATE: 8/21/24-8/21/24
DRILLING METHOD: Solid Flight Auger (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 321.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
0					**UNPAVED SURFACE**						
					CLAYEY SAND (SC), brown, moist, fine- to coarse-grained sand, few fine subangular to subrounded gravel. [FILL]						
	B	BULK			**CLAY WITH SAND (CL)**, brown, moist, exhibits plasticity, little fine- to coarse-grained sand. [FILL]		14				SA [75]
5		1	50/0.5"		**UKNOWN MATERIAL** Potential manmade material or very hard bedrock.						
					End of boring at approximately 5.04 feet. No groundwater encountered. Immediately backfilled with neat cement grout.						
10											
15											
20											
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.6**

LOG OF BORING B-06B

DRILLING DATE: 8/21/24-8/21/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 321.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
					CLAYEY SAND (SC), brown, moist, fine- to coarse-grained sand, few fine subangular to subrounded gravel. [FILL]						
					CLAY WITH SAND (CL), brown, moist, exhibits plasticity, little fine- to coarse-grained sand. [FILL]						
5											
		1	50/5"		**SILTSTONE**, light brown to brown, moderately hard, moderately weathered, closely to moderately fractured with extensive iron oxide staining. [HAMBRE FORMATION] RQD = 54%		14				
		2									US
10											PL
					End of boring at approximately 14 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
15											
20											
25											
30											

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.7**

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-07

DRILLING DATE: 8/30/24-8/30/24
DRILLING METHOD: Solid Flight Auger
DRILL RIG TYPE: Little Beaver Superman Rig
HAMMER TYPE: Manual Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 287.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					NATIVE SURFACE						
	BULK				**SANDY CLAY (CL)**, brown, dry to moist, exhibits plasticity, some fine- to coarse-grained sand, trace to few fine to coarse angular to subrounded gravel. [COLLUVIUM]						
		1A	13								
		1B	19		**SILTY SANDSTONE**, grayish brown, soft, friable, severely weathered, crushed to intensely fractured with extensive iron oxide staining. [HAMBRE FORMATION]						
		1C	20			90	15				
5		2A	30								
		2B	50/3"			92	19				
		3	39		-change to soft to moderately hard, friable to weak, moderate iron oxide staining.						
			50/3"								
					End of boring at approximately 8.25 feet.						
10					No groundwater encountered.						
					Immediately backfilled with neat cement grout.						
15											
20											
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.8**

LOG OF BORING B-08

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 314.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					TOP OF RIDGE						
					SANDY CLAY (CL), brown, moist, exhibits plasticity, some fine- to coarse-grained sand, trace fine subangular to subrounded gravel. [FILL]						
	B	BULK					24				SA [61]
5		1A	7								
		1B	18								
		1C	18		**SILTY SAND (SM)**, grayish brown, medium dense, little to some silt, few to little clay, medium to high plasticity.	96	24				WA [38]
		2A	9			97	23				WA
		2B	12					38	13		[24]
		2C	12			101	22	40	14		SAH [46]
10		3	5				27	40	20		WA [36]
			6								
			9								
					-driller notes harder material						
					SANDSTONE, grayish brown, very soft to soft, plastic to friable, severely weathered, crushed. [HAMBRE FORMATION]						
15		4	50/5"								
		RUN 1			-change to light gray, soft to moderately hard, weak to moderately strong, severely to moderately weathered, intensely fractured with extensive iron oxide staining. RQD = 0%						
20		RUN 2			RQD = 22.6%						
25		RUN 3			RQD = 11.5%						PL
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 2** | **PLATE A-1.9**

LOG OF BORING B-08

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 314.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					End of boring at approximately 30 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
35											
40											
45											
50											
55											
60											

LOG OF BORING B-09

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 329.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					AGGREGATE BASE, ~10" thick						
		BULK			**SANDY SILT (ML)**, dark brown to gray, moist, some fine- to coarse-grained sand, few fine angular to subangular gravel, trace organics. [FILL]						
	B						14				SA [56] R CC
5		1A 1B 1C	18 30 30		**POORLY GRADED GRAVEL WITH SAND (GP)**, dark brown to dark gray, very dense, fine to coarse angular to subangular gravel, little to some fine- to coarse-grained sand, trace to few fines. [FILL]	130	7				WA [6]
		2	11 12 10		**CLAYEY SAND (SC)**, dark brown, medium dense, fine- to coarse-grained sand, some fines, exhibits plasticity. [FILL]						
10		3	9 11 10				25				WA [48]
15		4	6 9 9		**SANDY CLAY (CL)**, dark brown, very stiff, exhibits plasticity, little fine- to medium-grained sand. [FILL]						
20		5A 5B 5C	14 28 23		**CLAYEY SAND (SC)**, dark brown, very dense, fine- to coarse-grained sand, some clay, exhibits plasticity, few fine subangular to subrounded gravel. [FILL]	110	20				SA [36]
25		6	4 3 6		**SANDY FAT CLAY (CH)**, olive brown, stiff, exhibits plasticity, some fine- to medium-grained sand. [COLLUVIUM]		29				WA [62]
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-09

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 329.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7A	8		**CLAYSTONE**, olive brown, very soft, plastic, severely weathered, crushed. [BRIONES FORMATION]						
		7B	10			91	33				WA
		7C	15					42	26		[71]
35		8A	6								
		8B	8			82	45				WA
		8C	10								[88]
40		9A	17		**SHALE**, grey, soft, friable to weak, severely weathered, crushed to intensely fractured. [BRIONES FORMATION]						
		9B	50/6"								
		9C				96	42				WA
			19								[79]
		10	21								
			25								
45		11	8								
			17								
			30								
50		12	50/4"		-change to dark grey, soft to moderately hard, weak to moderately strong, severely to moderately weathered, intensely fractured						
					End of boring at approximately 50.3 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
55											
60											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-10

DRILLING DATE: 8/29/24-8/29/24
DRILLING METHOD: Solid Flight Auger (Hand Auger to 2')
DRILL RIG TYPE: Little Beaver Superman Rig
HAMMER TYPE: Manual Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 342.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
	B	BULK			**SANDY CLAY (CL)**, dark brown, moist, very stiff, exhibits plasticity, some fine- to coarse-grained sand, few fine to coarse angular to subangular gravel, trace organics. [FILL]						R CC
		1A	15		-drillers note harder material						
		1B	9								
		1C	10		**CLAY WITH SAND (CL)**, dark brown, moist, very stiff, exhibits plasticity, little fine- to medium-grained sand. [FILL]	98	17	46	26		WA [84]
5		2A	8								
		2B	8								
		2C	8			109	19				
		3A	3		**CLAYEY SAND (SC)**, brown mottled with grayish brown, moist, medium dense, fine- to medium-grained sand, some clay, exhibits plasticity, trace to few fine subangular gravel. [FILL]						
		3B	6		-change to dark grayish brown						
		3C	14		**SANDY FAT CLAY (CH)**, very dark grayish brown with white mottling, moist, very stiff, high plasticity, little to some fine- to medium-grained sand, iron oxide staining. [COLLUVIUM]	95	29				
10		4A	7		-change to hard						CR
		4B	14								
			24								
		5A	20		**CLAYSTONE**, dark olive brown, moist, very soft, plastic, severely weathered, crushed. [BRIONES FORMATION]	80	35				TXUU
		5B	35			86	32	76	43		EI [>100]
		5C	50/6"								
15		6	16		-change to olive brown with white mottling, very soft to soft, plastic to friable, severely weathered, crushed to intensely fractured with moderate iron oxide staining						
			26								
			29								
20		7	10								
			10								
			10		-drillers note difficulty drilling, auger proceeds very slowly						
		8	6								
			8								
			9								
					End of boring at approximately 23.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.11**

LOG OF BORING B-11

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 363.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
					SILTY, CLAYEY SAND (SC-SM), brown, moist, dense, fine- to medium-grained sand, some to mostly fines, few to little fine subangular gravel. [FILL]						
	B	BULK									R CC
5		1A	8		-change to few fine subangular gravel						
		1B	17								
		1C	16			104	20				
		2A	5								
		2B	11								
		2C	21			99	23				WA [48]
10		3	10		-change to medium dense						
			12								
			16								
15		4A	11		**SILTY, CLAYEY SAND WITH GRAVEL (SC-SM)**, brown, moist, very dense, fine- to coarse-grained sand, some fines, little to some fine subangular gravel. [FILL]						
		4B	23								
		4C	36			103	19				WA [34]
20		5	7		**SANDY CLAY (CL)**, brown, very stiff, exhibits plasticity, little to some fine- to medium-grained sand, few silt.						
			10								
			9		-driller has slight water loss						
25		6A	10								
		6B	12								
		6C	13			104	24				SA [67]
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 2** | **PLATE A-1.12**

LOG OF BORING B-11

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 363.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7	5 6 8		**FAT CLAY WITH SAND (CH)**, brown, stiff, high plasticity, little fine-grained sand, few fine subangular gravel. [ALLUVIUM]		29	60	37		WA [76]
35		8A 8B 8C	5 9 10		**CLAYSTONE**, gray mottled with brown, moist, very soft, plastic, severely weathered, crushed. [BRIONES FORMATION]	86	32				
40		9A 9B 9C	13 21 30		-change to soft, weak to moderately strong, moderately weathered, intensely to closely fractured	84	31				WA [95]
45		10A 10B	23 50/6"			92	34				
50		11	14 21 31								
					End of boring at approximately 51.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
55											
60											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-12

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 353.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
					SANDY CLAY (CL), pale brown, soft, exhibits plasticity, little to some fine- to medium-grained sand, few fine subangular gravel. [FILL]						
	B	BULK									R CC
5		1A 1B 1C	2 1 1			87	18				WA [71]
		2	3 2 2		**SILTY, CLAYEY SAND (SC-SM)**, brown, very loose, fine- to coarse-grained sand, some fines, few to little fine subangular to subrounded gravel. [FILL]		29				SA [36]
10		3A 3B 3C	17 24 39		**GRAVELLY SILT WITH SAND (ML)**, grayish brown mottled with dark gray and white, hard, exhibits plasticity, little to some fine subangular gravel, little fine-grained sand, iron oxide staining.	112	20				WA [56]
15		4A 4B 4C	12 16 22			95	28	42	22		
					LEAN CLAY (CL), grayish brown mottled with yellowish brown, hard, high plasticity, few to little fine subangular gravel.						
20		5	2 2 1		**SANDY FAT CLAY (CH)**, yellowish brown to gray, soft, exhibits plasticity, some fine- to medium-grained sand, trace to few fine subangular gravel, iron oxide staining. [COLLUVIUM] -driller has significant water loss						
25		6A 6B 6C	11 18 22		**CLAYSTONE**, gray, very soft to soft, plastic to friable, severely weathered, crushed. [BRIONES FORMATION]	101	23				
30											

LOG OF BORING B-12

DRILLING DATE: 8/22/24-8/22/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 353.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7A 7B 7C	8 10 16			86	36				
35		8	8 14 16								
40		9	17 23 31		**SILTSTONE**, gray, soft, friable, severely to moderately weathered, intensely fractured. [BRIONES FORMATION]						
45		10	23 23 26		End of boring at approximately 46.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
50											
55											
60											

LOG OF BORING B-13

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 348.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
	B	BULK			**CLAY WITH SAND (CL)**, light yellowish brown, dry to moist, little fine-grained sand, exhibits plasticity, trace fine subangular to subrounded gravel. [FILL]		6				SA [79]
5		1A	6		**FAT CLAY WITH SAND (CH)**, brown, very stiff, high plasticity, little fine-grained sand, few fine subangular to subrounded gravel. [COLLUVIUM]						TXUU
		1B	12					96	59		WA
		1C	18			91	27				[77]
		2A	13					156	133		CN
		2B	18		**CLAYSTONE**, dark grey, very soft, plastic, severely weathered, crushed. [BRIONES FORMATION]			72	47		CN
		2C	26			94	23				
10		3	8				31				WA [94]
			11								
			10								
15		4	12								CR
			17								
			17								
					-driller notes harder material						
20		5	13				32				WA [81]
			12								
			14								
25		6A	17		**SILTSTONE**, dark grey, very soft, plastic to friable, severely weathered, crushed. [BRIONES FORMATION]			79	51		EI [>100]
		6B	30								
		6C	44								
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-13

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 348.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7	15 16 26								
35		8A 8B 8C	24 47 50/4"		-driller losing water	100	24				
40		9	50/4"		-driller notes very hard material -change to moderately hard, moderately strong, severely to moderately weathered, intensely fractured End of boring at approximately 42.3 feet below ground surface. No groundwater measured due to drilling method. Backfilled with neat cement grout immediately.						
45											
50											
55											
60											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-14

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 340.0 ft
DATUM: NGVD29
LOGGED BY: NP
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
	B	BULK			**CLAYEY SAND WITH GRAVEL (SC)**, olive brown, dry to moist, fine- to coarse-grained sand, exhibits plasticity, little to some fine to coarse angular to subangular gravel, little to some fines. [FILL]						
5		1A 1B 1C	13 16 18		-change to dark olive gray, dense	106	11				WA [24]
		2A 2B 2C	13 14 13		-change to medium dense, oxidation stains, trace tree roots	120	10				SA [22]
10		3	6 4 5		**SANDY CLAY (CL)**, very dark gray, stiff, exhibits plasticity, some fine- to medium-grained sand, few silt. -driller has slight water loss		22				WA [64]
15		4A 4B 4C	7 9 8		-change to very dark grayish brown, very stiff, little fine- to medium-grained sand, trace to few fine angular gravel						
					CLAY WITH SAND (CL), light olive brown, very stiff, exhibits plasticity, little fine- to medium-grained sand, trace to few fine angular gravel.		26				WA [78]
20		5	5 5 6		**FAT CLAY (CH)**, very dark gray, stiff, high plasticity. [ALLUVIUM]						
25		6A 6B 6C	5 13 19		**CLAYSTONE**, olive brown, very soft, plastic, severely weathered, crushed. [BRIONES FORMATION]	98	29				
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-14

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 340.0 ft
DATUM: NGVD29
LOGGED BY: NP
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7A 7B 7C	16 22 33		-change to soft, friable to weak, severely to moderately weathered, intensely fractured -driller has slight water loss	104	24				
35		8	20 20 26								
40		9	20 50/6"		**SHALE**, very dark gray with white mottling, soft, friable to weak, severely weathered, crushed to intensely fractured. [BRIONES FORMATION]						
					End of boring at approximately 41 feet below ground surface. No groundwater measured due to drilling method. Backfilled with neat cement grout immediately.						
45											
50											
55											
60											

LOG OF BORING B-15

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 342.0 ft
DATUM: NGVD29
LOGGED BY: NP
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					UNPAVED SURFACE						
	B	BULK			**CLAYEY SAND (SC)**, olive brown, dry to moist, fine- to coarse-grained sand, some to mostly clay, trace to few fine to coarse subangular to subrounded gravel. [FILL]		4				SA [49]
5		1A 1B 1C	13 30 42		**SANDY CLAY (CL)**, light brownish gray, moist, hard, some fine- to medium-grained sand, trace fine subangular gravel, exhibits plasticity.	103	13				WA [53]
		2	10 13 15		**FAT CLAY (CH)**, dark grayish brown, very stiff, high plasticity, trace to few fine- to medium-grained sand. [RESIDUAL SOIL]			59	32		
10		3A 3B 3C	11 17 25		**CLAYSTONE**, light olive brown, very soft, plastic, severely weathered, crushed with extensive oxidation stains. [BRIONES FORMATION]	88	29				WA [92]
15		4	12 13 15								
20		5	10 14 17				32	77	25		WA [98]
					-driller has slight water loss						
25		6	11 15 20		-change to soft, friable						
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-15

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 342.0 ft
DATUM: NGVD29
LOGGED BY: NP
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
		7	10 14 20		-change to dark grayish brown		30				WA [99]
35		8A 8B	30 50/6"		-change to dark grayish brown, soft to moderately hard, weak, severely to moderately weathered, crushed to intensely fractured						
40		9	13 23 36		**SHALE**, gray, soft to moderately hard, weak, severely to moderately weathered, intensely to closely fractured. [BRIONES FORMATION] -change to very dark gray						
45		10	42 27 50/4"		-change to light gray to white -change to very dark gray End of boring at approximately 47 feet below ground surface. No groundwater measured due to drilling method. Backfilled with neat cement grout immediately.						
50											
55											
60											

LOG OF BORING B-16

DRILLING DATE: 8/23/24-8/23/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Track (93% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 294.0 ft
DATUM: NGVD29
LOGGED BY: LL
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					TOP OF RIDGE						
					SILT WITH SAND (ML), light brown, moist, little fine- to medium-grained sand, little clay, exhibits plasticity. [FILL]						
	B	BULK					6				SAH [75]
5		1 RUN 1	50/5"		**SANDSTONE**, light gray, soft to moderately hard, weak to moderately strong, severely to moderately weathered, intensely to closely fractured with extensive iron oxide staining. [HAMBRE FORMATION] RQD = 12%		6				WA [14]
10		RUN 2			-change to moderately hard, moderately strong, intensely fractured with moderate iron oxide staining, RQD = 0%						
15					End of boring at approximately 14.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
20											
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

JOB NO. AGS-23-006 | **PROJECT: WCWTP Pretreatment Project** | **SHEET 1 OF 1** | **PLATE A-1.17**

LOG OF BORING B-17

DRILLING DATE: 8/19/24-8/19/24
DRILLING METHOD: Mud Rotary (Hand Auger to 5')
DRILL RIG TYPE: Diedrich D-70 Turbo Truck (85% eff.)
HAMMER TYPE: Auto Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 382.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					ASPHALTIC CONCRETE, ~5" thick						
					AGGREGATE BASE, ~3" thick						
	B	BULK			**SILTY SAND WITH GRAVEL (SM)**, light olive brown, dry, fine- to coarse-grained sand, few to little fine angular to subrounded gravel, little silt, trace to few clay. [FILL]						
					SILTSTONE, olive brown, very soft to soft, friable, severely weathered, crushed to intensely fractured. [HAMBRE FORMATION]						
5		1A	21								
		1B	24								
		1C	37			109	18				WA [54]
					-change to light olive brown mottled with very dark gray, iron oxide staining in fractures						
		2A	20								
		2B	37			105	19				TXUU
		2C	40			98	24	44	18		WA [51]
					-drillers note very hard material						
10		3A	40								
		3B	50/4"		-change to light olive brown to grayish brown, soft to moderately hard, weak to moderately strong, moderately weathered, intensely to closely fractured						
		3C				102	20				
15		4A	32								
		4B	50/4.5"								
		4C				111	19				
20		5	27								
			30								
			50/5.5"								
					End of boring at approximately 21.5 feet. No groundwater measured due to drilling method. Immediately backfilled with neat cement grout.						
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

LOG OF BORING B-18

DRILLING DATE: 8/30/24-8/30/24
DRILLING METHOD: Solid Flight Auger
DRILL RIG TYPE: Little Beaver Superman Rig
HAMMER TYPE: Manual Hammer (140-lb) falling 30 in

SURFACE ELEVATION: 277.0 ft
DATUM: NGVD29
LOGGED BY: MJ
CHECKED BY: CG

AGS

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT (N VALUE)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PID (ppm)	ADDITIONAL TESTS
					NATIVE SURFACE						
					SANDY CLAY (CH), grayish brown, moist, exhibits plasticity, some fine- to coarse-grained sand, few to little silt, trace fine angular to subangular gravel, trace organics [ALLUVIUM]						
	B	BULK			-drillers note stiff material from 3' to 5'						
5					**SILTSTONE**, dark grayish brown, very soft, plastic to friable, severely weathered, crushed. [HAMBRE FORMATION]						
		1A	15		-auger makes loud grinding noises from 4.5' to 5'						
		1B	16								SAH
		1C	21			93	12	48	32		[77]
		2A	16								
		2B	15		-changes to brown with white mottling			50	31		SAH
		2C	15			94	18				[77]
10											
		3A	12								
		3B	17								
		3C	18			94	28				
		4A	8								
		4B	15			89	29				TXUU
		4C	22			94	32				
15											
		5A	20					56	30		EI
		5B	30		-change to soft to moderately hard, friable to weak, crushed to intensely fractured						[>100]
		5C	45								CN
					-driller notes very hard material		17				
20											
		6	14		-change to moderately weathered, intensely fractured						
			20								
			26								
					End of boring at approximately 21.5 feet. No groundwater encountered. Immediately backfilled with neat cement grout.						
25											
30											

LBG CK AGS-23-006_WCWTP.GPJ 11/22/24

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POOORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND 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,
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS 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

UNIFIED SOIL CLASSIFICATION SYSTEM

⧓	Modified California	TXUU	Unconsolidated Undrained Triaxial
◪	Standard Penetration Test	UC	Unconfined Compression
▌▌	Rock Core	US	Unconfined Strength of Rock with Young's Modulus
B	Bulk Sample	WA	Wash Analysis
CC	Compaction	(20)	(with % Passing No. 200 Sieve)
CN	Consolidation	▽	Water Level at Time of Drilling
CR	Corrosivity		
EI	Expansion Index		
R	R-Value		
PL	Point Load		
SA	Sieve Analysis		
SAH	Sieve Analysis + Hydrometer		

ADDITIONAL TESTS AND KEY TO TEST DATA

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
WALNUT CREEK WATER TREATMENT PLANT PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO: AGS-23-006	DATE: NOV 2024	PLATE A-2

PHYSICAL CHARACTERISTICS OF ROCKS
FIELD TERMINOLOGY

HARDNESS

VERY SOFT:	EASILY CRUMBLED OR DEFOPRMED BY HAND.
SOFT:	MAY BE BROKEN USING BOTH HANDS OR IF PLASTIC, DEFORMED BY HAND. MAY BE CUT WITH DIFFICULTY WITH KNIFE. EASILY POWDERED WITH PICK. DULL THUD WHEN STRUCK WITH HAMMER.
MODERATELY HARD:	MAY BE SCRATCHED WITH KNIFE TO SHALLOW DEPTH. DULL RING WHEN STRUCK WITH HAMMER.
HARD:	CAN BE SCRATCHED WITH DIFFICULTY WITH KNIFE.
VERY HARD:	CANNOT BE SCRATCHED WITH KNIFE. SHARP RING WHEN STRUCK WITH HAMMER.

STRENGTH

PLASTIC:	CAN BE DEFORMED BY HAND.
FRIABLE:	CRUMBLES BY RUBBING WITH FINGERS.
WEAK:	AN UNFRACTURED OUTCROP OF SUCH MATERIAL WOULD CRUMBLE UNDER LIGHT HAMMER BLOWS.
MODERATELY STRONG:	OUTCROP WOULD WITHSTAND A FEW FIRM HAMMER BLOWS BEFORE BREAKING.
STRONG:	OUTCROP WOULD WITHSTAND A FEW HEAVY HAMMER BLOWS, BUT WILL YIELD LARGE FRAGMENTS.
VERY STRONG:	OUTCROP WOULD RESIST HEAVY RINGING HAMMER BLOWS AND WILL YIELD, WITH DIFFICULTY, ONLY DUST AND SMALL FRAGMENTS.

WEATHERING

EXTENT	DECOMPOSITION	DISINTEGRATION	DISCOLORATION	FRACTURE CONDITION
SEVERE	MODERATE TO COMPLETE ALTERATION OF MINERALS, FELDSPARS ALTERED TO CLAY, ETC.	GENERALLY FRIABLE, BUT ROCK TEXTURE AND STRUCTURE ARE PRESERVED.	EXTENSIVE AND THOROUGH.	ALL FRACTURES EXTENSIVELY COATED WITH OXIDES, CARBONATES OR CLAY.
MODERATE	SLIGHT ALTERATION OF MINERALS, CLEAVAGE SURFACES LUSTERLESS AND STAINED.	MOST CEMENTATION IS AFFECTED; MAY BE LOCALLY FRIABLE.	MODERATE OR LOCALIZED AND INTENSE.	THIN COATINGS OR STAINS.
SLIGHT	NO MEGASCOPIC ALTERATION OF MINERALS.	LITTLE OF NO EFFECT ON NORMAL CEMENTATION.	SLIGHT TO INTERMITTENT AND LOCALIZED.	FEW STAINS ON FRACTURE SURFACES.
FRESH	UNALTERED, CLEAVAGE SURFACES GLISTENING.	CEMENTATION UNAFFECTED.	NO DISCOLORATION.	NO STAINS.

FRACTURING*

EXTENT	ENGLISH SIZE RANGE	METRIC SIZE RANGE
CRUSHED (MAY CONTAIN CLAY)	LESS THAN 0.05 FT	LESS THAN 1.5 CM
INTENSELY FRACTURED	0.05 TO 0.1 FT	1.5 CM TO 3.0 CM
CLOSELY FRACTURED	0.1 TO 0.5 FT	3.0 CM TO 15 CM
MODERATELY FRACTURED	0.5 TO 1.0 FT	15 CM TO 30 CM
LITTLE FRACTURED	1.0 TO 3.0 FT	30 CM TO 100 CM
MASSIVE	3.0 FT AND LARGER	1.0 M AND LARGER

FRACTURE COATINGS

EXTENT	THICKNESS
UNSTAINED OR CLEAN: NEARLY ALL SURFACES CLEAN.	STAINED: NO PERCEPTIBLE THICKNESS.
SMALL: COVERS LESS THAN 10% OF FRACTURE SURFACE.	THIN: BARELY PERCEPTIBLE.
MODERATE OR PATCHY: COVERS 10% TO 50% OF SURFACE.	MEDIUM: UP TO 2 MM.
EXTENSIVE: COVERS NORE THAN 50% OF SURFACE.	THICK: OVER 2 MM THICK.

STRATIFICATION

STRATIFICATION (OR PARTING)	CROSS-STRATIFICATION	APPROXIMATE THICKNESS**	
		ENGLISH	METRIC
VERY THICK-BEDDED (-PARTED)	VERY THICKLY CROSS-BEDDED	OVER 3 FT	OVER 1 M
THICK-BEDDED (-PARTED)	THICKLY CROSS-BEDDED	1 TO 3 FT	30 TO 100 CM
MEDIUM-BEDDED (-PARTED)	MEDIUM CROSS-BEDDED	4 TO 12 IN	10 TO 30 CM
THIN-BEDDED (-PARTED)	THINLY CROSS-BEDDED	1 TO 4 IN	3 TO 10 CM
VERY THIN-BEDDED (-PARTED)	VERY THINLY CROSS-BEDDED	0.5 TO 1 IN	1 TO 3 CM
LAMINATED (THINLY PARTED)	CROSS-LAMINATED	0.1 TO 0.5 IN	0.3 TO 1.0 CM
THINLY LAMINATED (VERY THINLY PARTED)	THINLY CROSS-LAMINATED	LESS THAN 0.1 IN	LESS THAN 0.3 CM

* JOINTS AND FRACTURES ARE TREATED THE SAME FOR PHYSICAL DESCRIPTION AND BOTH ARE REFERRED TO AS FRACTURES; SIZE RANGE REFERS TO SIZE OF PIECES.
** MASSIVE IF BEDS ARE OVER 10 FT (3 M) THICK.

PHYSICAL CHARACTERISTICS OF ROCKS
WALNUT CREEK WATER TREATMENT PLANT PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO: AGS-23-006 | DATE: NOV 2024 | PLATE A-2.2



PHOTOGRAPH OF ROCK CORE
BORING B-3 (19 TO 24 FT)

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: NOV 2024	FIGURE A-3.1



PHOTOGRAPH OF ROCK CORE
BORING B-6B (9 TO 14 FT)

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

AGS

JOB NO. AGS-23-006	DATE: NOV 2024	FIGURE A-3.2



PHOTOGRAPH OF ROCK CORES - BORING B-8
RUN 1 (15.5 TO 20 FT) AND RUN 2 (20 TO 23 FT)

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

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JOB NO. AGS-23-006	DATE: NOV 2024	FIGURE A-3.3



PHOTOGRAPH OF ROCK CORES - BORING B-8
RUN 2 (23 TO 25 FT) AND RUN 3 (25 TO 30 FT)

WALNUT CREEK WATER TREATMENT PLANT
PRETREATMENT PROJECT
WALNUT CREEK, CALIFORNIA

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JOB NO. AGS-23-006	DATE: NOV 2024	FIGURE A-3.4



PHOTOGRAPH OF ROCK CORES - BORING B-16
RUN 1 (5.5 TO 9.5 FT) AND RUN 2 (9.5 TO 14.5 FT)

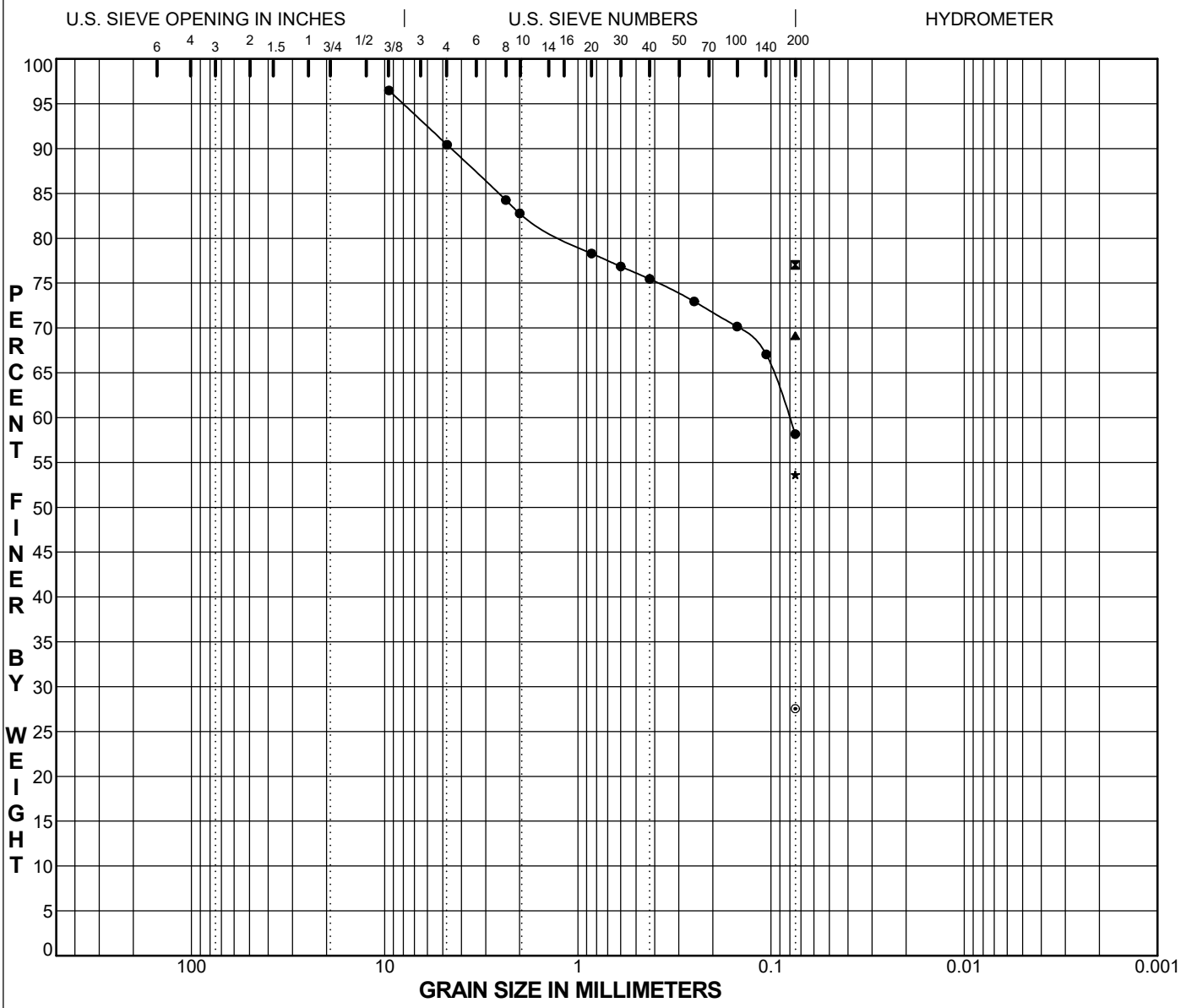
WALNUT CREEK WATER TREATMENT PLANT
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WALNUT CREEK, CALIFORNIA

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JOB NO. AGS-23-006	DATE: NOV 2024	FIGURE A-3.5

APPENDIX B

GEOTECHNICAL LABORATORY TESTING RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-01 @	2.5'	SANDY CLAY (CL) [FILL]	18					
⊠	B-01 @	5.0'	SILTSTONE [HAMBRE FORMATION]	19	35	32	3		
▲	B-01 @	7.5'	SILTSTONE [HAMBRE FORMATION]	19					
★	B-02 @	2.5'	SANDY CLAY (CL) [FILL]	6					
⊙	B-02 @	6.0'	CLAYEY SAND (SC) [FILL]	15					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-01 @	2.5'	9.50	0.08			6.1	32.3	58.2	
⊠	B-01 @	5.0'	0.08				0.0	0.0	77.0	
▲	B-01 @	7.5'	0.08				0.0	0.0	69.1	
★	B-02 @	2.5'	0.08				0.0	0.0	53.6	
⊙	B-02 @	6.0'	0.08				0.0	0.0	27.5	

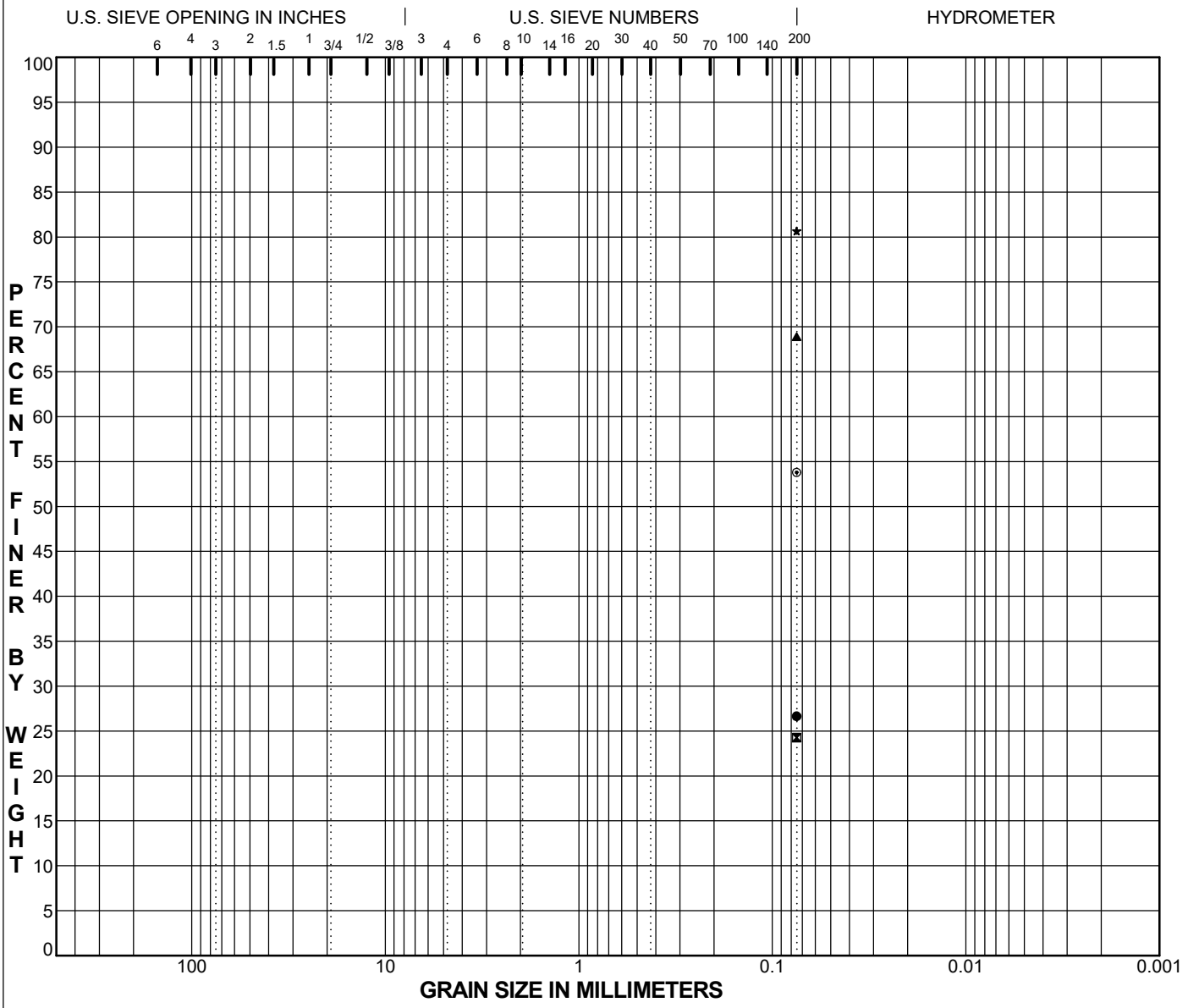
PARTICLE SIZE ANALYSIS

WCWTP Pretreatment Project

Walnut Creek WTP - 2201 Larkey Lane

AGS

JOB NO.	AGS-23-006	DATE	Oct 2024



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-02 @	8.5'	SANDSTONE [HAMBRE FORMATION]	17					
⊠	B-02 @	10.0'	SANDSTONE [HAMBRE FORMATION]	20					
▲	B-02 @	25.0'	CLAYSTONE [HAMBRE FORMATION]	24					
★	B-02 @	30.0'	SILTSTONE [HAMBRE FORMATION]	37	43	32	11		
⊙	B-02 @	35.0'	CLAYSTONE [HAMBRE FORMATION]	32					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-02 @	8.5'	0.08				0.0	0.0	26.6	
⊠	B-02 @	10.0'	0.08				0.0	0.0	24.3	
▲	B-02 @	25.0'	0.08				0.0	0.0	68.9	
★	B-02 @	30.0'	0.08				0.0	0.0	80.7	
⊙	B-02 @	35.0'	0.08				0.0	0.0	53.8	

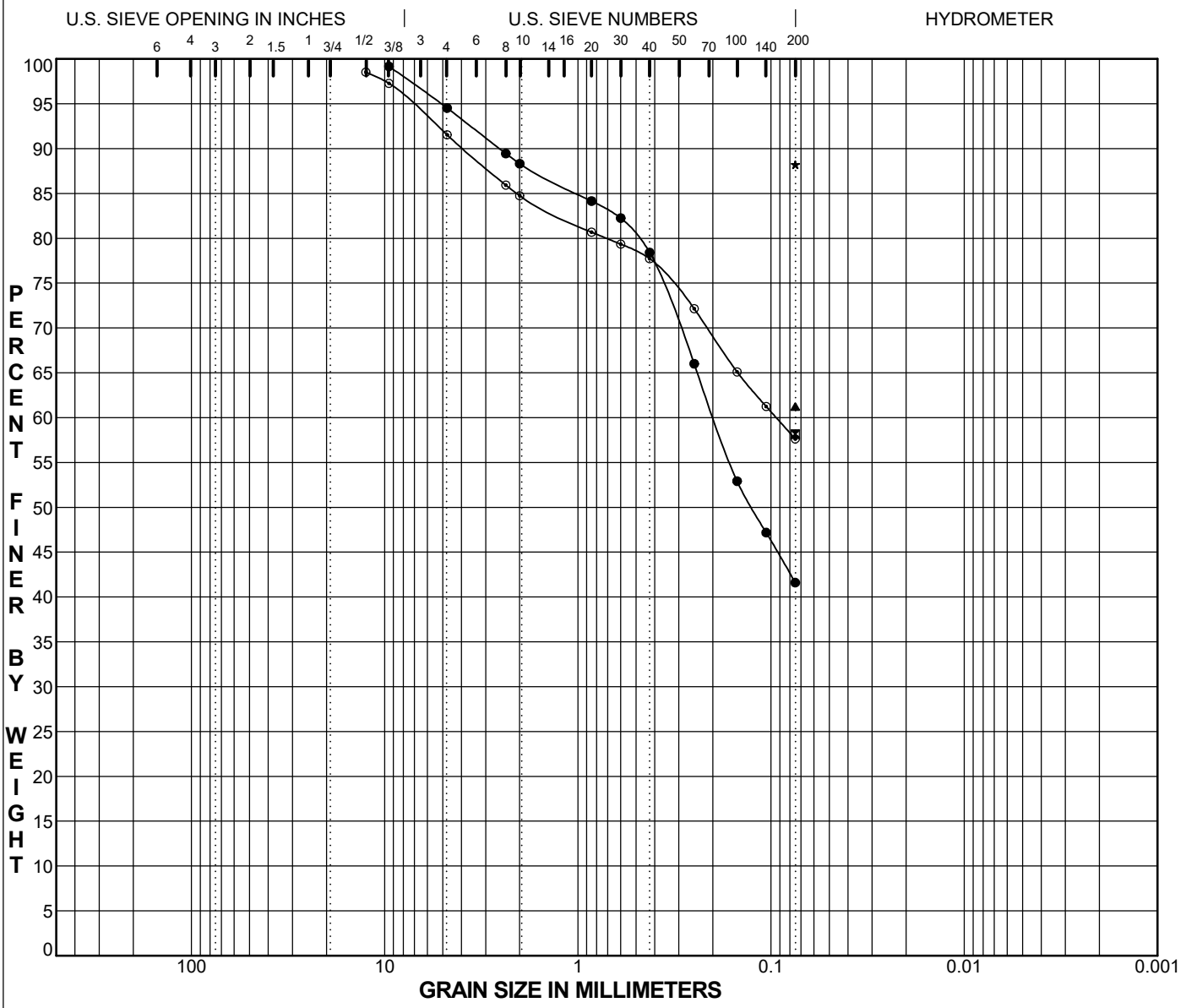
PARTICLE SIZE ANALYSIS

WCWTP Pretreatment Project

Walnut Creek WTP - 2201 Larkey Lane

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JOB NO.	AGS-23-006	DATE	Oct 2024



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-03 @	2.5'	SILTY, CLAYEY SAND (SC-SM) [FILL]	8					
⊠	B-03 @	7.5'	SILTSTONE [HAMBRE FORMATION]	26					
▲	B-03 @	10.0'	SILTSTONE [HAMBRE FORMATION]	23					
★	B-03 @	15.0'	SILTSTONE [HAMBRE FORMATION]	25					
⊙	B-04 @	1.0'	SANDY CLAY (CL)	6					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-03 @	2.5'	9.50	0.20			4.6	52.9	41.6	
⊠	B-03 @	7.5'	0.08				0.0	0.0	58.2	
▲	B-03 @	10.0'	0.08				0.0	0.0	61.2	
★	B-03 @	15.0'	0.08				0.0	0.0	88.2	
⊙	B-04 @	1.0'	12.50	0.09			7.0	33.9	57.6	

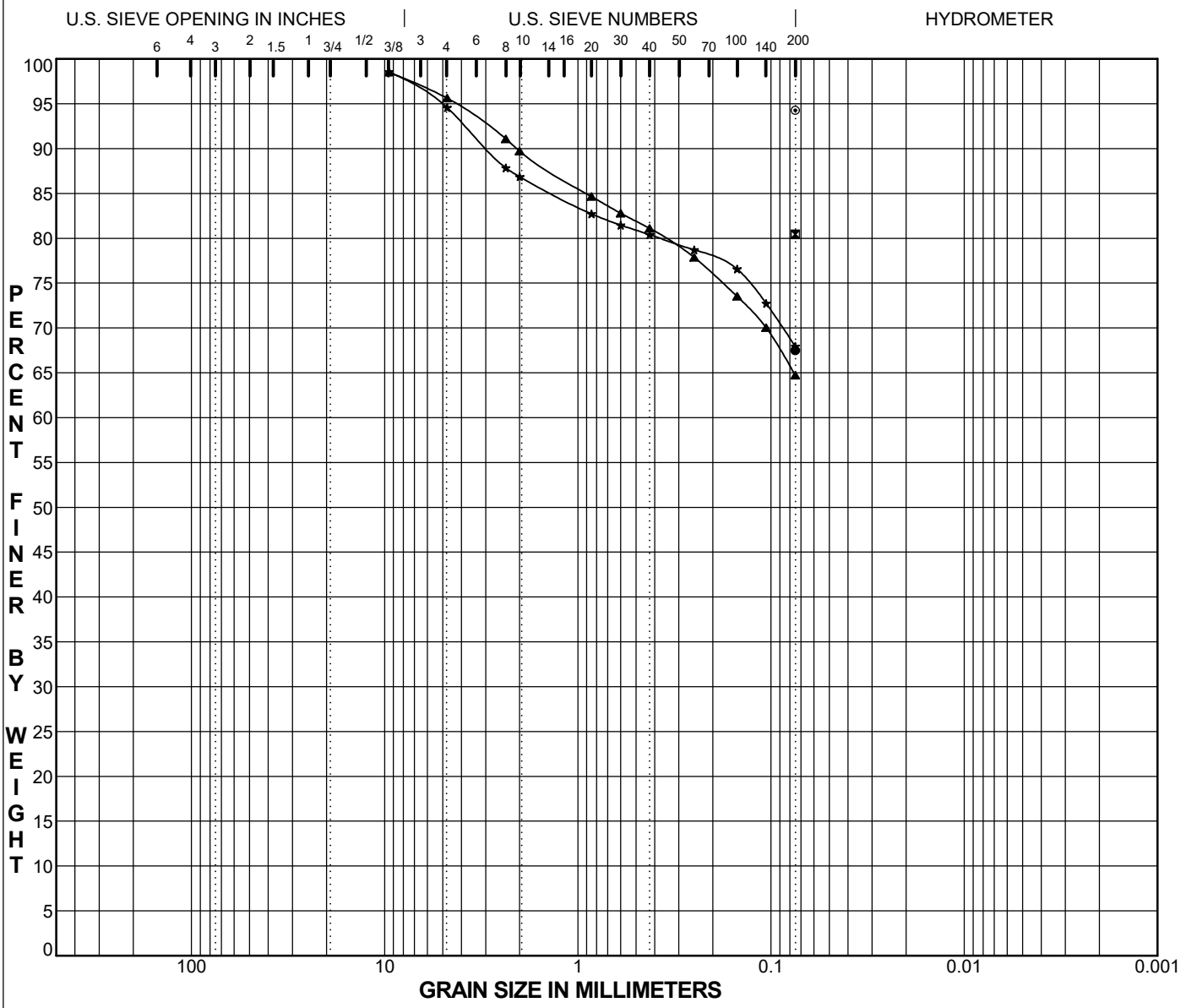
PARTICLE SIZE ANALYSIS

WCWTP Pretreatment Project

Walnut Creek WTP - 2201 Larkey Lane

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-04 @	3.5'	SILTSTONE [HAMBRE FORMATION]	24					
⊠	B-04 @	7.5'	SILTSTONE [HAMBRE FORMATION]	27					
▲	B-05 @	2.5'	SANDY CLAY (CL) [FILL]	12					
★	B-05 @	6.0'	SANDY CLAY (CL) [FILL]	18					
⊙	B-05 @	8.5'	CLAYSTONE [HAMBRE FORMATION]	27					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-04 @	3.5'	0.08				0.0	0.0	67.5	
⊠	B-04 @	7.5'	0.08				0.0	0.0	80.4	
▲	B-05 @	2.5'	9.50				2.9	30.9	64.7	
★	B-05 @	6.0'	9.50				4.0	26.6	67.9	
⊙	B-05 @	8.5'	0.08				0.0	0.0	94.3	

PARTICLE SIZE ANALYSIS

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-05 @	16.0'	CLAYSTONE [HAMBRE FORMATION]	25	42	22	20		
⊠	B-05 @	25.0'	SILTSTONE [HAMBRE FORMATION]	18					
▲	B-05 @	35.0'	SILTSTONE [HAMBRE FORMATION]	27					
★	B-06A @	2.5'	CLAY WITH SAND (CL) [FILL]	14					
⊙	B-08 @	2.5'	SANDY CLAY (CL) [FILL]	24					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-05 @	16.0'	19.00	0.08			10.8	19.3	60.0	
⊠	B-05 @	25.0'	0.08				0.0	0.0	65.7	
▲	B-05 @	35.0'	0.08				0.0	0.0	91.6	
★	B-06A @	2.5'	4.75				0.0	24.4	74.8	
⊙	B-08 @	2.5'	12.50				6.2	30.9	60.6	

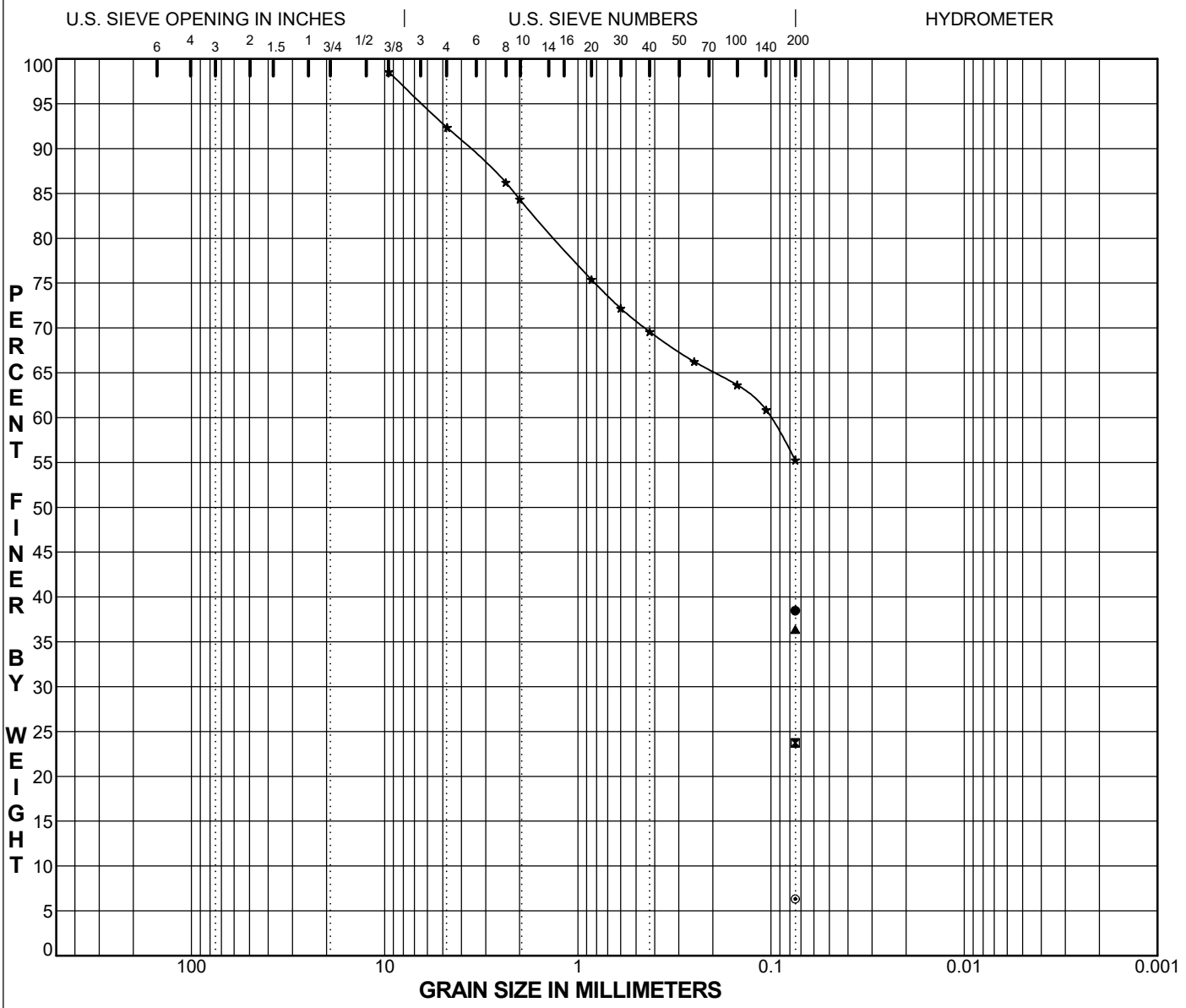
PARTICLE SIZE ANALYSIS

WCWTP Pretreatment Project

Walnut Creek WTP - 2201 Larkey Lane

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-08 @	6.0'	SILTY SAND (SM) [TERRACE DEPOSITS]	24					
⊠	B-08 @	7.5'	SILTY SAND (SM) [TERRACE DEPOSITS]	23					
▲	B-08 @	10.0'	SILTY SAND (SM) [TERRACE DEPOSITS]	27	40	20	20		
★	B-09 @	2.5'	SANDY SILT (ML) [FILL]	14					
⊙	B-09 @	6.0'	POORLY GRADED GRAVEL WITH SAND (GP) [FILL]	7					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-08 @	6.0'	0.08				0.0	0.0	38.5	
⊠	B-08 @	7.5'	0.08				0.0	0.0	23.7	
▲	B-08 @	10.0'	0.08				0.0	0.0	36.4	
★	B-09 @	2.5'	9.50	0.10			6.2	37.1	55.3	
⊙	B-09 @	6.0'	0.08				0.0	0.0	6.3	

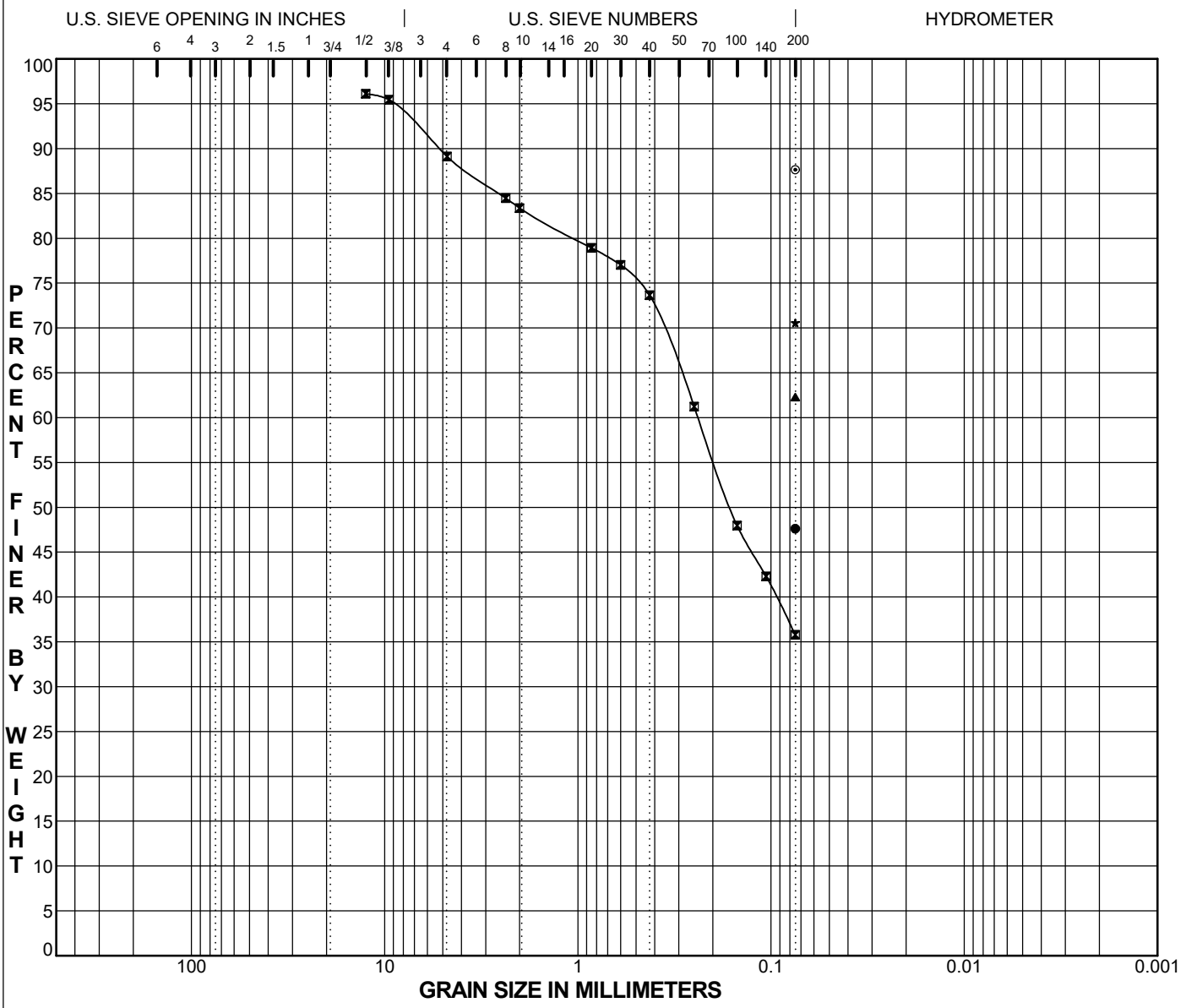
PARTICLE SIZE ANALYSIS

WCWTP Pretreatment Project

Walnut Creek WTP - 2201 Larkey Lane

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-09 @	10.0'	CLAYEY SAND (SC) [FILL]	25					
⊠	B-09 @	21.0'	CLAYEY SAND (SC) [FILL]	20					
▲	B-09 @	25.0'	SANDY FAT CLAY (CH) [COLLUVIUM]	29					
★	B-09 @	30.5'	CLAYSTONE [BRIONES FORMATION]	33					
⊙	B-09 @	35.5'	CLAYSTONE [BRIONES FORMATION]	45					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-09 @	10.0'	0.08				0.0	0.0	47.6	
⊠	B-09 @	21.0'	12.50	0.24			7.0	53.3	35.8	
▲	B-09 @	25.0'	0.08				0.0	0.0	62.3	
★	B-09 @	30.5'	0.08				0.0	0.0	70.6	
⊙	B-09 @	35.5'	0.08				0.0	0.0	87.7	

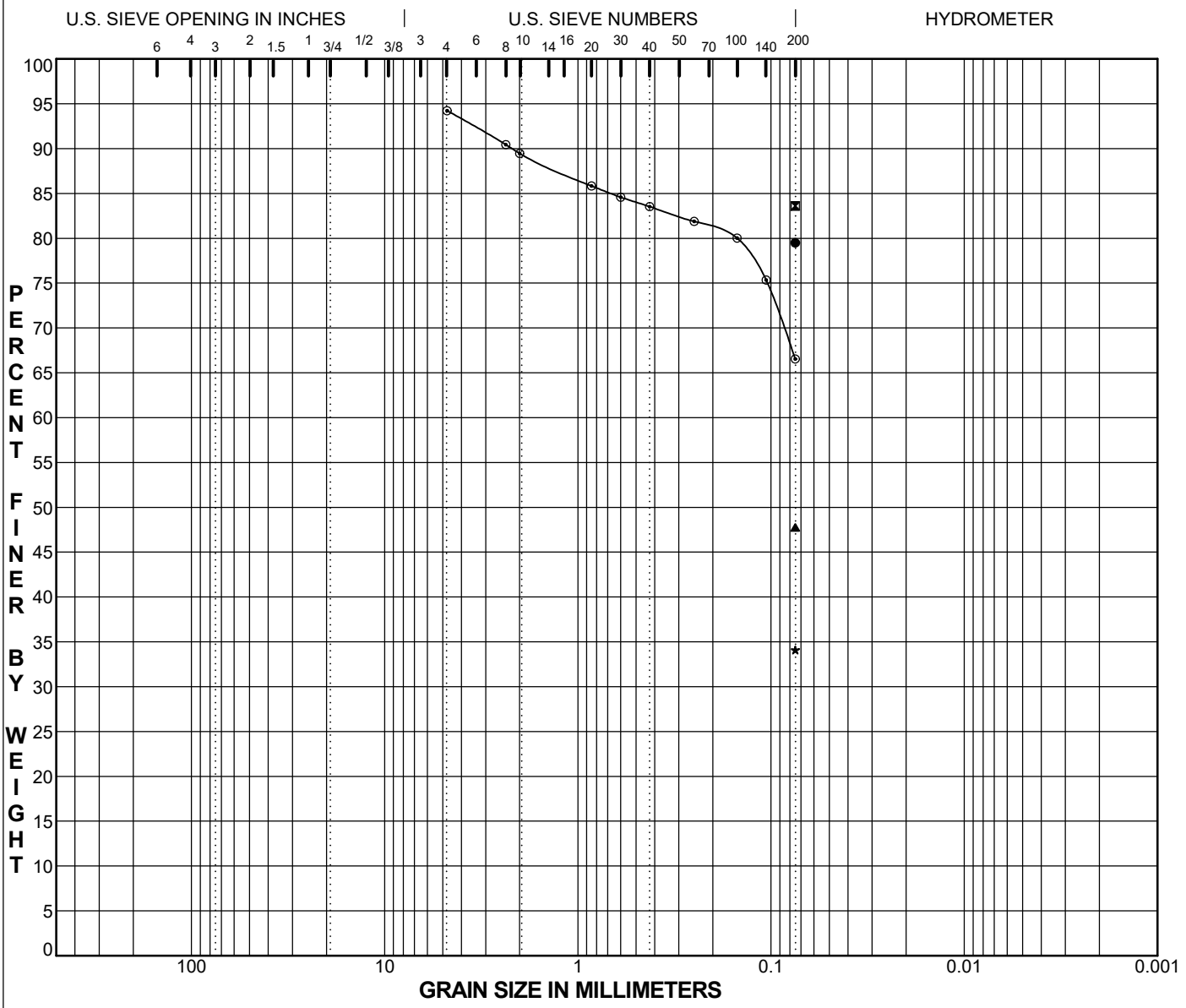
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-09 @	41.0'	SHALE [BRIONES FORMATION]	42					
⊠	B-10 @	3.0'	CLAY WITH SAND (CL) [FILL]	17	46	20	26		
▲	B-11 @	8.5'	SILTY, CLAYEY SAND (SC-SM) [FILL]	23					
★	B-11 @	16.0'	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM) [FILL]	19					
⊙	B-11 @	26.0'	SANDY CLAY (CL) [FILL]	24					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-09 @	41.0'	0.08				0.0	0.0	79.5	
⊠	B-10 @	3.0'	0.08				0.0	0.0	83.6	
▲	B-11 @	8.5'	0.08				0.0	0.0	47.8	
★	B-11 @	16.0'	0.08				0.0	0.0	34.1	
⊙	B-11 @	26.0'	4.75				0.0	27.7	66.5	

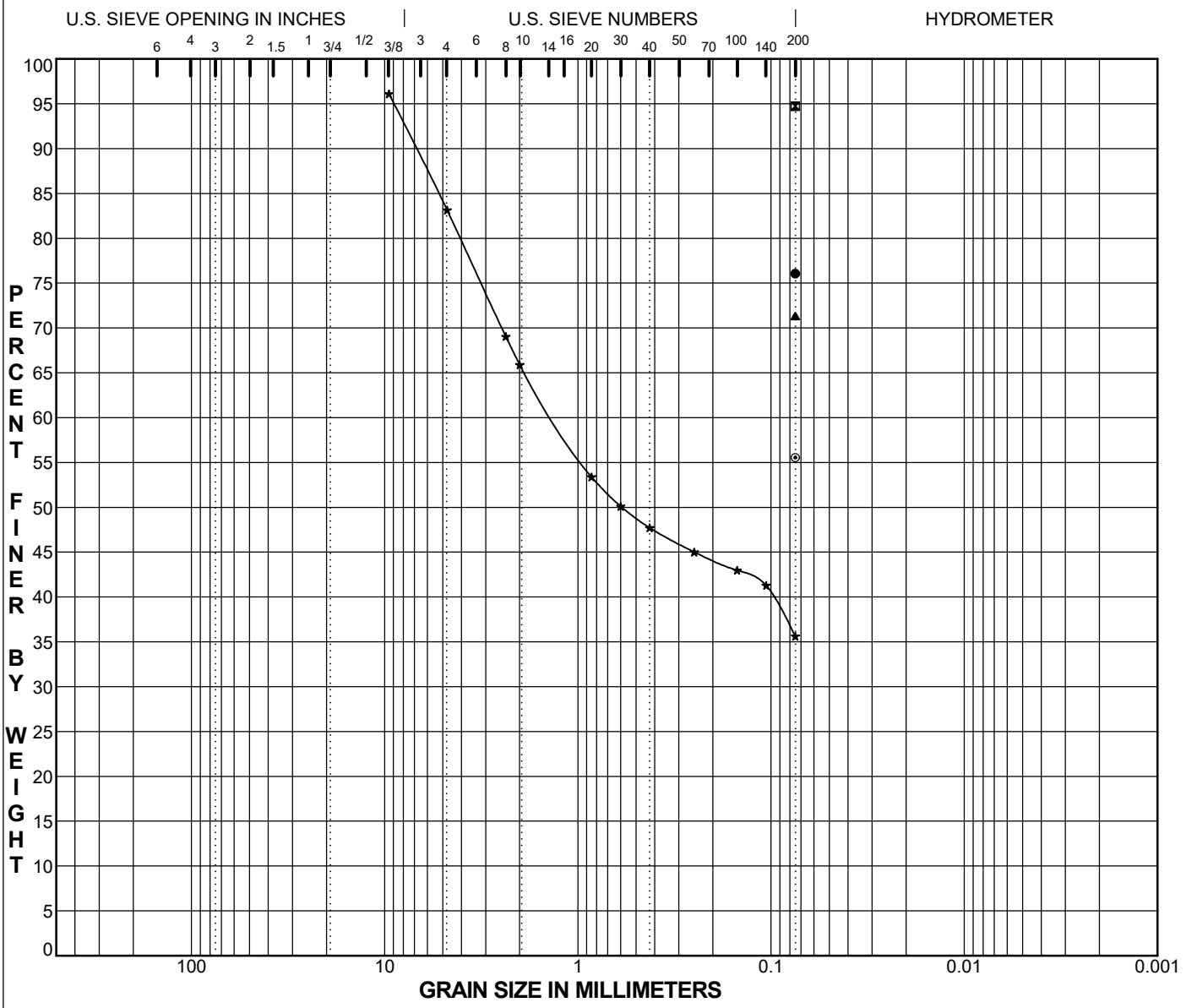
PARTICLE SIZE ANALYSIS

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-11 @	30.0'	FAT CLAY WITH SAND (CH) [ALLUVIUM]	29	60	23	37		
⊠	B-11 @	41.0'	CLAYSTONE [BRIONES FORMATION]	31					
▲	B-12 @	6.0'	SANDY CLAY (CL) [FILL]	18					
★	B-12 @	7.5'	SILTY, CLAYEY SAND (SC-SM) [FILL]	29					
⊙	B-12 @	11.0'	GRAVELLY SILT WITH SAND (SM) [FILL]	20					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11 @	30.0'	0.08				0.0	0.0	76.1	
⊠	B-11 @	41.0'	0.08				0.0	0.0	94.7	
▲	B-12 @	6.0'	0.08				0.0	0.0	71.3	
★	B-12 @	7.5'	9.50	1.34			13.0	47.5	35.6	
⊙	B-12 @	11.0'	0.08				0.0	0.0	55.5	

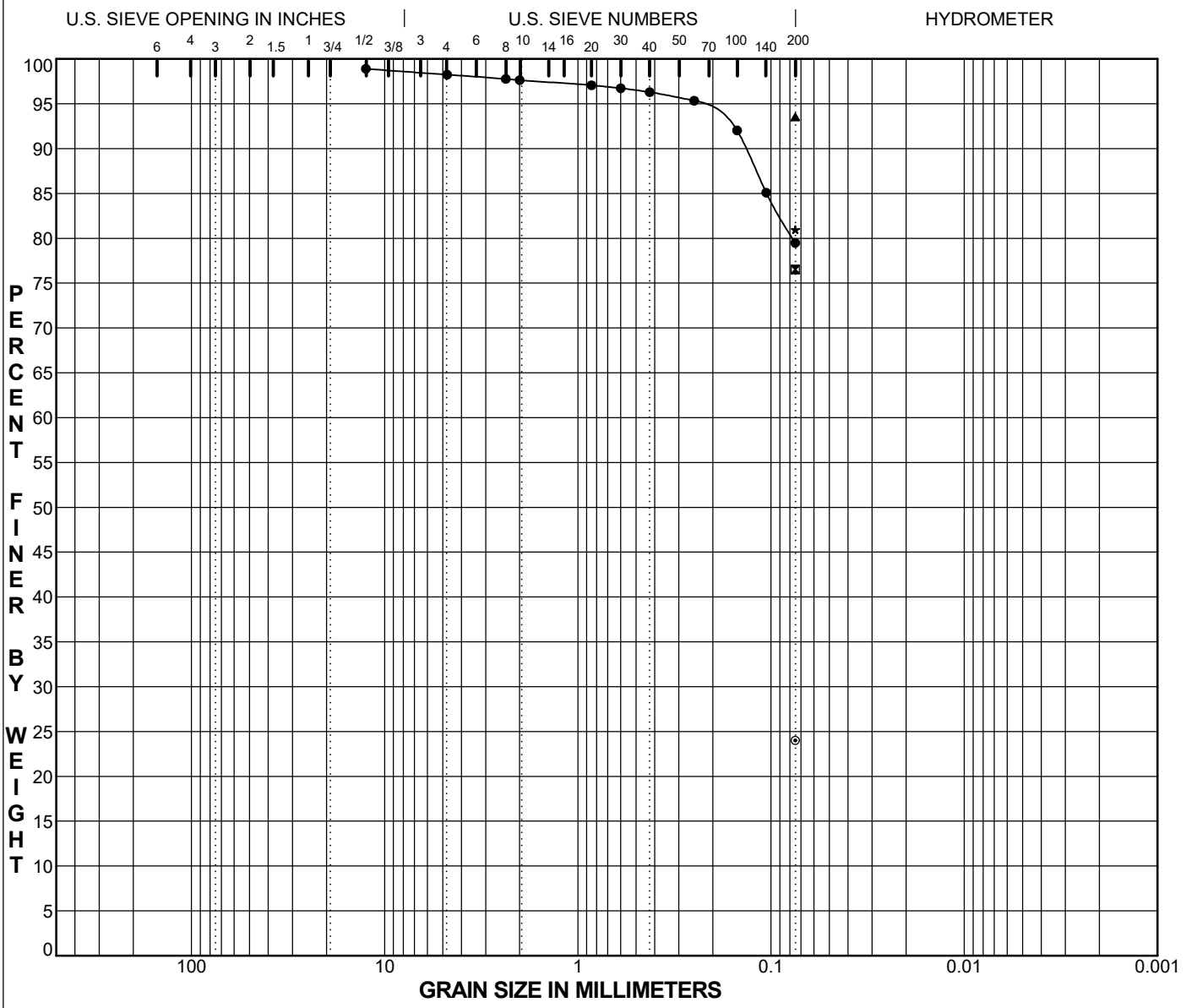
PARTICLE SIZE ANALYSIS

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-13 @	2.5'	CLAY WITH SAND (CL) [FILL]	6					
⊠	B-13 @	5.5'	FAT CLAY WITH SAND (CH) [COLLUVIUM]		96	37	59		
▲	B-13 @	10.0'	CLAYSTONE [BRIONES FORMATION]	31					
★	B-13 @	20.0'	CLAYSTONE [BRIONES FORMATION]	32					
⊙	B-14 @	6.0'	CLAYEY SAND WITH GRAVEL (SC) [FILL]	11					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-13 @	2.5'	12.50				0.7	18.8	79.5	
⊠	B-13 @	5.5'	0.08				0.0	0.0	76.5	
▲	B-13 @	10.0'	0.08				0.0	0.0	93.5	
★	B-13 @	20.0'	0.08				0.0	0.0	81.0	
⊙	B-14 @	6.0'	0.08				0.0	0.0	24.0	

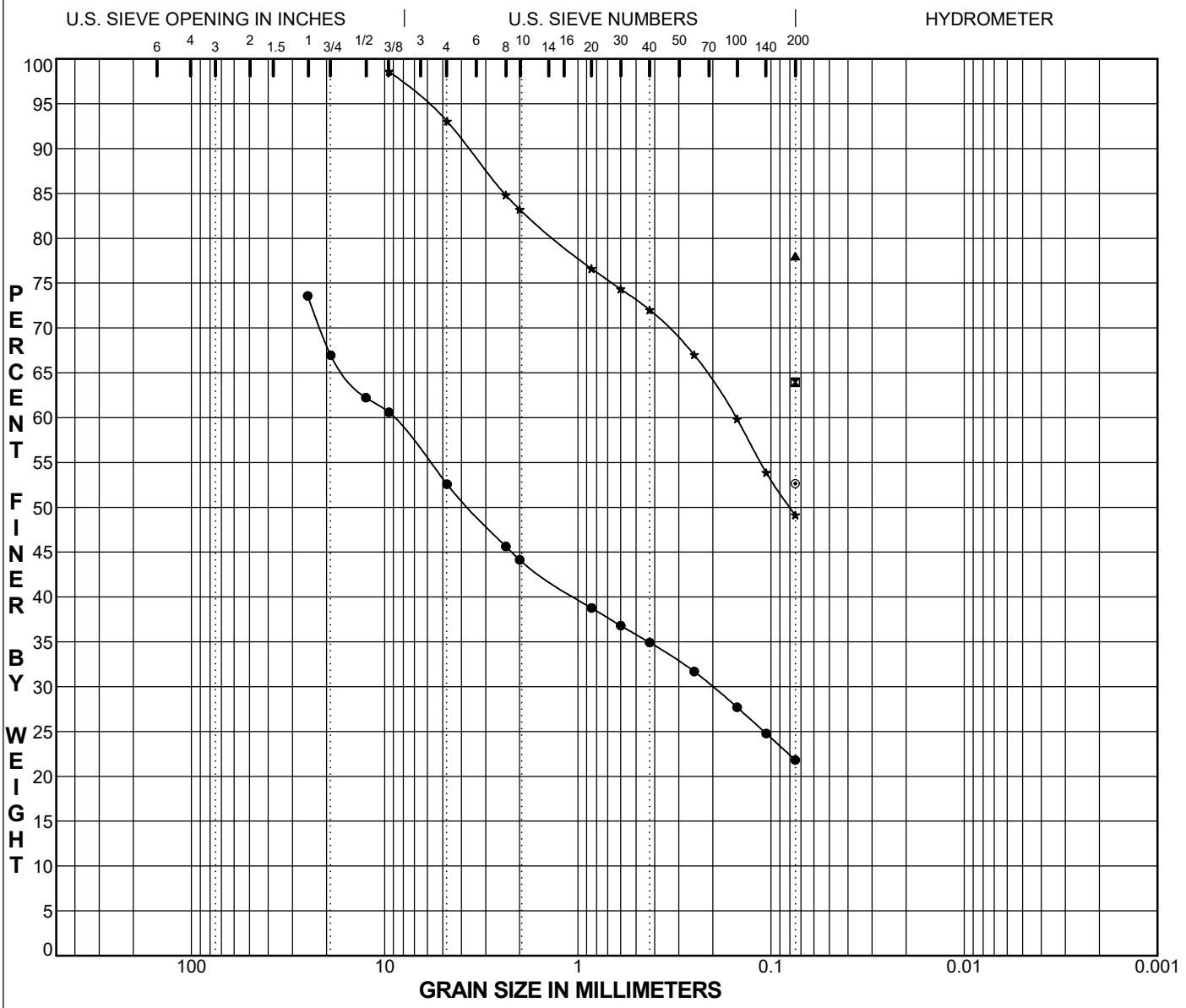
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-14 @	8.5'	CLAYEY SAND WITH GRAVEL (SC) [FILL]	10					
⊠	B-14 @	10.0'	SANDY CLAY (CL) [FILL]	22					
▲	B-14 @	16.0'	CLAY WITH SAND (CL) [FILL]	26					
★	B-15 @	2.5'	CLAYEY SAND (SC) [FILL]	4					
⊙	B-15 @	6.0'	SANDY CLAY (CL)	13					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-14 @	8.5'	25.00	9.03	0.201		21.0	30.8	21.8	
⊠	B-14 @	10.0'	0.08				0.0	0.0	63.9	
▲	B-14 @	16.0'	0.08				0.0	0.0	78.0	
★	B-15 @	2.5'	9.50	0.15			5.6	43.9	49.1	
⊙	B-15 @	6.0'	0.08				0.0	0.0	52.6	

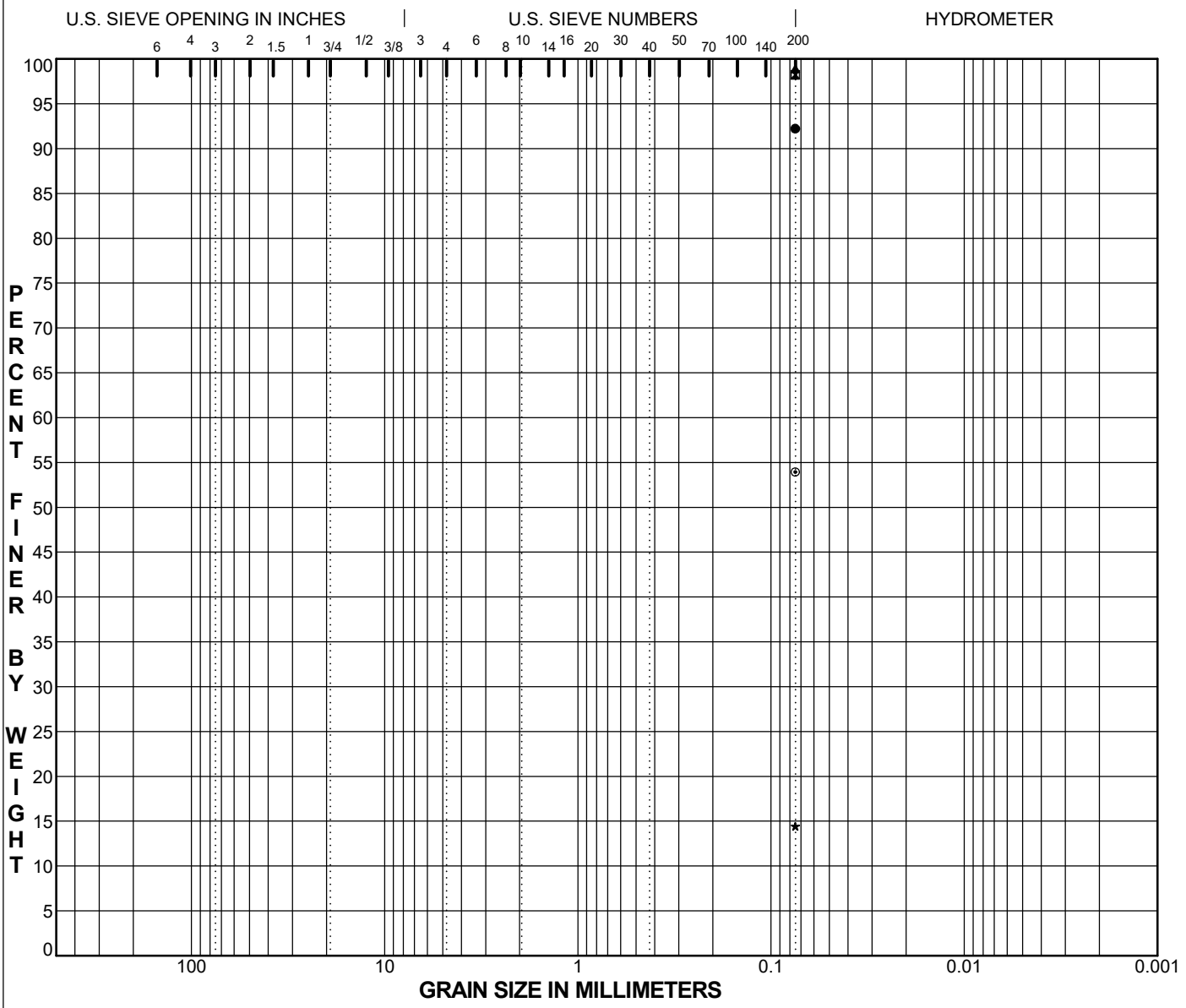
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE		CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-15 @	11.0'	CLAYSTONE [BRIONES FORMATION]	29					
⊠	B-15 @	20.0'	CLAYSTONE [BRIONES FORMATION]	32	77	52	25		
▲	B-15 @	30.0'	CLAYSTONE [BRIONES FORMATION]	30					
★	B-16 @	5.0'	SANDSTONE [HAMBRE FORMATION]	6					
⊙	B-17 @	6.0'	SILTSTONE [HAMBRE FORMATION]	18					

	SAMPLE SOURCE		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-15 @	11.0'	0.08				0.0	0.0	92.2	
⊠	B-15 @	20.0'	0.08				0.0	0.0	98.2	
▲	B-15 @	30.0'	0.08				0.0	0.0	98.9	
★	B-16 @	5.0'	0.08				0.0	0.0	14.4	
⊙	B-17 @	6.0'	0.08				0.0	0.0	53.9	

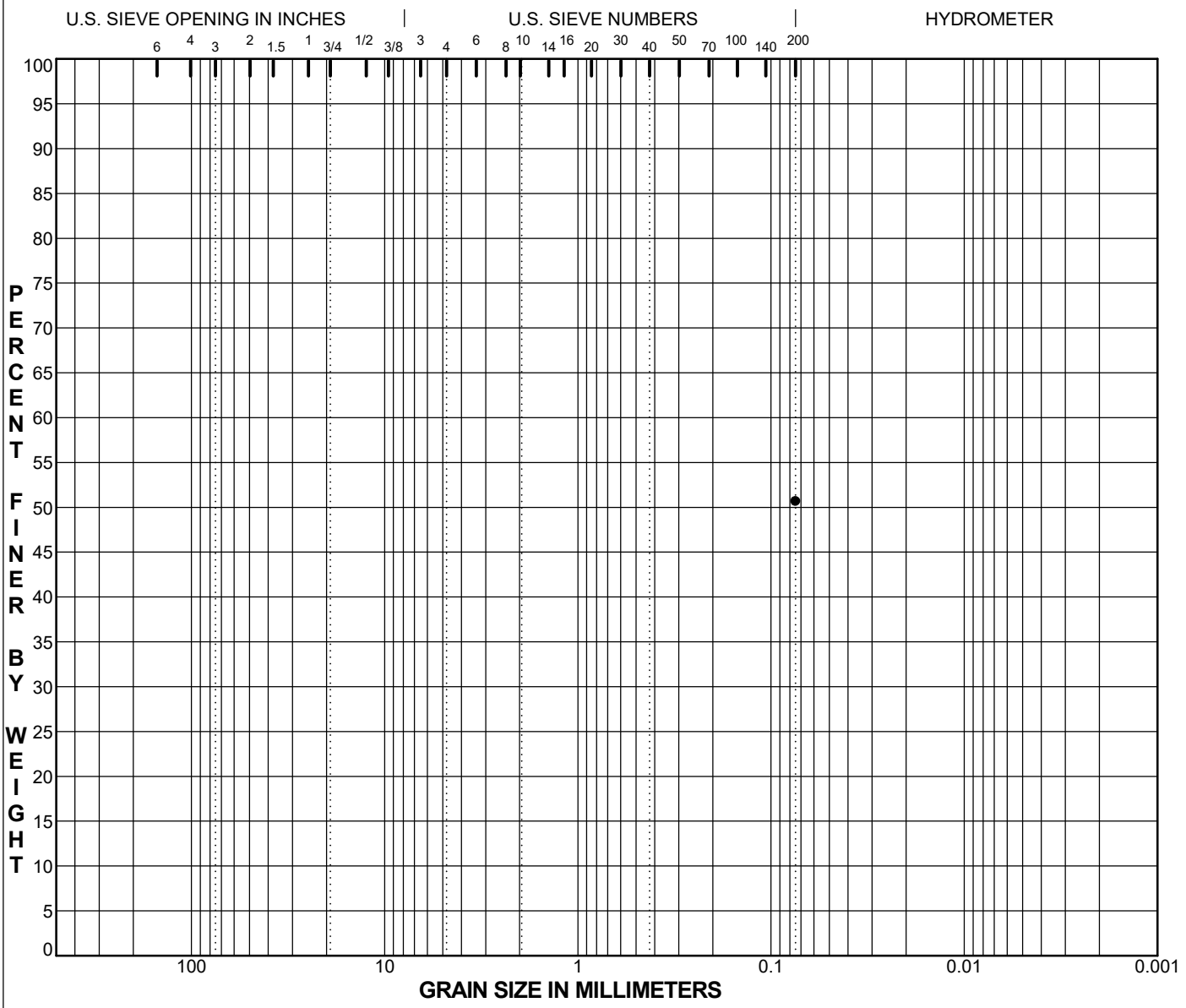
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	SAMPLE SOURCE	CLASSIFICATION	MC%	LL	PL	PI	Cc	Cu
●	B-17 @ 8.5'	SILTSTONE [HAMBRE FORMATION]	24	44	26	18		

	SAMPLE SOURCE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-17 @ 8.5'	0.08				0.0	0.0	50.7	

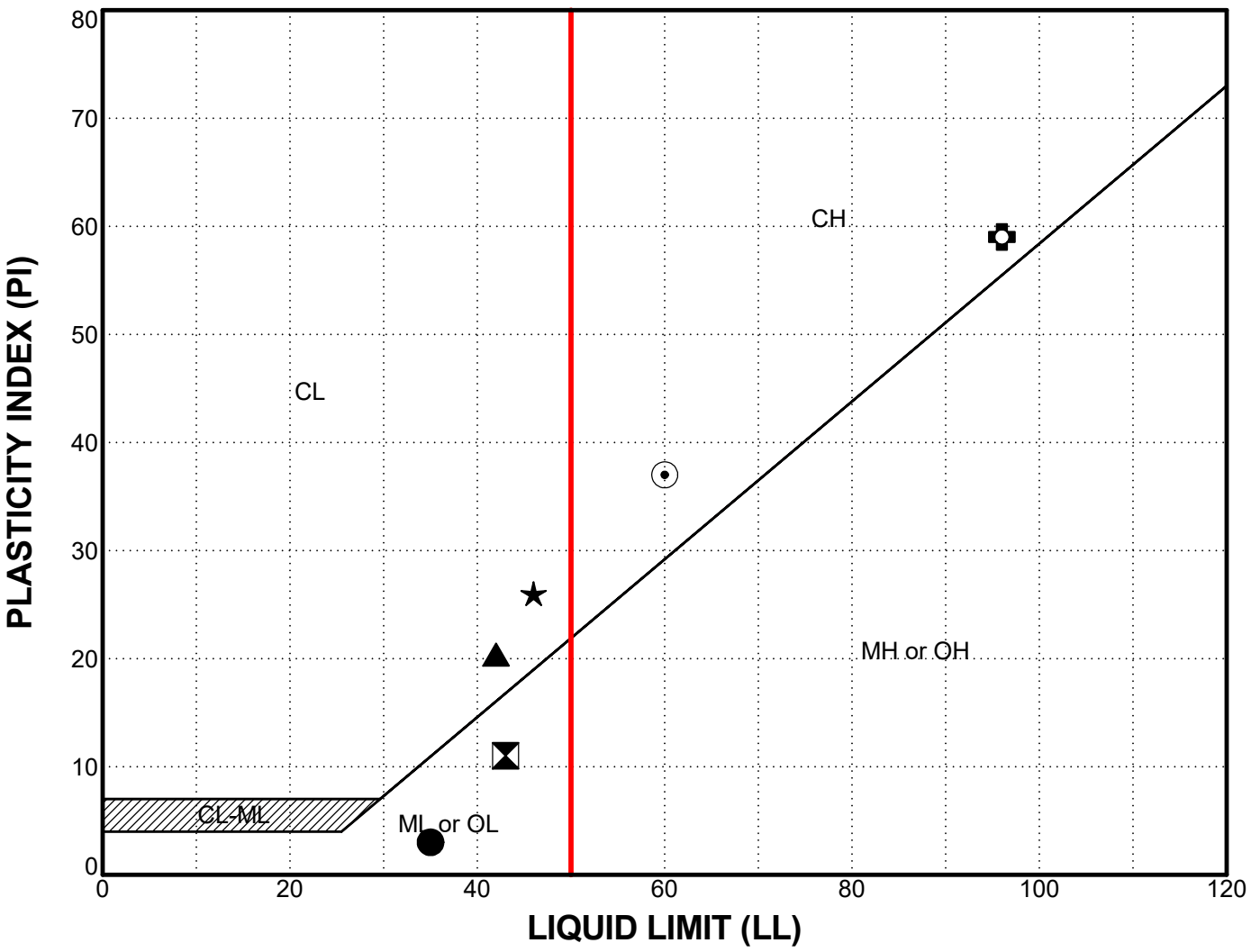
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AGS

JOB NO.	AGS-23-006	DATE	Oct 2024

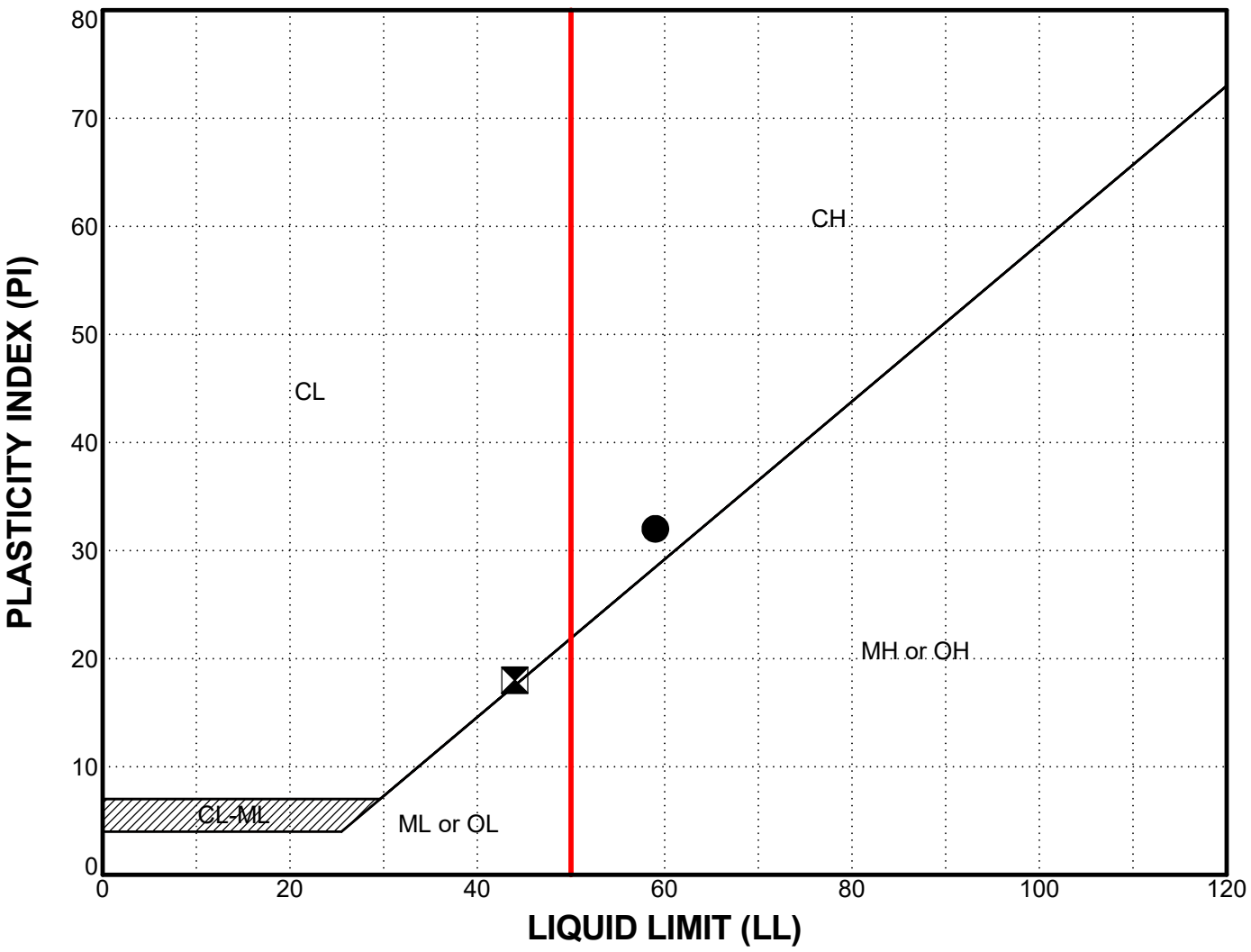


SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
● B-01 @ 5.0'	SILTSTONE [HAMBRE FORMATION]	35	32	3	77
⧓ B-02 @ 30.0'	SILTSTONE [HAMBRE FORMATION]	43	32	11	81
▲ B-05 @ 16.0'	CLAYSTONE [HAMBRE FORMATION]	42	22	20	60
★ B-10 @ 3.0'	CLAY WITH SAND (CL) [FILL]	46	20	26	84
⊙ B-11 @ 30.0'	FAT CLAY WITH SAND (CH) [ALLUVIUM]	60	23	37	76
✿ B-13 @ 5.5'	FAT CLAY WITH SAND (CH) [COLLUVIUM]	96	37	59	77

PLASTICITY CHART
WCWTP Pretreatment Project
Walnut Creek WTP - 2201 Larkey Lane

AGS

JOB NO.	AGS-23-006	DATE	Oct 2024		PLATE B-1



SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
● B-15 @ 7.5'	FAT CLAY (CH) [RESIDUAL SOIL]	59	27	32	
⊠ B-17 @ 8.5'	SILTSTONE [HAMBRE FORMATION]	44	26	18	51

PLASTICITY CHART
WCWTP Pretreatment Project
Walnut Creek WTP - 2201 Larkey Lane

AGS

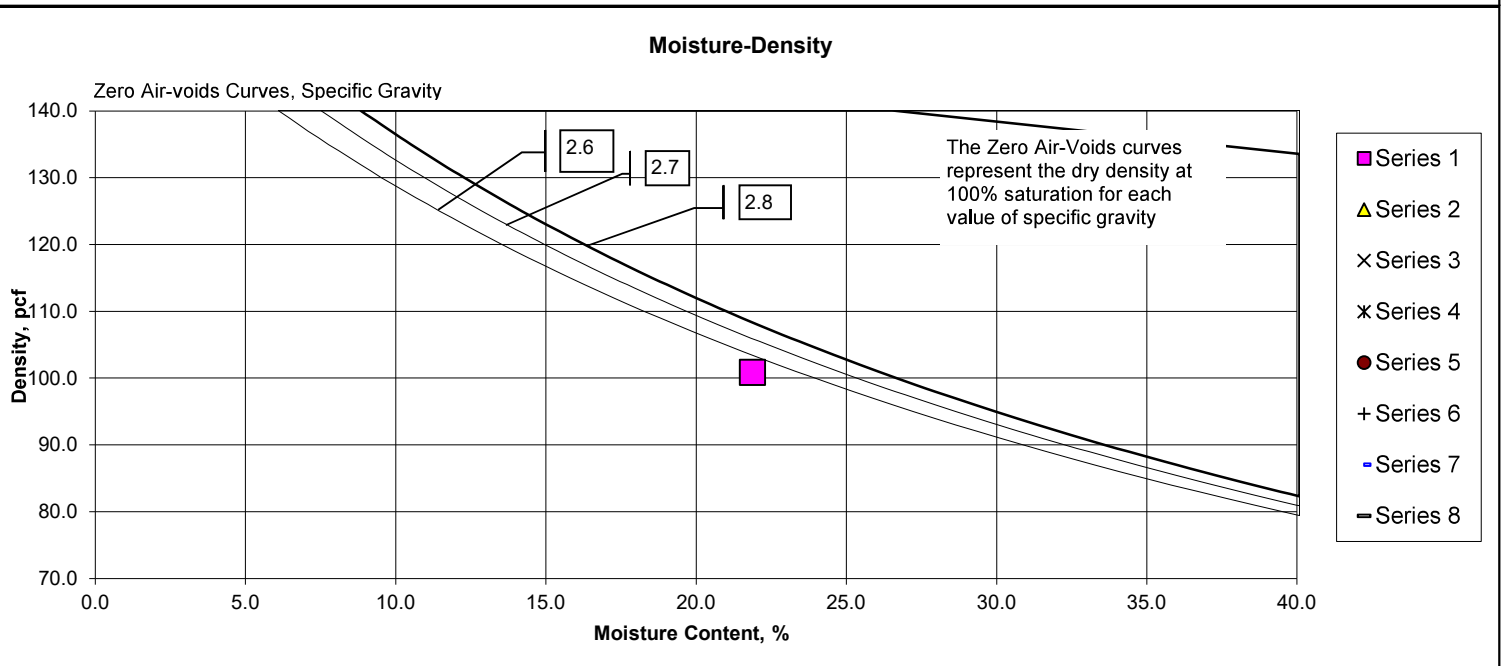
JOB NO.	AGS-23-006	DATE	Oct 2024		PLATE B-1

Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

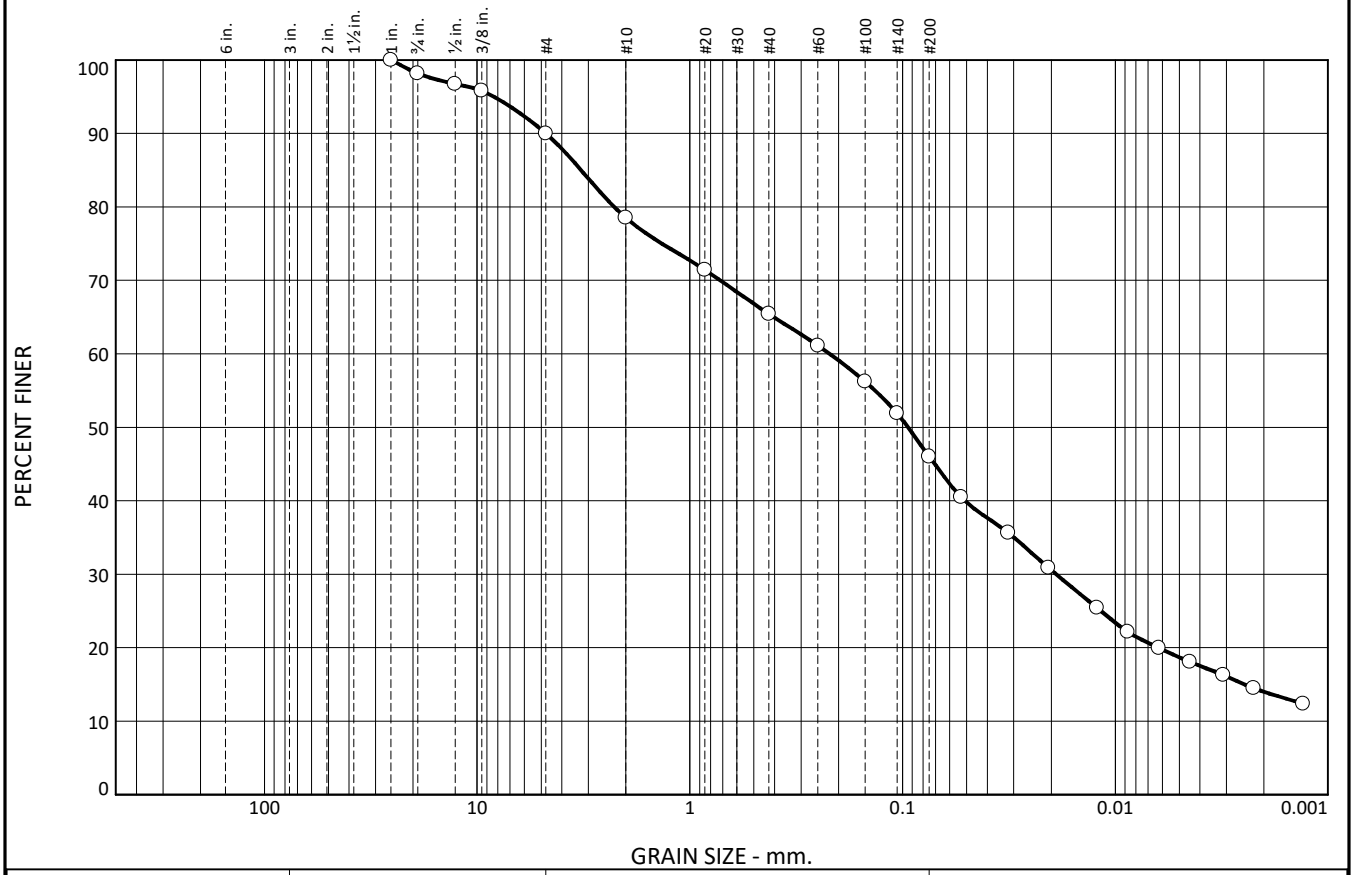
CTL Job No:	041-247	**Project No.**	AGS-23-006	**By:**	RU
Client:	AGS	**Date:**	09/18/24		
Project Name:	WCWTP	**Remarks:**			

Boring:	B-8							
Sample:	2C							
Depth, ft:	8-8.5							
Visual Description:	Brown Sandy SILT w/ Gravel							
Actual G_s								
Assumed G_s	2.70							
Moisture, %	21.9							
Wet Unit wt, pcf	122.9							
Dry Unit wt, pcf	100.9							
Dry Bulk Dens.ρb, (g/cc)	1.62							
Saturation, %	88.1							
Total Porosity, %	40.2							
Volumetric Water Cont,Θw,%	35.4							
Volumetric Air Cont., Θa,%	4.8							
Void Ratio	0.67							
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.8	8.2	11.5	13.1	19.4	32.0	14.0

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	98.2		
1/2"	96.7		
3/8"	95.8		
#4	90.0		
#10	78.5		
#20	71.4		
#40	65.4		
#60	61.1		
#100	56.2		
#140	51.9		
#200	46.0		
#270	40.5		
0.0319 mm.	35.6		
0.0206 mm.	30.9		
0.0122 mm.	25.4		
0.0087 mm.	22.1		
0.0062 mm.	20.0		
0.0045 mm.	18.1		
0.0031 mm.	16.3		
0.0022 mm.	14.5		
0.0013 mm.	12.4		

* (no specification provided)

Soil Description

Grayish Brown Silty SAND

Atterberg Limits

PL= 25 LL= 38 PI= 13

Coefficients

D_{90}= 4.7541 D_{85}= 3.2462 D_{60}= 0.2205
D_{50}= 0.0943 D_{30}= 0.0190 D_{15}= 0.0025
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-6(3)

Remarks

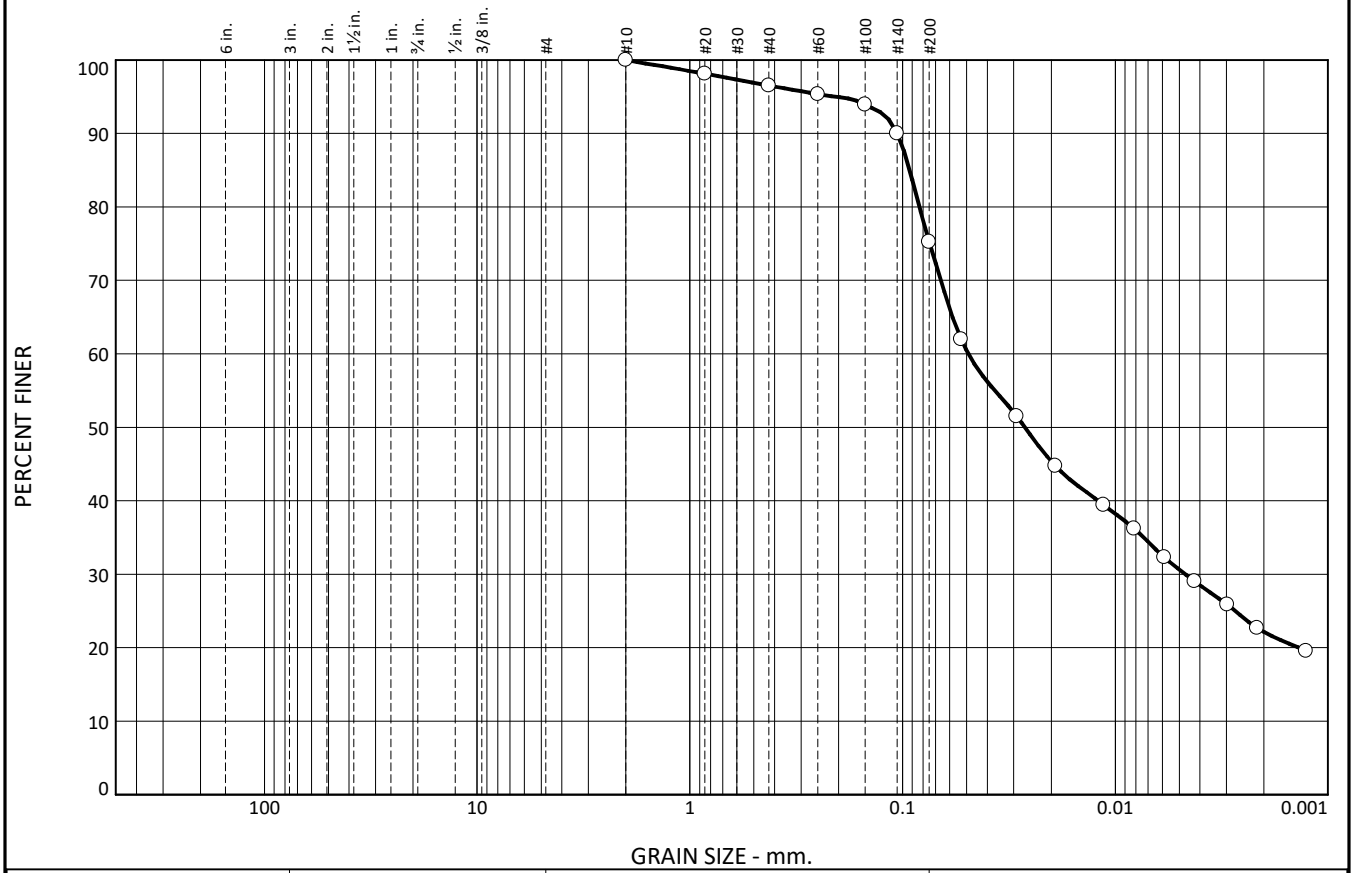
Source of Sample: B-8 **Depth:** 8-8.5'
Sample Number: 2B **Date:**

COOPER TESTING LABORATORY

Client: AGS
Project: WCWTP - AGS-23-006

Project No: 041-247 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.5	21.3	53.1	22.1

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	98.1		
#40	96.5		
#60	95.3		
#100	93.9		
#140	90.0		
#200	75.2		
#270	62.0		
0.0291 mm.	51.5		
0.0191 mm.	44.7		
0.0113 mm.	39.4		
0.0082 mm.	36.2		
0.0059 mm.	32.3		
0.0042 mm.	29.0		
0.0030 mm.	25.9		
0.0022 mm.	22.7		
0.0013 mm.	19.5		

* (no specification provided)

Soil Description

Light Brown SILT w/ Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1059 D_{85}= 0.0927 D_{60}= 0.0490
D_{50}= 0.0266 D_{30}= 0.0047 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

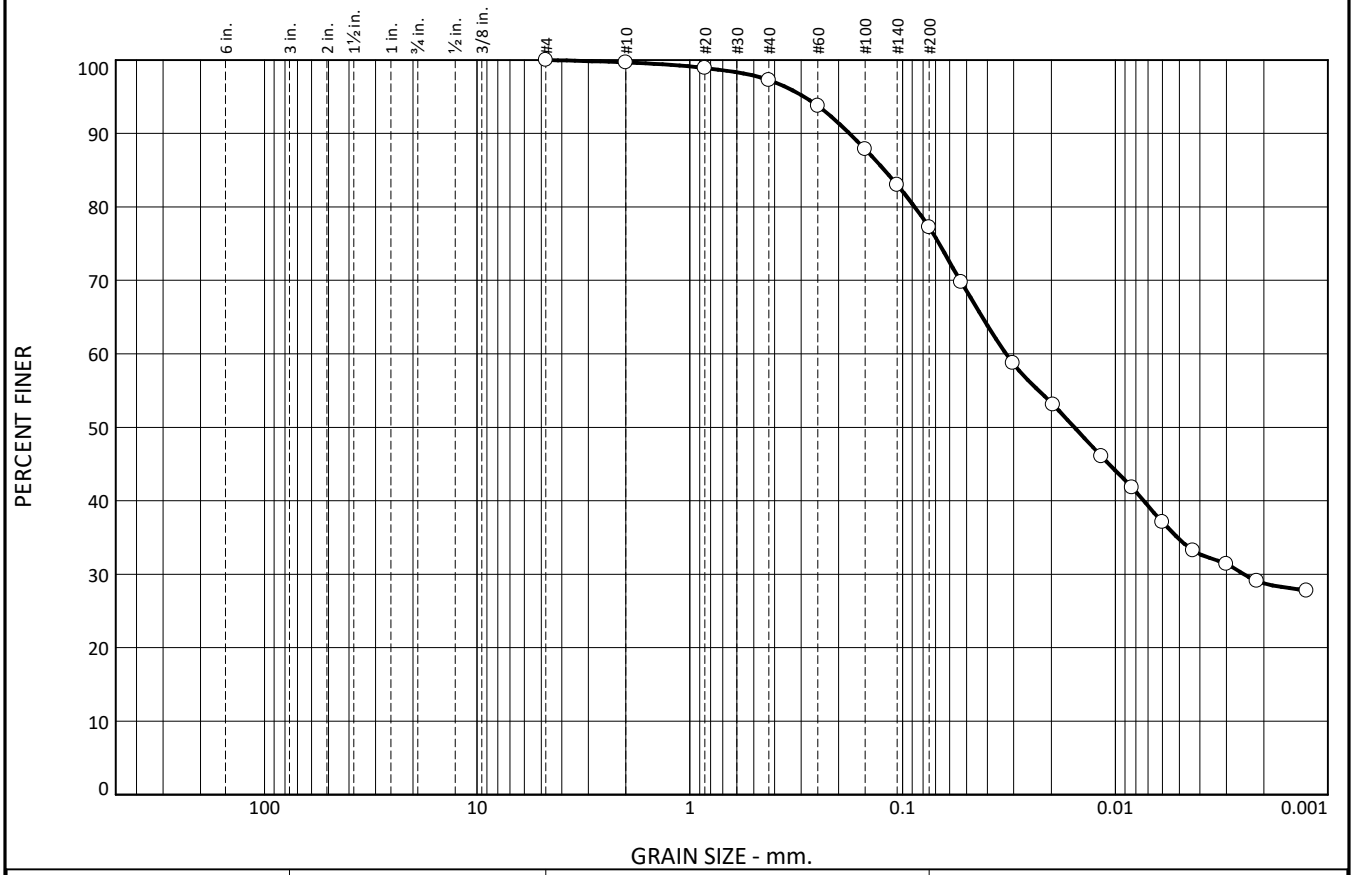
Remarks

Source of Sample: B-16 **Depth:** 0-5'
Sample Number: Bulk **Date:**

COOPER TESTING LABORATORY

Client: AGS
Project: WCWTP - AGS-23-006
Project No: 041-247 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	2.5	20.0	48.4	28.8

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	98.9		
#40	97.2		
#60	93.7		
#100	87.8		
#140	83.0		
#200	77.2		
#270	69.8		
0.0303 mm.	58.8		
0.0196 mm.	53.1		
0.0116 mm.	46.1		
0.0083 mm.	41.8		
0.0060 mm.	37.1		
0.0043 mm.	33.2		
0.0030 mm.	31.4		
0.0022 mm.	29.1		
0.0013 mm.	27.8		

* (no specification provided)

Soil Description

Brown Lean CLAY w/ Sand

Atterberg Limits

PL= 16 LL= 48 PI= 32

Coefficients

D_{90}= 0.1778 D_{85}= 0.1215 D_{60}= 0.0326
D_{50}= 0.0156 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(24)

Remarks

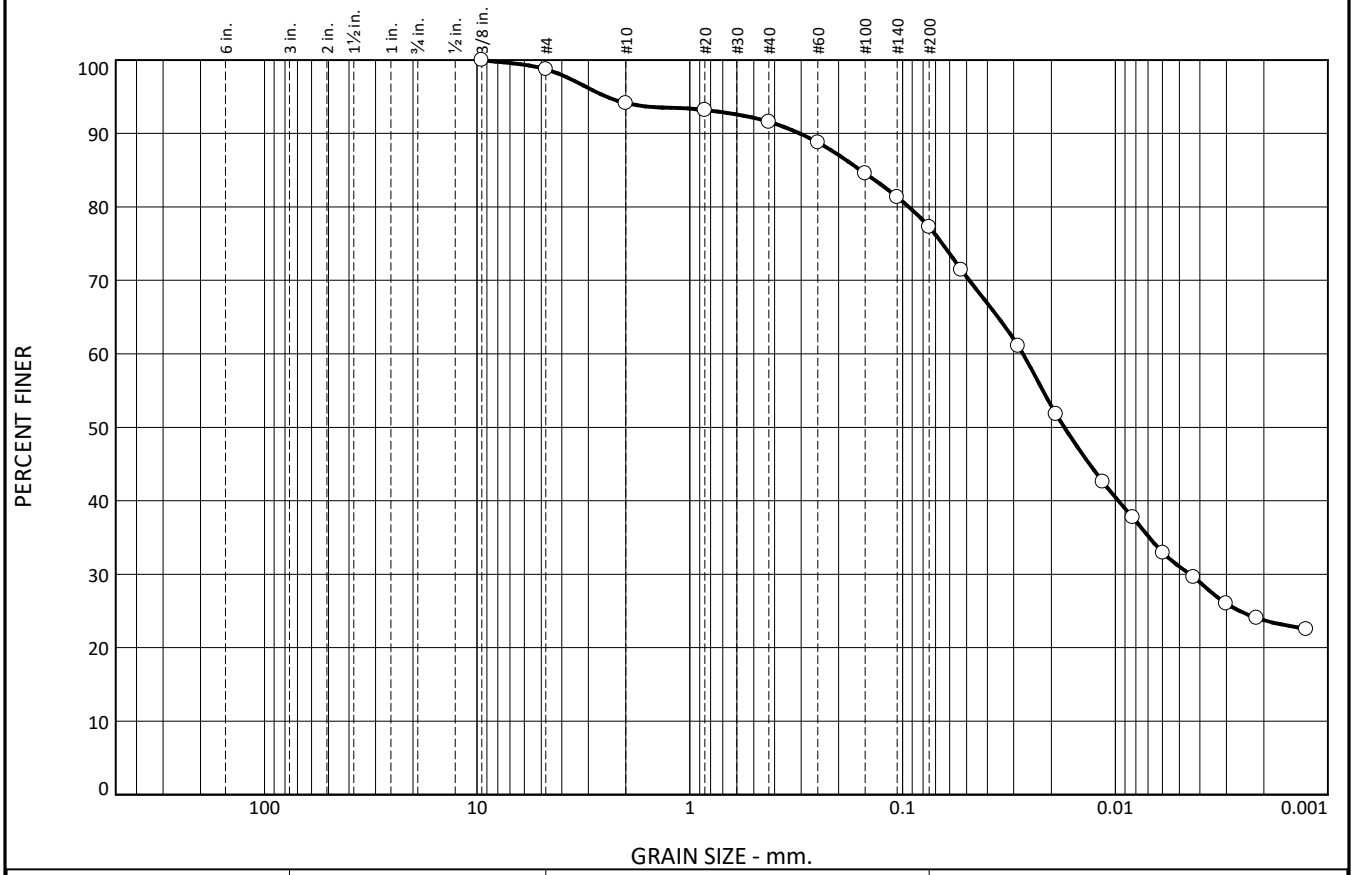
Source of Sample: B-18 **Depth:** 5.5-6'
Sample Number: 1C **Date:**

COOPER TESTING LABORATORY

Client: AGS
Project: WCWTP - AGS-23-006

Project No: 041-247 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	4.6	2.5	14.3	53.6	23.7

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	98.7		
#10	94.1		
#20	93.2		
#40	91.6		
#60	88.8		
#100	84.6		
#140	81.3		
#200	77.3		
#270	71.4		
0.0286 mm.	61.1		
0.0190 mm.	51.8		
0.0115 mm.	42.6		
0.0083 mm.	37.7		
0.0060 mm.	32.9		
0.0043 mm.	29.6		
0.0030 mm.	26.0		
0.0022 mm.	24.0		
0.0013 mm.	22.5		

* (no specification provided)

Soil Description

Brown Sandy Fat CLAY w/ Sand

Atterberg Limits

PL= 19 LL= 50 PI= 31

Coefficients

D_{90}= 0.3046 D_{85}= 0.1575 D_{60}= 0.0272
D_{50}= 0.0174 D_{30}= 0.0045 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(24)

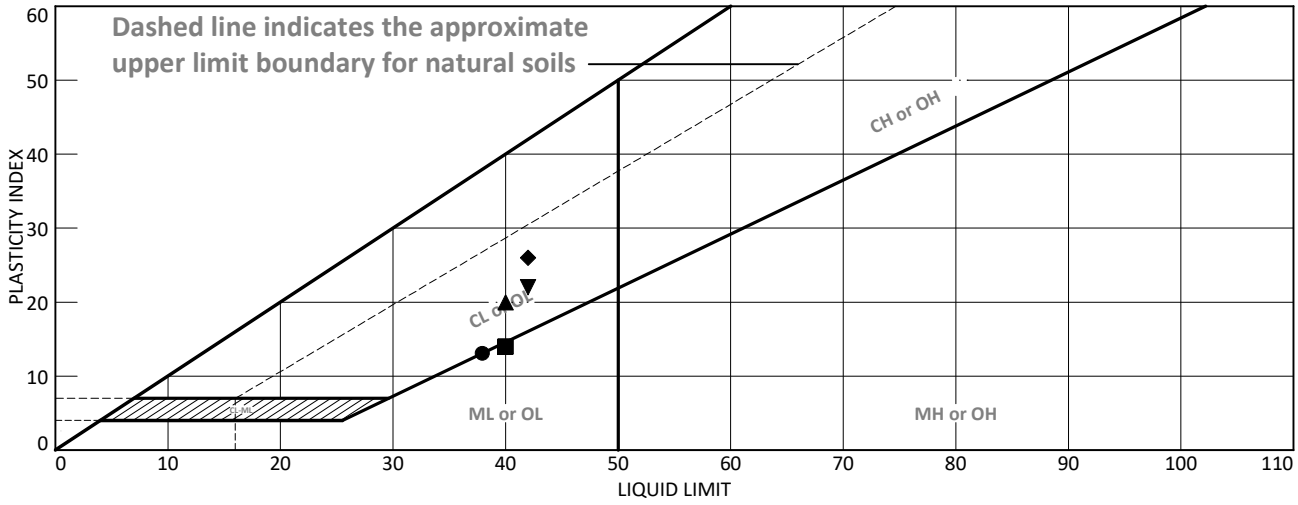
Remarks

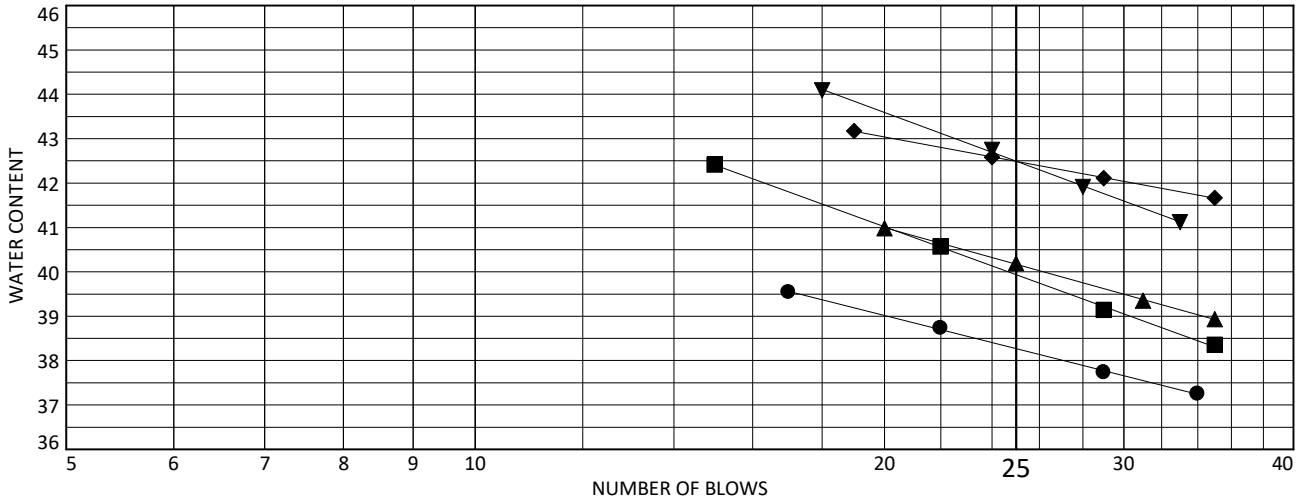
Source of Sample: B-18 **Depth:** 8-8.5'
Sample Number: 2B **Date:**

COOPER TESTING LABORATORY

Client: AGS
Project: WCWTP - AGS-23-006
Project No: 041-247 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Grayish Brown Silty SAND	38	25	13	65.4	46.0	SM
■	Brown Sandy SILT w/ Gravel	40	26	14			
▲	Dark Olive Gray Sandy CLAY w/ Gravel	40	20	20			
◆	Dark Gray Sandy Lean CLAY (Bay Mud)	42	16	26			
▼	Brown Sandy Lean CLAY w/ Gravel	42	20	22			

Project No. 041-247 **Client:** AGS

Project: WCWTP - AGS-23-006

Remarks:

●**Source of Sample:** B-8 **Depth:** 8-8.5' **Sample Number:** 2B

■**Source of Sample:** B-8 **Depth:** 8-8.5' **Sample Number:** 2C

▲**Source of Sample:** B-8 **Depth:** 10-11.5' **Sample Number:** 3

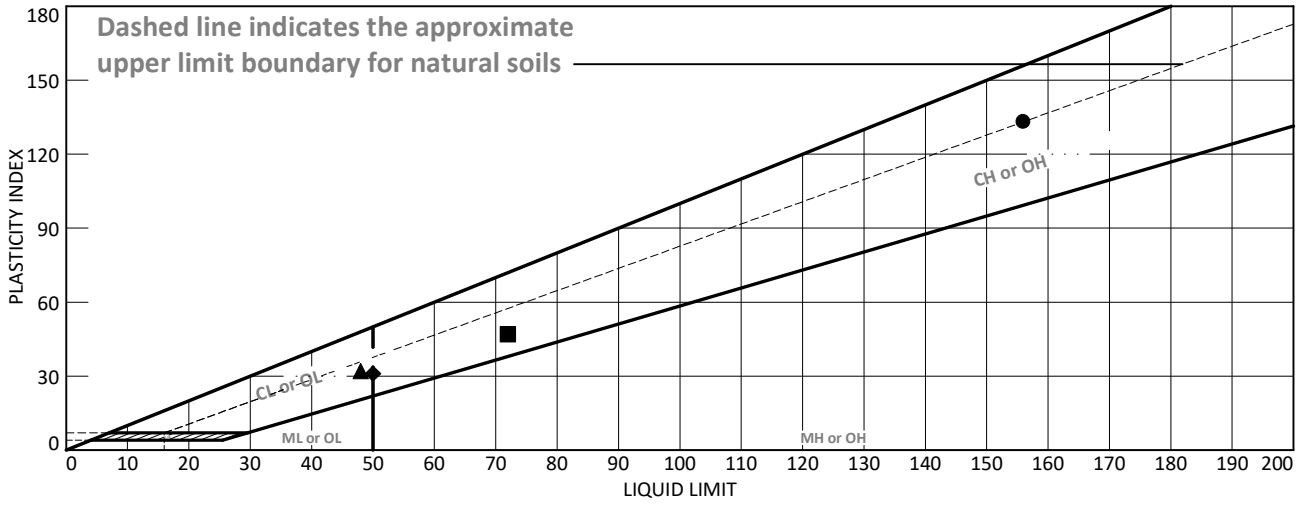
◆**Source of Sample:** B-9 **Depth:** 30.5-31' **Sample Number:** 7C

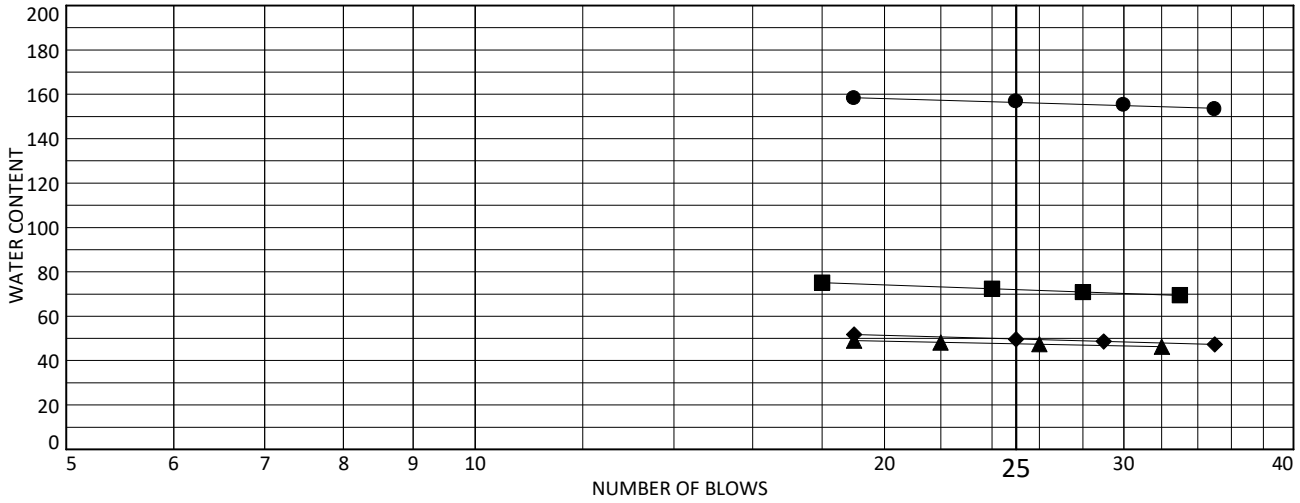
▼**Source of Sample:** B-12 **Depth:** 15.5-16' **Sample Number:** 4C

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish Brown Fat CLAY w/ Sand & Gravel	156	23	133			
■	Yellowish Brown Fat CLAY w/ Sand (Weathered Rock)	72	25	47			
▲	Brown Lean CLAY w/ Sand	48	16	32	97.2	77.2	CL
◆	Brown Sandy Fat CLAY w/ Sand	50	19	31	91.6	77.3	CH

Project No. 041-247 **Client:** AGS

Project: WCWTP - AGS-23-006

Remarks:

●**Source of Sample:** B-13 **Depth:** 7.5-8' **Sample Number:** 2A

■**Source of Sample:** B-13 **Depth:** 8-8.5' **Sample Number:** 2B

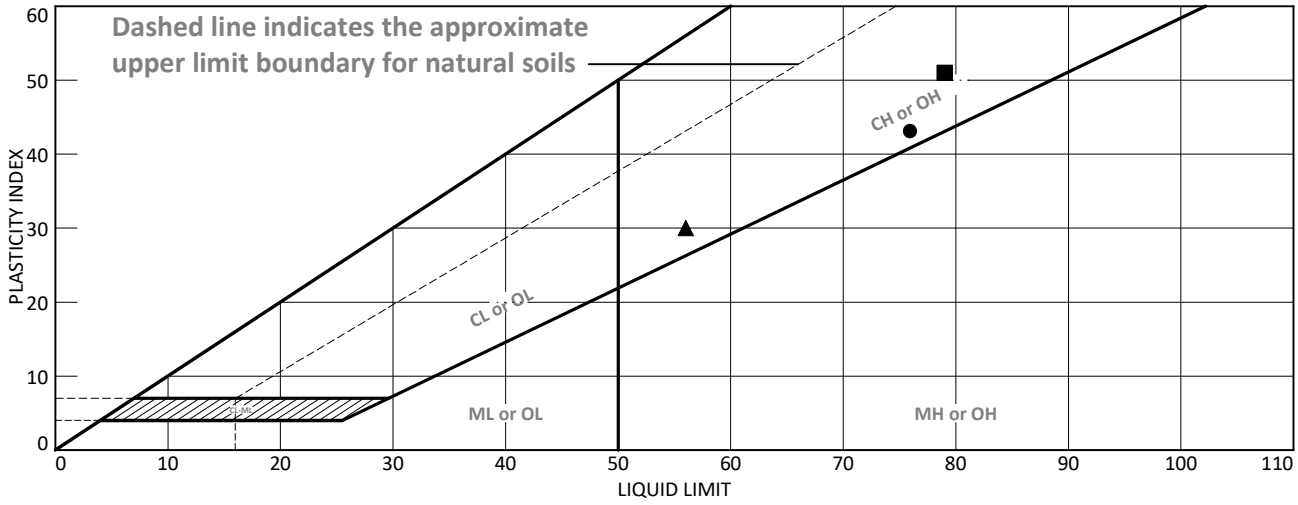
▲**Source of Sample:** B-18 **Depth:** 5.5-6' **Sample Number:** 1C

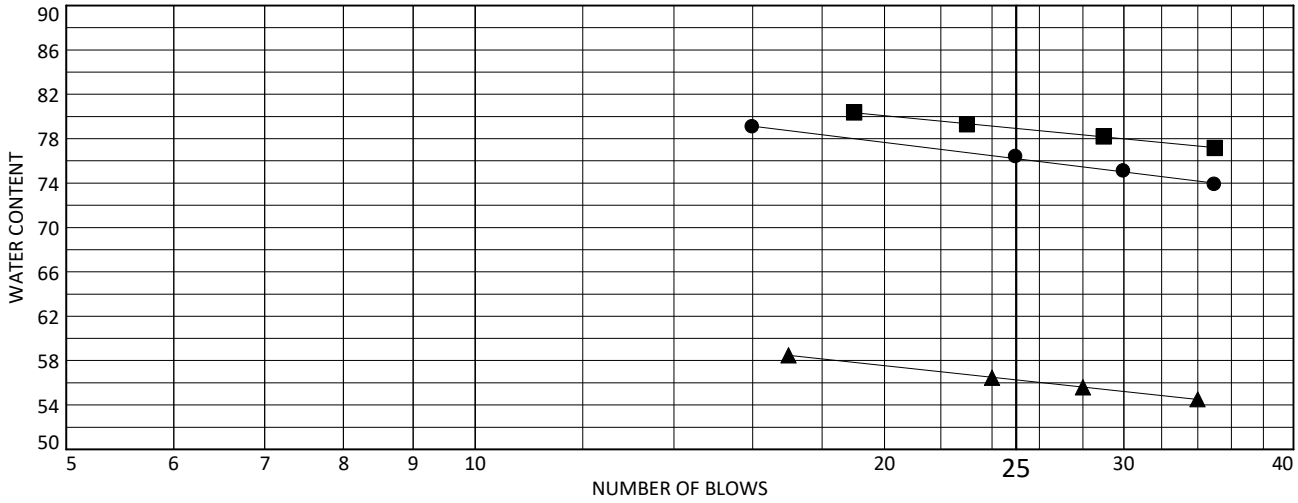
◆**Source of Sample:** B-18 **Depth:** 8-8.5' **Sample Number:** 2B

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Yellowish Brown Sandy Fat CLAY	76	33	43			
■	Yellowish Brown Sandy Fat CLAY w/ Gravel	79	28	51			
▲	Yellowish Brown Sandy Fat CLAY w/ Gravel	56	26	30			

Project No. 041-248 **Client:** AGS, Inc.

Project: WCWTP - AGS-23-006

Remarks:

●**Source of Sample:** B-10 **Depth:** 12.5-16.5' **Sample Number:** 5-6

■**Source of Sample:** B-13 **Depth:** 25-26.5' **Sample Number:** 6

▲**Source of Sample:** B-18 **Depth:** 15-16.5' **Sample Number:** 5

COOPER TESTING LABORATORY

Figure

COOPER TESTING LABORATORY

Expansion Index

ASTM D-4829-07 X

CTL Job No.:	041-248	**Boring:**	B-10	**Date:**	9/23/2024
Client:	AGS, Inc.	**Sample:**	5+6	**By:**	PJ
Project Name:	WCWTP	**Depth:**	12.5-16.5'		
Project No:	AGS-23-006				

Visual Description: Light Yellowish Brown Sandy Fat CLAY

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.007 **Diameter (in.) =** 4.007

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	788.1	854.0
Dry Wt. + Tare, (gm)	728.8	728.8
Tare Wt., (gm)	116.4	116.4
Wt. Of Water, (gm)	59.3	125.2
% Water	23.6	50.0

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	671.6	737.6	grams
Ring:	361.7	361.7	grams
Remolded Wet Wt.:	310.0	375.9	grams
Wet Density	93.0	99.9	pcf
Dry Density	75.2	66.6	pcf
% Sat. = $\frac{(2.7)(\text{dry dens.})(m/c)}{168.48 - (\text{dry dens.})}$	51.5	88.2	UBC Saturation range 49-51% ASTM Saturation range 48-52%

Expansion Test:

Date	Time	Dial	Delta h, %
9/19/2024	12:30	0.0000	0.000
9/19/2024	12:43	-0.0460	4.568
9/19/2024	12:57	-0.0796	7.905
9/19/2024	17:16	-0.1246	12.373
9/20/2024	11:03	-0.1300	12.910
9/20/2024	12:33	-0.1301	12.920
		Total Dial	12.9

Tested with 1 psi Surcharge

Remarks:

Expansion Index Results

$$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$$

EI = 129

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877 or D4546

COOPER TESTING LABORATORY

Expansion Index

ASTM D-4829-07 X

CTL Job No.:	041-248	**Boring:**	B-13	**Date:**	9/25/2024
Client:	AGS, Inc.	**Sample:**	6	**By:**	PJ
Project Name:	WCWTP	**Depth:**	25-26.5'		
Project No:	AGS-23-006				

Visual Description: Yellowish Brown Sandy Fat CLAY w/ Gravel

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.005 **Diameter (in.) =** 4.001

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	806.9	870.1
Dry Wt. + Tare, (gm)	752.4	752.4
Tare Wt., (gm)	113.0	113.0
Wt. Of Water, (gm)	54.5	117.7
% Water	20.0	43.1

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	693.9	757.1	grams
Ring:	366.6	366.6	grams
Remolded Wet Wt.:	327.3	390.5	grams
Wet Density	98.7	104.4	pcf
Dry Density	82.3	72.9	pcf
% Sat. = (2.7)(dry dens.)(m/c) / 168.48 - (dry dens.)	51.4	88.8	UBC Saturation range 49-51% ASTM Saturation range 48-52%

Expansion Test:

Date	Time	Dial	Delta h, %
9/23/2024	12:12	0.0000	0.000
9/23/2024	12:22	-0.0058	0.577
9/23/2024	12:53	-0.0302	3.005
9/23/2024	17:20	-0.0763	7.592
9/24/2024	11:12	-0.1279	12.726
9/24/2024	12:17	-0.1288	12.816
		Total Dial	12.8

Tested with 1 psi Surcharge

Remarks:

Expansion Index Results

initial dial - final dial / initial sample height x 1000

EI = 128

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877 or D4546

COOPER TESTING LABORATORY

Expansion Index

ASTM D-4829-07 X

CTL Job No.:	041-248	**Boring:**	B-18	**Date:**	9/20/2024
Client:	AGS, Inc.	**Sample:**	5	**By:**	PJ
Project Name:	WCWTP	**Depth:**	15-16.5'		
Project No:	AGS-23-006				

Visual Description: Yellowish Brown Sandy Fat CLAY w/ Gravel

Processing:

Percent Passing #4 Sieve

Total Air Dry Weight:	N/A
Wt. Retained on #4 Sieve:	N/A
% Retained	N/A
% Passing #4 Sieve:	N/A

Sample Dimensions

Height (in.)= 1.005 **Diameter (in.) =** 4.001

Moisture Calcs

	Initial	Final
Tare #		
Wet Wt. + Tare, (gm)	823.3	891.4
Dry Wt. + Tare, (gm)	775.2	775.2
Tare Wt., (gm)	116.3	116.3
Wt. Of Water, (gm)	48.2	116.2
% Water	16.5	39.8

Remolding:

Tamp two lifts, 15 blows/lift @ slightly below optimum moisture content

	Initial	Final	
Ring & Sample:	707.0	775.1	grams
Ring:	366.6	366.6	grams
Remolded Wet Wt.:	340.4	408.5	grams
Wet Density	102.6	111.0	pcf
Dry Density	88.1	79.4	pcf
% Sat. = $\frac{(2.7)(\text{dry dens.})(m/c)}{168.48 - (\text{dry dens.})}$	48.8	95.8	UBC Saturation range 49-51% ASTM Saturation range 48-52%

Expansion Test:

Date	Time	Dial	Delta h, %
9/18/2024	14:41	0.0000	0.000
9/18/2024	15:13	-0.0508	5.055
9/18/2024	15:32	-0.0838	8.338
9/18/2024	17:04	-0.0985	9.801
9/19/2024	8:22	-0.1095	10.896
9/19/2024	9:18	-0.1097	10.915
9/19/2024	11:09	-0.1098	10.925
		Total Dial	10.9

Tested with 1 psi Surcharge

Remarks:

Expansion Index Results

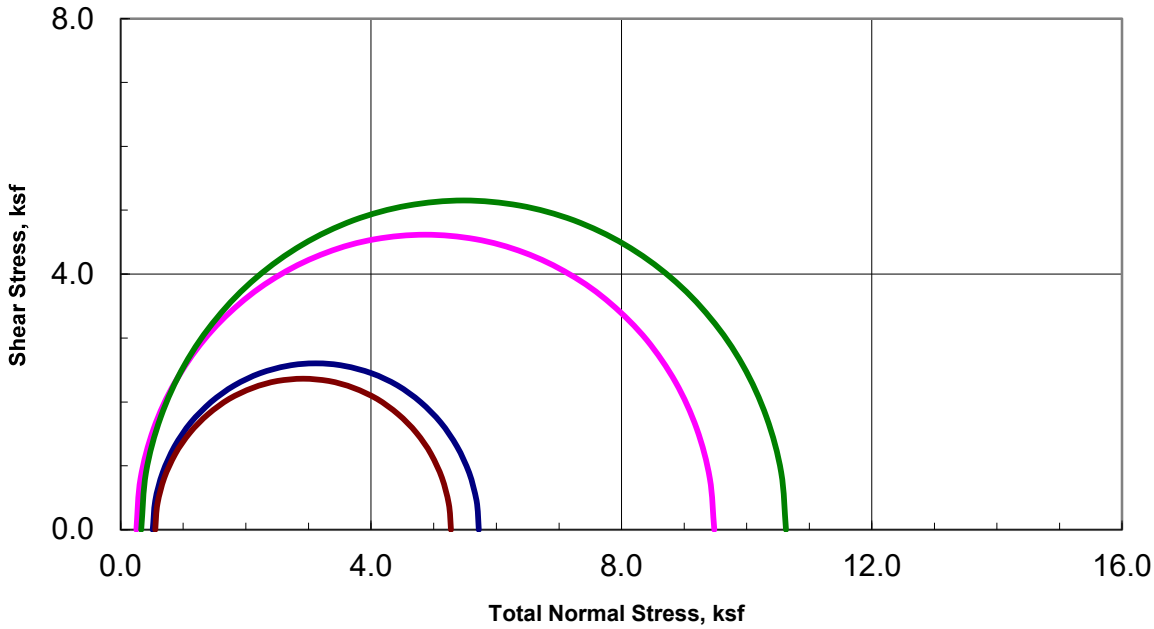
$\frac{\text{initial dial - final dial}}{\text{initial sample height}} \times 1000$

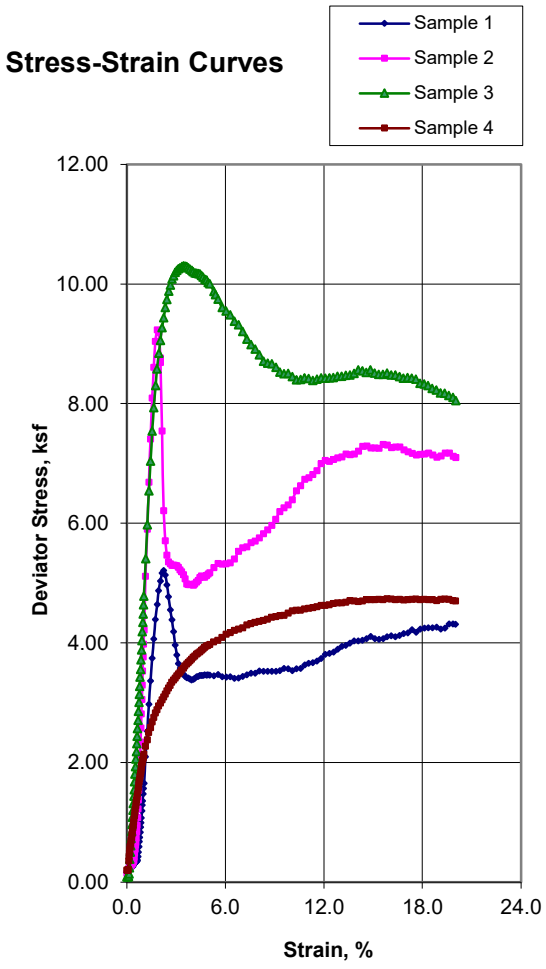
EI = 109

This test is a simplified index test and may not show the full potential for expansion and/or shrinkage. Use result with caution! See ASTM D 3877 or D4546

Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

Unconsolidated-Undrained Triaxial Test
ASTM D2850





Sample Data				
	1	2	3	4
Moisture %	34.6	27.1	19.3	28.6
Dry Den,pcf	80.4	91.0	104.8	89.1
Void Ratio	1.096	0.853	0.608	0.891
Saturation %	85.2	85.9	85.6	86.7
Height in	5.01	5.01	5.02	5.03
Diameter in	2.40	2.44	2.44	2.39
Cell psi	3.6	1.7	2.3	3.8
Strain %	2.24	1.84	3.44	15.00
Deviator, ksf	5.210	9.235	10.304	4.724
Rate %/min	1.00	1.00	1.00	1.00
in/min	0.050	0.050	0.050	0.050
Job No.:	041-247			
Client:	AGS			
Project:	AGS-23-006			
Boring:	B-10	B-13	B-17	B-18
Sample:	5B	1C	2B	4B
Depth ft:	13-13.5	6-6.5	8-8.5	13-13.5

Visual Soil Description	
Sample #	
1	Brown Sandy CLAY w/ Gravel
2	Yellowish Brown Sandy CLAY
3	Brown Sandy CLAY w/ Gravel
4	Brown Sandy CLAY

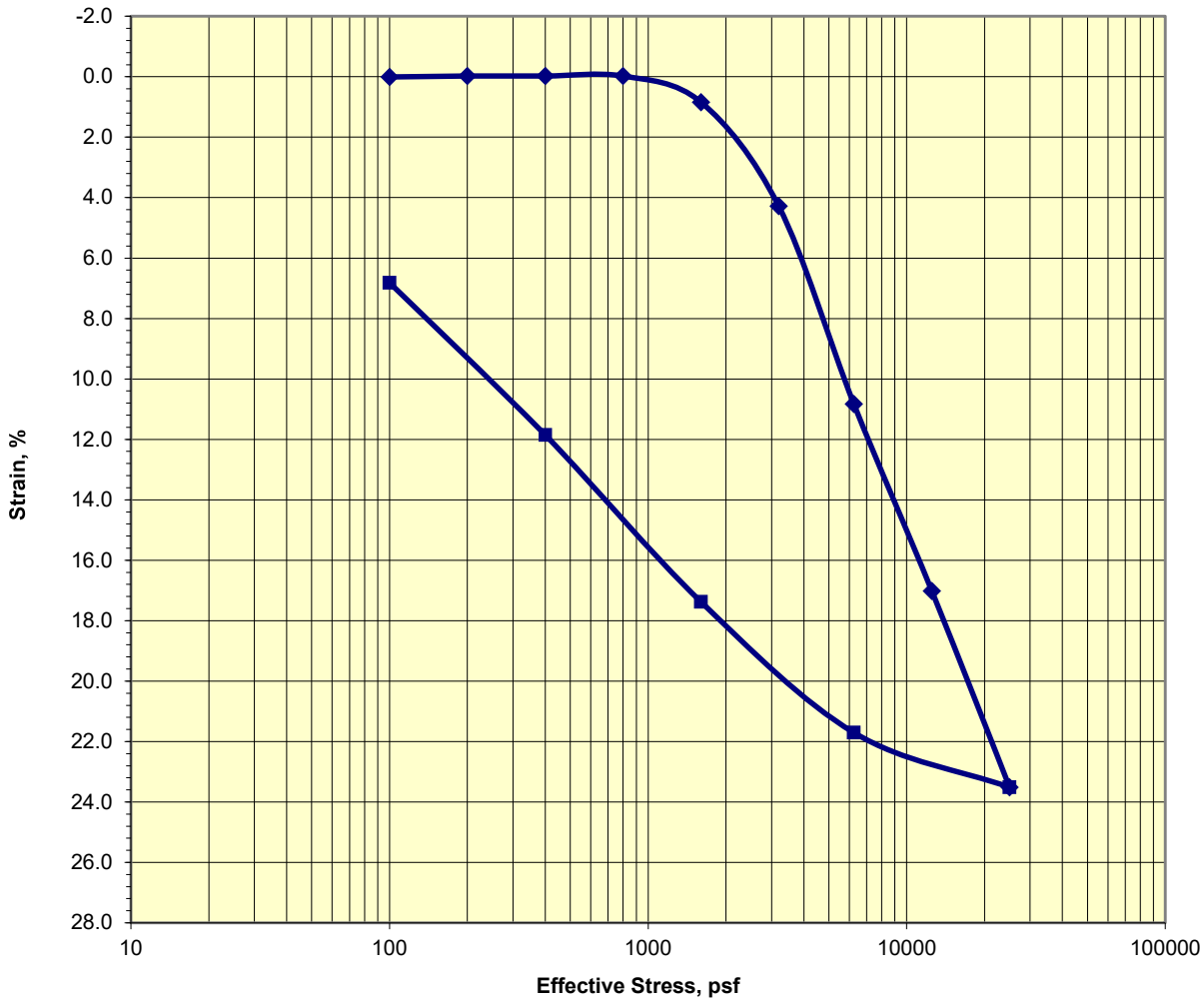
Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

Consolidation Test
ASTM D2435

Job No.:	041-247	**Boring:**	B-13	**Run By:**	HM
Client:	AGS	**Sample:**	2A	**Reduced:**	RU
Project:	AGS-23-006	**Depth, ft.:**	7.5-8	**Checked:**	PJ
Soil Type:	Yellowish Brown Fat CLAY w/ Sand & Gravel			**Date:**	9/23/2024

Strain-Log-P Curve



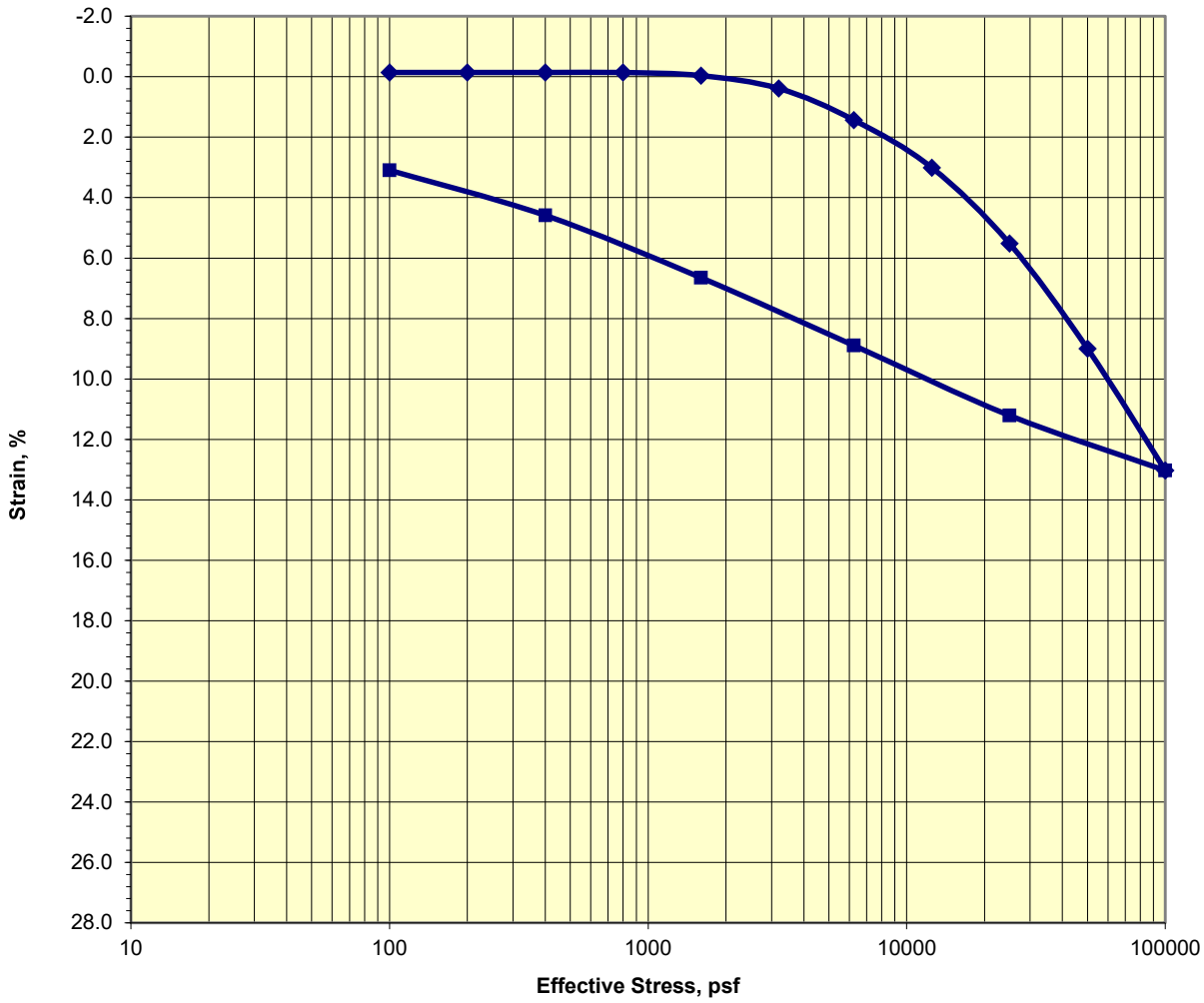
Assumed Gs 2.75	Initial	Final
Moisture %:	44.7	42.2
Dry Density, pcf:	74.0	79.5
Void Ratio:	1.320	1.160
% Saturation:	93.1	100.0

Remarks:

Consolidation Test
ASTM D2435

Job No.:	041-247	**Boring:**	B-13	**Run By:**	HM
Client:	AGS	**Sample:**	2B	**Reduced:**	RU
Project:	AGS-23-006	**Depth, ft.:**	8-8.5	**Checked:**	PJ
Soil Type:	Yellowish Brown Fat CLAY w/ Sand (Weathered Rock)			**Date:**	9/24/2024

Strain-Log-P Curve



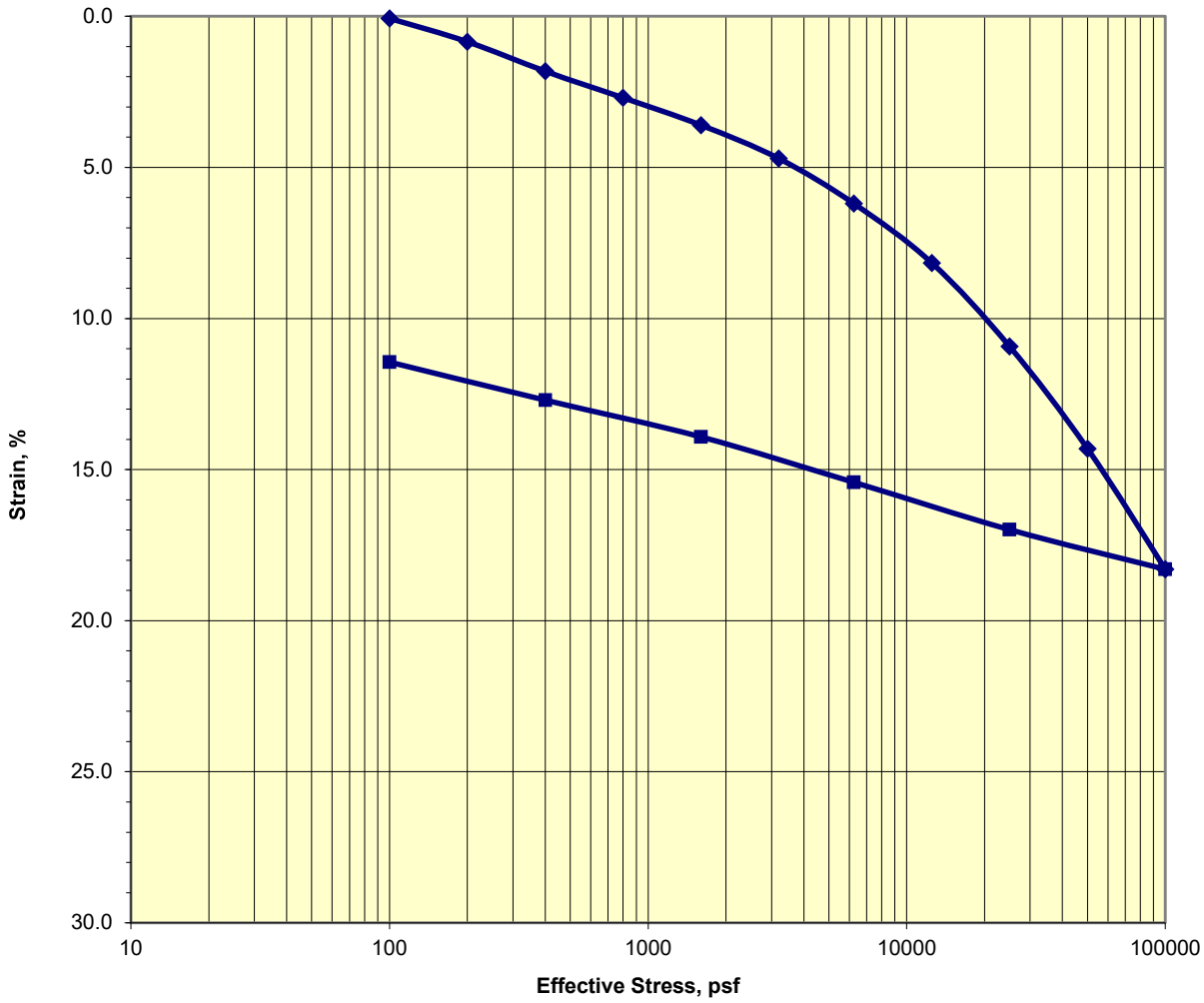
Assumed Gs 2.7	Initial	Final
Moisture %:	27.6	29.5
Dry Density, pcf:	90.3	93.9
Void Ratio:	0.867	0.795
% Saturation:	86.0	100.0

Remarks:

Consolidation Test
ASTM D2435

Job No.:	041-247	**Boring:**	B-18	**Run By:**	HM
Client:	AGS	**Sample:**	5B	**Reduced:**	RU
Project:	AGS-23-006	**Depth, ft.:**	15.5-16	**Checked:**	PJ
Soil Type:	Dark Olive Brown Clayey SAND (Weathered Claystone)			**Date:**	9/27/2024

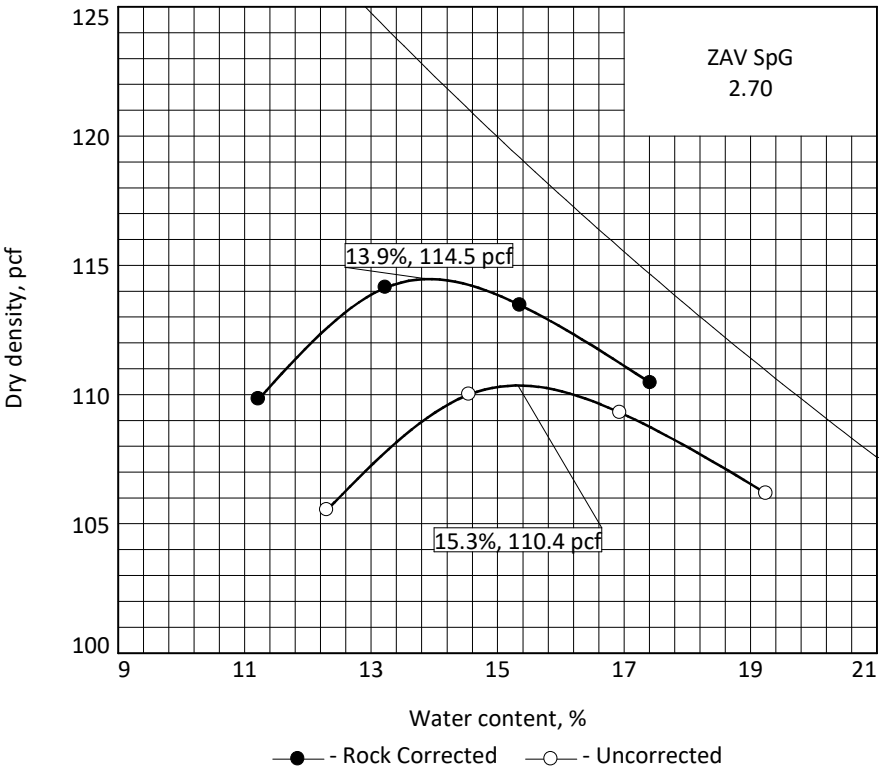
Strain-Log-P Curve



Assumed Gs 2.8	Initial	Final
Moisture %:	29.0	29.1
Dry Density, pcf:	86.4	96.3
Void Ratio:	1.022	0.814
% Saturation:	79.3	100.0

Remarks:

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-00 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: 0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM _____ **Sp.G.** 2.7
LL _____ **PI** _____
%>3/8 in. 10.8 **%<#200** _____
USCS _____ **AASHTO** _____

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.65	8.71	8.40	8.67		
WM	4.45	4.45	4.45	4.45		
WW + T #1	772.8	880.5	805.2	844.9		
WD + T #1	715.7	800.0	748.9	761.1		
TARE #1	323.3	324.7	291.5	325.6		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	13.2	15.4	11.2	17.4		
DRY DENSITY	114.1	113.5	109.8	110.4		

ROCK CORRECTED TEST RESULTS	UNCORRECTED	Material Description
Maximum dry density = 114.5 pcf	110.4 pcf	Brown Sandy CLAY w/ Gravel
Optimum moisture = 13.9 %	15.3 %	

Project No. 041-248 **Client:** AGS, Inc.
Project: WCWTP - AGS-23-006

○ **Source:** B-9,10,11,12 **Depth:** 0-5' **Sample No.:** Bulk

Remarks:

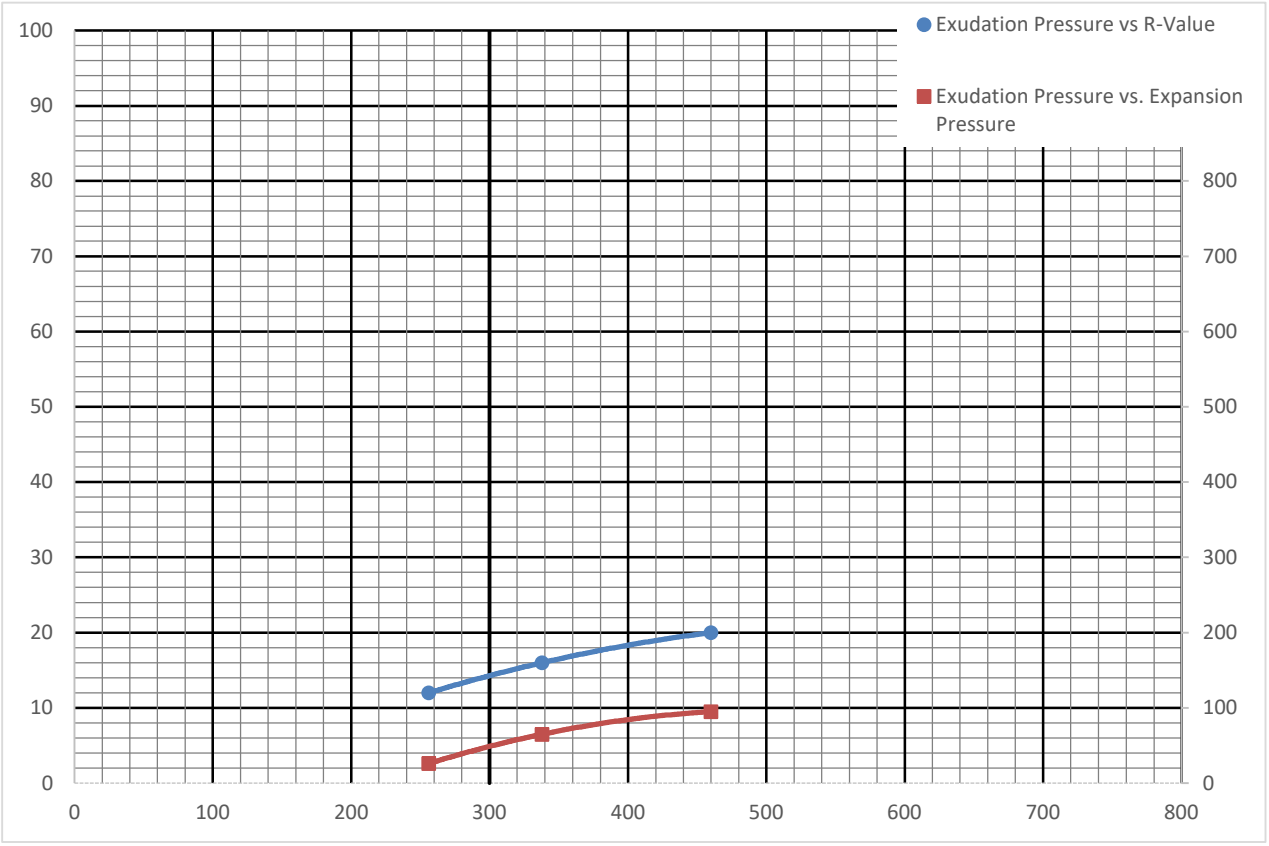
COOPER TESTING LABORATORY

Figure

R-Value
CTM 301

CTL Job No.:	041-248	Boring:	B-9,10,11,12	Reduced By:	RU
Client:	AGS	Sample:	Bulk	Checked By:	PJ
Project Number:	AGS-23-006	Depth:	0-5'	Date:	9/17/2024
Project Name:	WCWTP		**R-Value**		**14**
Soil Description:	Brown Sandy CLAY w/ Gravel				
Remarks:			**Expansion Pressure**		**50**

Specimen Designation	A	B	C	D	E
Compactor Foot Pressure (psi)	150	120	200		
Exudation Pressure (psi)	338	256	460		
Exudation Load (lbf)	4247	3217	5781		
Height After Compaction (in)	2.54	2.68	2.65		
Expansion Pressure (psf)	65	26	95		
Stabilometer @ 2000	134	136	126		
Turns Displacement	2.60	3.70	3.03		
R-value	16	11	18		
Corrected R-Value	16	12	20		
Moisture Content (%)	24.2	25.7	22.7		
Wet Density (pcf)	121.9	121.2	124.8		
Dry Density (pcf)	98.2	96.4	101.7		



Corrosivity Tests Summary

CTL # 041-248 | Date: 9/13/2024 | Tested By: PJ | Checked: PJ
Client: AGS, Inc. | Project: WCWTP | Proj. No: AGS-23-006
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		E_H (mv)	At Test	Qualitative by Lead	At Test %	
						Dry Wt.	Dry Wt.	Dry Wt.						
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
B-10	4	10-11.5'	-	-	519	11	305	0.0305	7.5	485	18	Negative	35.3	Light Olive Brown Sandy CLAY
B-13	4	15-16.5'	-	-	868	23	54	0.0054	7.4	513	19	Negative	29.8	Dark Yellowish Brown Sandy CLAY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.:	041-250A	Boring:	B-6B	Date:	11/6/2024
Client:	AGS	Sample:		By:	PJ
Project Name:	Rock Core Testing	Depth,ft.:	10'-10.5'	Checked:	DC
Project No.:	AGS-23-006				

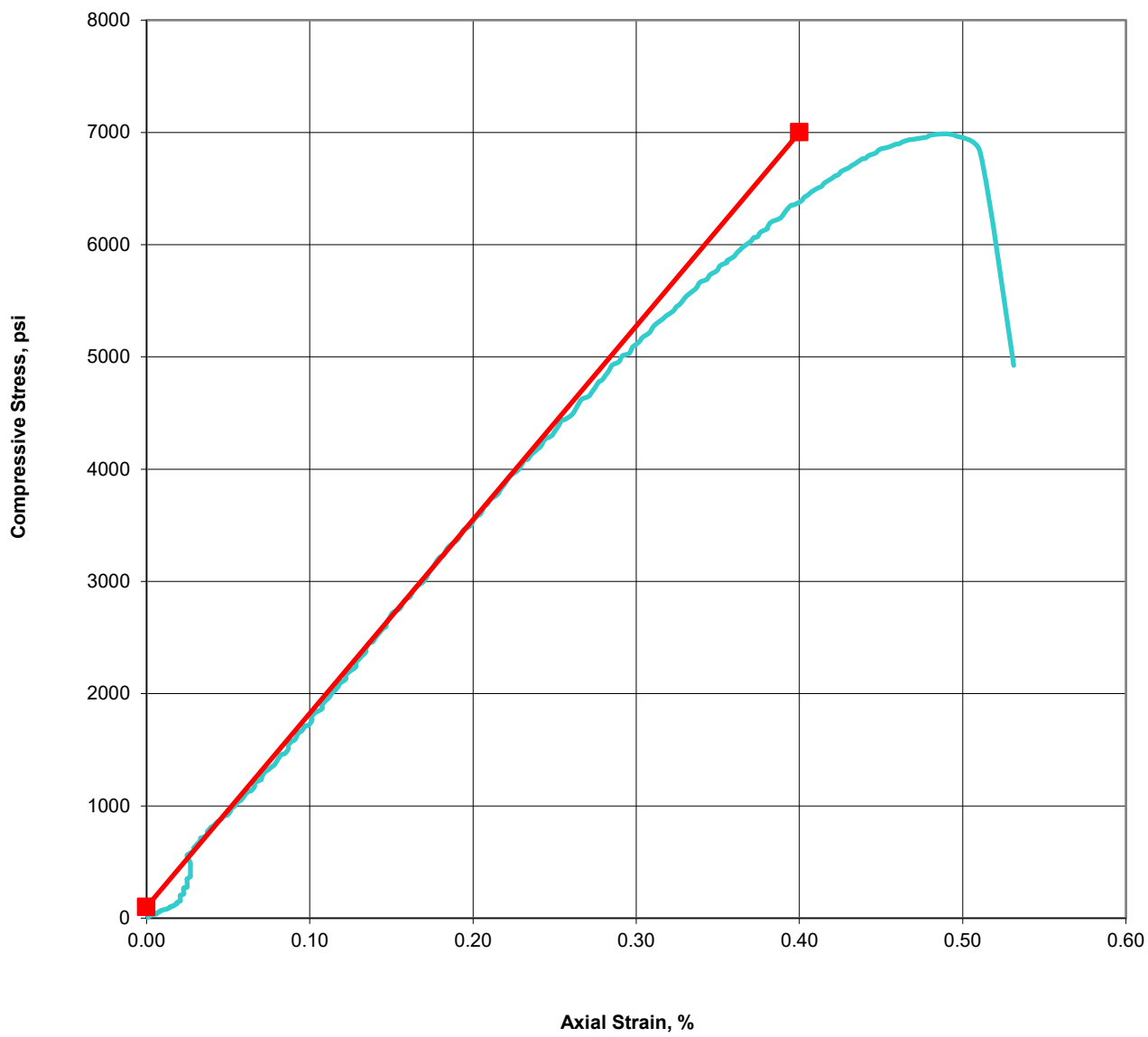
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (°C): Ambient

Remarks: Minor spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.84	**Unconfined Compressive Strength (psi)**	**6987**
Sample Diameter, in.	2.39		
Height / Diameter	2.0		
Sample Area, in^2	4.49		
Wet Density, pcf	146.8	**Young's Modulus (E) (psi)**	**1,725,000**
Dry Density, pcf	136.7		
Moisture Content, %	7.4		
Strain Rate, % / min	0.25		



POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 041-250 **Project No.:** AGS-23-006
Client: AGS **Date:** 11/11/2024
Project Name: Rock Core Testing **By:** PJ

Boring:	B-3	B-3				
Sample:						
Depth, ft:	23-24	23-24				
Visual Description:	Light Grayish Brown Rock	Light Grayish Brown Rock				
Test Type	Diametral	Diametral				
Test Type ID	1	1				
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None				
Loading Orientation Rel. to Bedding	N/A	N/A				
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	59.5	59.5				
Length Perpendicular to Loading, L, mm	30	30				
Diameter Parallel to Loading, D, mm	59.5	59.5				
Diameter at Failure, D', mm	56	55				
STRENGTH DATA						
Peak Load, P, kN	0.275	0.313				
Peak Load, P, lbs	61.8	70.4				
Uncorr. Pt. Load Strength Index, I_S, MPa	0.083	0.096				
Uncorr. Pt. Load Strength Index, I_S, psi	**12.0**	**13.9**				
Size Correction Factor, F	1.07	1.06				
Corr. Pt. Load Strength Index, $I_{S(50)}$, Mpa	0.09	0.10				
Corr. Pt. Load Strength Index, $I_{S(50)}$, psi	**13**	**15**				
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received				
Pan No.						
Pan wt. (g)	74.4	74.4				
Total wet wt. (g)	292.3	292.3				
Total dry wt (g)	276.09	276.09				
Moisture Content, %	**8.0**	**8.0**				
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 041-250 **Project No.:** AGS-23-006
Client: AGS **Date:** 11/11/2024
Project Name: Rock Core Testing **By:** PJ

Boring:	B-6B	B-6B				
Sample:						
Depth, ft:	13-13.5	13-13.5				
Visual Description:	Light Gray Rock	Light Gray Rock				
Test Type	Diametral	Axial				
Test Type ID	1	2				
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None				
Loading Orientation Rel. to Bedding	N/A	N/A				
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60.8	60.8				
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60.8	43				
Diameter at Failure, D', mm	59	41				
STRENGTH DATA						
Peak Load, P, kN	0.295	0.88				
Peak Load, P, lbs	66.3	197.8				
Uncorr. Pt. Load Strength Index, I_S, MPa	0.082	0.277				
Uncorr. Pt. Load Strength Index, I_S, psi	**11.9**	**40.2**				
Size Correction Factor, F	1.08	1.06				
Corr. Pt. Load Strength Index, $I_{S(50)}$, Mpa	0.09	0.29				
Corr. Pt. Load Strength Index, $I_{S(50)}$, psi	**13**	**42**				
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received				
Pan No.						
Pan wt. (g)	20.23	20.23				
Total wet wt. (g)	176.98	176.98				
Total dry wt (g)	168.77	168.77				
Moisture Content, %	**5.5**	**5.5**				
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No:	041-250	**Project No.:**	AGS-23-006
Client:	AGS	**Date:**	11/11/2024
Project Name:	Rock Core Testing	**By:**	PJ

Boring:	B-8					
Sample:						
Depth, ft:	26-26.5					
Visual Description:	Yellowish Gray Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60.7					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60.7					
Diameter at Failure, D', mm	58					
STRENGTH DATA						
Peak Load, P, kN	0.786					
Peak Load, P, lbs	176.7					
Uncorr. Pt. Load Strength Index, I_S, MPa	0.223					
Uncorr. Pt. Load Strength Index, I_S, psi	**32.4**					
Size Correction Factor, F	1.08					
Corr. Pt. Load Strength Index, $I_{S(50)}$, Mpa	0.24					
Corr. Pt. Load Strength Index, $I_{S(50)}$, psi	**35**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	22.28					
Total wet wt. (g)	276.45					
Total dry wt (g)	248.88					
Moisture Content, %	**12.2**					
Comments:	Invalid Test. Did not fail through both loading points.					

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

APPENDIX C

PREVIOUS BORING LOGS BY OTHERS

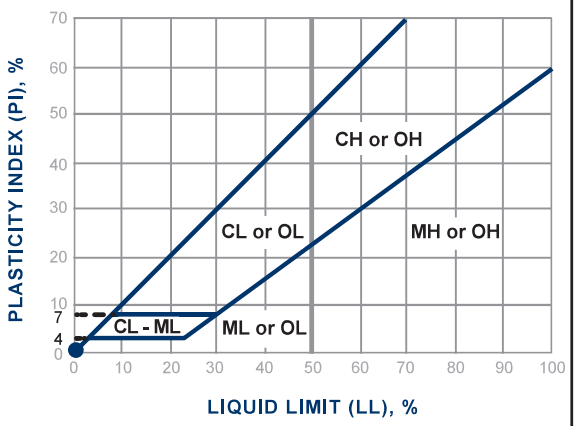
Soil Classification Chart Per ASTM D 2488

Primary Divisions			Secondary Divisions	
			Group Symbol	Group Name
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	**GRAVEL** more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines	GW	well-graded GRAVEL
			GP	poorly graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines	GW-GM	well-graded GRAVEL with silt
			GP-GM	poorly graded GRAVEL with silt
			GW-GC	well-graded GRAVEL with clay
			GP-GC	poorly graded GRAVEL with
		GRAVEL with FINES more than 12% fines	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND 50% or more of coarse fraction passes No. 4 sieve	CLEAN SAND less than 5% fines	SW	well-graded SAND
			SP	poorly graded SAND
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines	SW-SM	well-graded SAND with silt
			SP-SM	poorly graded SAND with silt
			SW-SC	well-graded SAND with clay
			SP-SC	poorly graded SAND with clay
		SAND with FINES more than 12% fines	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS 50% or more passes No. 200 sieve	**SILT and CLAY** liquid limit less than 50%	INORGANIC	CL	lean CLAY
			ML	SILT
			CL-ML	silty CLAY
		ORGANIC	OL (PI > 4)	organic CLAY
			OL (PI < 4)	organic SILT
	SILT and CLAY liquid limit 50% or more	INORGANIC	CH	fat CLAY
			MH	elastic SILT
		ORGANIC	OH (plots on or above "A"-line)	organic CLAY
			OH (plots below "A"-line)	organic SILT
	Highly Organic Soils		PT	Peat

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		> 12"	> 12"	Larger than basketball-sized
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

Plasticity Chart



Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

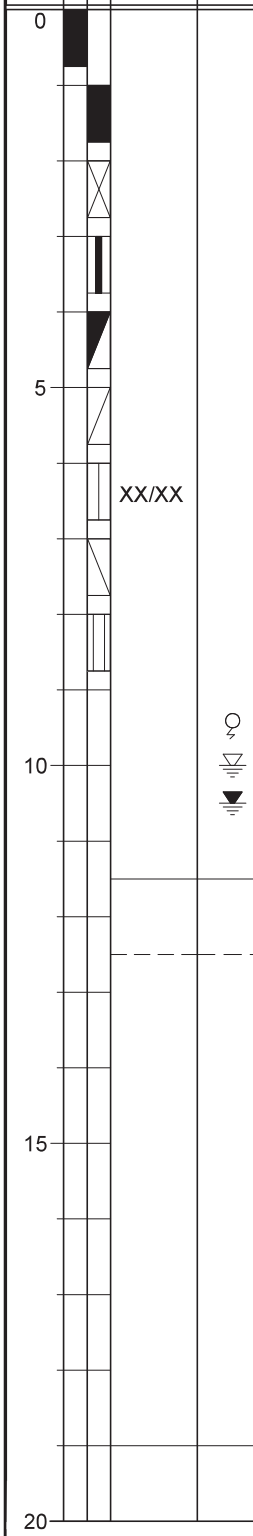
Consistency - Fine-Grained Soil

Consis-tency	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
Stiff	9 - 15	11 - 20	6 - 10	7 - 13
Very Stiff	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

USCS METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET



Bulk sample.

Modified split-barrel drive sampler.

No recovery with modified split-barrel drive sampler.

Sample retained by others.

Standard Penetration Test (SPT).

No recovery with a SPT.

Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.

No recovery with Shelby tube sampler.

Continuous Push Sample.

Seepage.

Groundwater encountered during drilling.

Groundwater measured after drilling.

SM

MAJOR MATERIAL TYPE (SOIL):
Solid line denotes unit change.

CL

Dashed line denotes material change.

Attitudes: Strike/Dip
b: Bedding
c: Contact
j: Joint
f: Fracture
F: Fault
cs: Clay Seam
s: Shear
bss: Basal Slide Surface
sf: Shear Fracture
sz: Shear Zone
sbs: Shear Bedding Surface

The total depth line is a solid line that is drawn at the bottom of the boring.

LEGEND FOR ROCK CORE BORINGS

The following tables present the terminology used, along with definitions and abbreviations of the terminology used on the rock core boring logs presented in this appendix. The tables have been derived from the Engineering Geology Field Manual published by the U.S. Department of the Interior Bureau of Reclamation.

Tables A–1 through A–3: Rock Descriptions

Table A–1: Description of Rock Fracturing

	Unfractured	No Observed Fractures
1	Very slightly fractured	Core length recovery greater than 3’
2	Slightly to very slightly fractured	*
3	Slightly fractured	Core length recovery from 1’ to 3’
4	Moderately to slightly fractured	*
5	Moderately fractured	Core length recovery from 0.33’ to 1’
6	Intensely to moderately fractured	*
7	Intensely fractured	Core length recovery from 0.1’ to 0.33’
8	Very intensely to intensely fractured	*
9	Very intensely fractured	Core length recovery mostly chips and fragments
	*Note: Combinations of fracture densities are used where equal distribution of both fracture density characteristics are present over a significant core interval or exposure.	

Table A–2: Description of Rock Weathering

1	Fresh	No discoloration, surfaces not oxidized.
2	Slightly weathered	Discoloration and oxidation limited to surfaces.
3	Moderately weathered	Discoloration and oxidation extends from fractures, partial chemical alteration of some minerals.
4	Intensely weathered	Discoloration and oxidation throughout; chemical alteration of most minerals; Rock is friable.
5	Decomposed	Rock decomposed; resembles a soil.

Table A–3: Description of Rock Hardness

1	Extremely hard	Can’t be scratched with knife; can only be chipped with repeated heavy hammer blows.
2	Very hard	Can’t be scratched with knife; core can only be broken with repeated heavy hammer blows.
3	Hard	Can be scratched with a knife with difficulty; core can be broken with heavy hammer blow.
4	Moderately hard	Can be scratched with a knife with light to moderate pressure; core breaks with moderate hammer blow.
5	Moderately soft	Can be grooved 1/16 in. deep by knife with moderate to heavy pressure; core can be broken with light hammer blow.
6	Soft	Can be grooved easily with a knife with light pressure; core breaks with light to moderate manual pressure.
7	Very soft	Can be easily carved with a knife; core breaks with light manual pressure.

Tables A–4.1 through A–4.5: Descriptions and Abbreviations for Fractures

Table A–4.1: Surface Roughness

St	Stepped	Near normal steps and ridges occur on the fracture surface.
R	Rough	Large, angular asperities can be seen.
Mr	Moderately rough	Asperities are clearly visible and fracture surface feels abrasive.
Sm	Smooth	No asperities; smooth to the touch.

Table A–4.2: Surface Shape

Pl	Planar	Flat and uniform.
Un	Undulatory	Wavy and symmetrical.
Irr	Irregular	Non-uniform and symmetrical.

Table A–4.3: Aperture

T	Tight	No visible separation
So	Slightly Open	<1/32 inch
Mo	Moderately Open	1/32 inch – 1/8 inch
O	Open	1/8 inch – 3/8 inch
Mw	Moderately Wide	3/8 inch – 1.2 inches
W	Wide	>1.2 inches

Table A–4.4: Type of Infilling

Cl	Clay
Ca	Calcite
Ch	Chlorite
Fe	Iron Oxide
G	Gypsum
Mn	Manganese Oxide
Q	Quartz

Table A–4.5: Thickness of Infilling

Sta	Surface Staining	---
Vth	Very thin	<1/32 inch
Mth	Moderately thin	1/32 inch – 1/8 inch
Th	Thin	1/8 inch – 3/8 inch
Mtk	Moderately thick	3/8 inch – 1.2 inches
Tk	Thick	>1.2 inches

DATE DRILLED 9/10/2021 BORING NO. SB-1

GROUND ELEVATION 363' ± PD SHEET 1 OF 1

METHOD OF DRILLING 6" Sonic Dual Tube, Geoprobe 8140LS (Geo-Ex)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	FILL: Brown, dry, clayey SAND; like gravel.
			30.8				Dark brown, moist.
10						CH	COLLUVIUM: Dark brown, moist, fat CLAY; little sand.
			25.1				
						ROCK	BRIONES FORMATION: Olive brown, moist, weakly cemented, SILTSTONE; highly weathered.
			24.7				
20			42.1				Moderately cemented.
			25.7				
30							Total depth = 28 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
40							

DATE DRILLED 9/10/2021 BORING NO. SB-2

GROUND ELEVATION 355' ± PD SHEET 1 OF 2

METHOD OF DRILLING 6" Sonic Dual Tube, Geoprobe 8140LS (Geo-Ex)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	FILL: Gray, dry, clayey SAND; little gravel.
						SM	Light brown, moist, silty SAND; little gravel.
						CL	Brown, moist, sandy lean CLAY; little gravel.
			27.4				
10			23.4				Dark gray.
			21.2			GC	Dark gray, moist, clayey GRAVEL; some sand.
						CL	Brown, moist, sandy CLAY.
20			27.1				Orange streaks.
30							Olive brown; trace sand. Trace sand.
			26.8				Tree root.
						ROCK	BRIONES FORMATION: Light gray, moist, weakly cemented, SANDSTONE and SILTSTONE; weathered.
40							

FIGURE A- 2

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

403982001 | 6/22

DATE DRILLED 9/10/2021 BORING NO. SB-2

GROUND ELEVATION 355' ± PD SHEET 2 OF 2

METHOD OF DRILLING 6" Sonic Dual Tube, Geoprobe 8140LS (Geo-Ex)

DRIVE WEIGHT N/A DROP N/A

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								BRIONES FORMATION: (Continued) Dark gray, moist, weakly cemented, SILTSTONE.
								Total depth = 45 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
50								
60								
70								
80								

DATE DRILLED 9/27/2021 BORING NO. NMB-1

GROUND ELEVATION 387' ± PD SHEET 1 OF 1

METHOD OF DRILLING 2.5" HQ Wireline Core, CME 75 Track Mounted Rig (Geo Ex)

DRIVE WEIGHT 140 lbs (Auto Trip) DROP 30 inches

SAMPLED BY TBG LOGGED BY DCS REVIEWED BY PCC

DEPTH (feet)	Samples: Bulk	Samples: Driven	BLOWS/FOOT	INTERVAL CORED (feet)	RECOVERY (%)	RQD (%)	FRACTURE FREQ. (per ft)	FRACTURE DIP (degrees)	DRILLING RATE (min/ft.)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0											ROCK	HAMBRE FORMATION: Light gray and brown, weakly to strongly cemented, SILTSTONE and sandy SILTSTONE; intensely to moderately fractured, intensely to moderately weathered, soft to moderately hard.
			78									
			50/5"									Moisture content = 25.8%; Dry Density = 77.2 pcf.
10												
			50/3" 50/5"									
				1.7	100	50	2	75 65	5.9			Core Run 1 - 14.8' to 16.5' - Recovery 100% - RQD=50. Mr, Pl, So, G, Vth Mr, Pl, So, G, Mth
							3					
							2	55				Core Run 2 - 16.9' to 21.5' - Recovery 93% - RQD=66.
				5	93	66	1		2.4			Mr, Pl, So, Ca, Mth Moderately hard, carbonate cement, iron oxide staining on bioturbation structures, appears massive.
20							2					
							2 2	75				Sm, Pl, So, G, Mth Core Run 3 - 21.5' to 26.5' - Recovery 98% - RQD=43.
				5	98	43	1 3 2	85	3.4			Mr, Pl, So, Ca, Mth
30												Total Depth = 26.5 feet. Boring was backfilled with cement grout, on 9/27/2021, after drilling. Groundwater was not measurable due to drilling fluid. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020) reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
40												

DATE DRILLED 9/27/2021 BORING NO. NMB-2

GROUND ELEVATION 383' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ROCK	HAMBRE FORMATION: Light gray, dry, weathered, silty SANDSTONE; iron oxide staining on fractures.
			50/3"					
			50/5"					
10								Total depth = 9.4 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
20								
30								
40								

DATE DRILLED 9/27/2021 BORING NO. NMB-3

GROUND ELEVATION 377' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: 4.5 INCHES.
						SC	AGGREGATE BASE: 5.5 INCHES.
							FILL: Gray and brown, moist, medium dense, clayey SAND; trace gravel.
		38				CH	Mottled gray, brown, reddish brown, moist, hard, fat CLAY; some sand.
		51				SM	Gray and brown, moist, dense, silty SAND; pieces of sandstone in silty matrix.
10						CL	Brown, moist, hard, sandy lean CLAY; trace gravel composed of pieces of bedrock.
		44	24.0	94.0		SC	Gray and brown, moist, dense, clayey SAND; little gravel.
		45	26.5	91.5		SM	Gray, moist, dense, silty SAND; little gravel.
20		59					
		50/2"				ROCK	HAMBRE FORMATION: Gray, weathered, silty SANDSTONE and sandy SILTSTONE.
30							Total depth = 28.7 feet.
							Backfilled with cement grout and on-site soils after completion of drilling.
							Notes:
							Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
							The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
40							

DATE DRILLED 9/28/2021 BORING NO. NMB-4

GROUND ELEVATION 363' ± PD SHEET 1 OF 2

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	FILL: Gray and brown, dry, dense, clayey SAND; little gravel. Asphalt chunk.
		57	19.2	89.5			
		17	26.8	91.3		SM	Light to medium brown, moist, medium dense, silty SAND; little gravel.
		75	18.8	101.1		CL	Gray and brown, moist, sandy lean CLAY; trace gravel.
10							
		33	28.0	94.1		SC CL	Brown, moist, medium dense, clayey SAND; scattered rootlets; brick debris. Brown, moist, hard, lean CLAY.
		16	13.6	113.1		GC	Dark gray and brown, moist, medium dense, clayey GRAVEL with sand; scattered asphalt debris; scattered rootlets.
20							
		64					Medium brown to gray; scattered rootlets. Olive brown; dense.
		50				CL	Brown, moist, hard, sandy lean CLAY with gravel; asphalt chunks.
30							
		45	26.6	93.9			Trace gravel.
		56				ROCK	BRIONES FORMATION:
40							

FIGURE A- 7

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

DATE DRILLED 9/28/2021 BORING NO. NMB-4

GROUND ELEVATION 363' ± PD SHEET 2 OF 2

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								Gray, moist, weakly cemented, SANDSTONE; weathered; iron oxide staining on fractures.
								Total depth = 40 feet.
								Backfilled with cement grout and on-site soils after completion of drilling.
								Notes:
								Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
								The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
50								
60								
70								
80								

DATE DRILLED 9/28/2021 BORING NO. NMB-5

GROUND ELEVATION 319' ± PD SHEET 1 OF 2

METHOD OF DRILLING 4" Solid Stem Auger, 4" mud rotary CME-75 Track Mounted (Geo-

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0		50/5"	17.7	99.1		SC	FILL: Brown, dry, very dense, clayey SAND with gravel.
		50/6"	20.4	100.6		CL	Brown, moist, hard, lean CLAY.
						ROCK	HAMBRE FORMATION: Light brown and brown, dry, moderately cemented, sandy SILTSTONE and silty SANDSTONE; weathered.
		50/5"					
10		50/6"	18.2				
		50/3"					
20							Switched to rotary wash @20'.
		50/6"	36.4				
		50/5"					Gray.
30							
		50/2"					
		50/3"	29.8				
40							

FIGURE A- 9

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

403982001 | 6/22

DATE DRILLED 9/28/2021 BORING NO. NMB-5

GROUND ELEVATION 319' ± PD SHEET 2 OF 2

METHOD OF DRILLING 4" Solid Stem Auger, 4" mud rotary CME-75 Track Mounted (Geo-

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY SSA REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								Total depth = 38.8 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
50								
60								
70								
80								

FIGURE A- 10

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

DATE DRILLED 10/08/2021 BORING NO. NMB-6

GROUND ELEVATION 352' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	FILL: Brown, moist, medium dense, clayey SAND with gravel; scattered asphalt.
10		19	23.0	98.6			Brown and olive brown.
		45	26.9	94.6			Orange and gray, dense. Grayish brown.
20		76	31.5	91.3		ROCK	BRIONES FORMATION: Gray, moist, weakly cemented, SILTSTONE; weathered; iron oxide staining on fractures; gypsum veins.
		69					Light brown.
30							Total depth = 25 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
40							

DATE DRILLED 10/08/2021 BORING NO. NMB-7

GROUND ELEVATION 331' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	FILL: Brown, moist, clayey SAND.
		46	25.1	96.7			Brown, moist, dense, clayey SAND; little gravel.
10		76	23.5	96.2			Very dense.
		35	30.7	82.7		CL	Brown, moist, hard, sandy lean CLAY.
20		36	22.1	91.3		CH	COLLUVIUM: Dark brown, moist, hard, fat CLAY; little sand.
		76	29.8	88.6		ROCK	BRIONES FORMATION: Olive brown, moist, weakly cemented, SILTSONE; weathered; iron oxide staining on fractures.
30		73					
		84	22.9	96.8			Moderately cemented.
							Total depth = 35 feet. Backfilled with cement grout and on-site soils after completion of drilling. See Figure A-1 for groundwater and elevation notes.
40							

FIGURE A- 12

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

DATE DRILLED 10/08/2021 BORING NO. NMB-8

GROUND ELEVATION 303' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0			50/6"				CL	FILL: Brown, dry, hard, sandy lean CLAY.
			50/6"				ROCK	HAMBRE FORMATION: Gray, dry, moderately cemented, silty SANDSTONE; weathered. Light brown and gray; strongly cemented.
10			50/3"					
								Total depth = 10.8 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
20								
30								
40								

FIGURE A- 13

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

DATE DRILLED 10/08/2021 BORING NO. NMB-9

GROUND ELEVATION 382' ± PD SHEET 1 OF 1

METHOD OF DRILLING 4" Solid Stem Auger, CME-75 Track Mounted (Geo-Ex)

DRIVE WEIGHT 140 lbs (automatic) DROP 30 inches

SAMPLED BY TBG LOGGED BY TBG REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	COLLUVIUM: Brown, dry, medium dense, clayey SAND.
						CL	Dark brown, moist, hard, sandy lean CLAY.
		29					
10		38	21.2	95.7			
						ROCK	BRIONES FORMATION: Gray, dry, weakly cemented, sandy SILTSTONE; weathered; iron oxide staining on fractures.
		69	27.6	90.7			
20		50/3"					Moderately cemented.
		50/5"					Dark gray; strongly cemented.
							Total depth = 25.9 feet. Backfilled with cement grout and on-site soils after completion of drilling. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of topographic information (EBMUD, 2020). It is not sufficiently accurate for preparing construction bids and design documents.
30							
40							

FIGURE A- 14

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WALNUT CREEK WATER TREATMENT PLANT
2201 LARKEY LANE, WALNUT CREEK, CALIFORNIA

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

MAJOR DIVISIONS			SYMBOLS		SECONDARY DIVISIONS
COARSE-GRAINED SOILS more than half is larger than No. 200 sieve	GRAVELS more than half coarse fraction is larger than No. 4 sieve size	CLEAN GRAVELS (less than 5% fines)	GW		well graded gravels, gravel-sand mixtures, little or no fines
			GP		poorly graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS with fines	GM		silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC		clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS more than half coarse fraction is smaller than No. 4 sieve size	CLEAN SANDS (less than 5% fines)	SW		well graded sands, gravelly sands, little or no fines
			SP		poorly graded sand or gravelly sands, little or no fines
		SANDS with fines	SM		silty sands, sand-silt mixtures, non-plastic fines
			SC		clayey sands, sand-clay mixtures, plastic fines
FINE-GRAINED SOILS (fines) more than half is smaller than No. 200 sieve	SILTS AND CLAYS liquid limit is less than 50		ML		inorganic silts and 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 is greater than 50		MH		inorganic silts, micaceous or diatomacious 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

PENETRATION RESISTANCE

(RECORDED AS BLOWS/FOOT)

SANDS AND GRAVELS

RELATIVE DENSITY	BLOWS/FOOT *
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CLAYS AND SILTS

CONSISTENCY	BLOWS/FOOT *	STRENGTH **
VERY SOFT	0 - 2	0 - 1/4
SOFT	2 - 4	1/4 - 1/2
MEDIUM STIFF	4 - 8	1/2 - 1
STIFF	8 -16	1 - 2
VERY STIFF	16 - 32	2 - 4
HARD	OVER 32	OVER 4

* Number of blows of 140 pound hammer falling 30 inches to drive a 2-inch O.D (1-3/8 inch I.D.) split-barrel sampler (ASTM-1586 standard penetration test).

** Unconfined compressive strength in tons per square foot

DEFINITION OF TERMS

GRAIN SIZES

U.S. STANDARD SERIES SIEVE

#200 #50 #16 #4 3/4" 3" 12"

SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

GRADATION

Well-graded gravels and sands: Specimen with a *wide* range of grain sizes.
Poorly-graded gravels and sands: Specimen with a *narrow* range of grain sizes.

MOISTURE CONDITION

DRY SLIGHTLY DAMP DAMP MOIST VERY MOIST WET (SATURATED)

EBMUD

WALNUT CREEK WTP IMPROVEMENTS PROJECT

Date: 4/1/2001

Figure:

u:\template\boring log legend.xls.xls

LEGEND

EBMUD

SAMPLE

MC	Modified California Sampler
SPT	Standard Penetration Test Sampler
1	First Sample Interval (2=second, etc.)
I	First Sample Tube Recovered (II=second, etc.)

TEST RESULTS

LL	Liquid Limit (%)	} ATTERBERG LIMITS
PL	Plastic Limit (%)	
PI	Plasticity Index (%)	
SG	Specific Gravity	
FINES	Percentage Passing #200 Sieve	
TX (1000)	Triaxial Shear Strength, psf (Confining Stress) (Strength taken at peak stress ratio)	

UU - Unconsolidated Undrained
CU - Consolidated Undrained

NOTES

$\underline{\nabla}_{10/27}$ Indicates approximate ground water level on October 27.

Elevations are referenced to National Geodetic Vertical Datum (1929) [redacted]

Blow counts shown are actual counts recorded for the 12 inches of penetration after the first 6 inches. 50/3" indicates 50 blows to drive the sampler 3" total. Each sampler was driven as follows:

Sampler Type	Hammer Wt. (pound)	Hammer Drop (inches)	Sampler penetration (inches)
MC	140	30	18
SPT	140	30	18

PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

I. CONSOLIDATION OF SEDIMENTARY ROCKS: Usually determined from unweathered samples. Largely dependant on cementation.

U = Unconsolidated
P = Poorly consolidated
M = Moderately consolidated
W = Well consolidated

II. BEDDING OF SEDIMENTARY ROCKS

SPLITTING PROPERTY	THICKNESS (IN FEET)	STRATIFICATION
Massive	Greater than 4.0	Very thick-bedded
Blocky	2.0 to 4.0	Thick-bedded
Slabby	0.2 to 2.0	Thin-bedded
Flaggy	0.05 to 0.2	Very thin-bedded
Shaly or Platy	0.01 to 0.05	Laminated
Papery	Less than 0.01	Thinly laminated

III. FRACTURING

INTENSITY	SIZE OF PIECES (IN FEET)
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

IV. HARDNESS

1. SOFT - Reserved for plastic material alone.
2. LOW HARDNESS - Can be gouged deeply or carved easily with a knife.
3. MODERATELY HARD - Can be readily scratched by a knife; scratch leaves a heavy trace of dust and is readily visible after the powder is blown away.
4. HARD - Can be scratched with difficulty; scratch produces little powder and is often faintly visible.
5. VERY HARD - Cannot be scratched with knife blade; leaves a metallic streak.

V. STRENGTH

1. PLASTIC or very low strength
2. FRIABLE - Crumbles easily by rubbing with fingers.
3. WEAK - An unfractured specimen of such material will crumble under light hammer blows.
4. MODERATELY STRONG - Specimen will fracture with a few hammer blows.
5. STRONG - Specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

VI. WEATHERING The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. DEEP - Moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates, and/or clay or silt.
M. MODERATE - Slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasional intense discoloration. Moderately coated fractures.
L. LITTLE - No megascopic decomposition of minerals; little or no effect on normal cementation. Slight and intermittent or localized discoloration. Few stains on fracture surfaces.
F. FRESH - Unaffected by weathering agents. No disintegration or discoloration. Fractures usually less numerous than joints.

EAST BAY MUNICIPAL UTILITY DISTRICT
OAKLAND, CALIFORNIA

WALNUT CREEK WTP
IMPROVEMENTS PROJECT

	DRAWN BY: A. B. YIADOM
	SCALE: NONE
	DATE: April 2001

LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 28, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -1

SURFACE ELEV. : 376.8

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown silty CLAY (CH), stiff (fill)
SG=2.75 LL=54, PI=33	27.4		19		MC-1	
FINES=74.4% LL=52, PI=30	32.2		17	5	SPT-2	
LL=40, PI=8	27.4		30		SPT-3	olive brown sandy SILT (ML), very stiff (fill)
TX-CU=2700 (1300) SG=2.69	27.4	94.5		10	P-4	brown silty SAND (SM), dense, with gravel and a few cobbles. Gravel is crushed sandstone, siltstone and claystone (fill)
FINES=35.8%						
FINES=47.2%	30.4		34		SPT-5	
	27.6		38	15	SPT-6	
FINES=44.6%	29.6		26		SPT-7	
TX-CU=3100 (2600) FINES=34.9%	25.2	96.2		20	P-8	
FINES=42.6%	24.9		47		SPT-9	
	22.1		34	25	SPT-10	
FINES=44.3%	21.6		52		SPT-11	
				30		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 28, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -1

SURFACE ELEV. : 376.8

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				30	P-12	brown silty SAND (SM), dense, with gravel and a few cobbles. Gravel is crushed sandstone, siltstone, and claystone (fill)
FINES=38.8%	24.6		47		SPT-13	
	22.3		34	35	SPT-14	
FINES=42.9%	24.8		37		SPT-15	
TX-CU=6600 (5100)	22.1	97.2		40	P-16	
FINES=33.7%						
LL=41, PI=14	25.7		30		SPT-17	
				45		
FINES=27.9%	24.2		49		SPT-18	
TX-CU=6400 (5900)						
FINES=36.5%	24.1	92.7			P-19	
				50		
TX-CU=4950 (6600)					P-20	
FINES=44.8%	32.1	89.4			P-21	
LL=39, PI=9				55		
	30.3		56		SPT-22	dark brown sandy SILT (ML), hard (fill)
TX-CU=3150 (2400) 6100 (4900) 8550 (7100)	30.2	89.8			P-23	
				60		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 28, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -1

SURFACE ELEV. : 376.8

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
	30.5		35	60	SPT-24	mottled dark brown sandy SILT (ML), hard (fill)
			50	65	SPT-25	
				70	P-26	grey SANDSTONE, SILTSTONE and CLAYSTONE, friable to moderately strong, moderately weathered
			50/3"	75	SPT-27	
						Bottom of Boring at 76.0'
				80		
				85		
				90		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 5, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -2

SURFACE ELEV. : 359'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		dark brown sandy SILT (ML), stiff (fill)
FINES=52.7% LL=42, PI=25	17.9		20		SPT-1	
				5		
LL=53, PI=31	31.5		14		SPT-2	gravelly
						brown silty SAND (SM), medium dense (fill)
FINES=38.3% LL=54, PI=22	34.5		25		SPT-3	
TX-CU=1400 (1100) SG=2.61 LL=40, PI=7	27.7	91.3		10	P-4	reddish brown silty SAND (SM) with gravel. Gravel is crushed sandstone, siltstone, and claystone (fill)
FINES=30.4%	28.6		29		SPT-5	
				15		
	31.6		33		SPT-6	
FINES=32.2%	35.3		23		SPT-7	
				20	P-8	
FINES=36.3%	26.2		28		SPT-9	
						brown SANDSTONE, SILTSTONE, CLAYSTONE, friable to moderately strong, deep to moderately weathered
				25		
			50/5"		SPT-10	
			50/3"		SPT-11	
				30		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 5, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -2

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				30	P-12	orange-brown clayey SANDSTONE, weak, deeply weathered
			50/6"		SPT-13	
						Bottom of Boring at 33.0'
				35		
				40		
				45		
				50		
				55		
				60		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 3, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -3

SURFACE ELEV. : 376'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown clayey SILTY SAND (SM), medium dense with gravel. Gravel is crushed sandstone, siltstone and claystone (fill)
FINES=29%	24.3		49		SPT-1	
				5		
LL=48;PI=16	31.4		16		SPT-2	sandy CLAY layer
LL=45;PI=16	36.1		24		SPT-3	
TX-CU=1750 (2400)	24.5	98.5		10		
LL=30;PI=4 FINES=23.4%					P-4	
						sandy CLAY layer
			28		SPT-5	clayey SAND layer
				15		
	32.8		29		SPT-6	
	25.1		30		SPT-7	
				20		
TX-CU=5700 (4500)	36.4	81.8			P-8	
LL=40;PI=13 FINES=29.7%						
	35.4		26		SPT-9	
				25		
	34.5		22		SPT-10	
	22.3		48		SPT-11	
				30		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 3, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -3

SURFACE ELEV. : 376'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				30	P-12	brown silty SAND (SM), medium dense, with gravel. Gravel is crushed sandstone, siltstone and claystone (fill)
LL=36, PI=5	25.9		28		SPT-13	
TX-CU=4400 (4500) SG=2.65	25.8	95.2		35	P-14	
FINES=29.4% LL=42, PI=12	29.3		35		SPT-15	grey
FINES=27.3%				40	P-16	
LL=39, PI=8	31.2		27		SPT-17	
LL=37, PI=6	30.6		45	45	SPT-18	
TX-CU=6200 (6400) FINES=35.4% LL=44, PI=13	30.8		40		SPT-19	Orange-brown
FINES=34.7	29.8	90.0		50	P-20	
FINES=40.7% LL=39, PI=5	24.8		55		SPT-21	greyish-brown SANDSTONE and SILTSTONE, friable to moderately strong, deep to moderately weathered
			50	55	SPT-22	
			50/5"		SPT-23	
				60		

LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 3, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -3

SURFACE ELEV. : 376'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-CU=7550 (7610)	27.0	95.9		60	P-24	dark grey SILTSTONE, moderately strong, moderately weathered
			50/3"	65	SPT-25	Bottom of Boring at 65.5'
				70		
				75		
				80		
				85		
				90		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
LOCATION : Walnut Creek Clearwell
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 5, 1997
CONTRACTOR : Pitcher Drilling
EQUIPMENT : Failing 750
JOB NUMBER : 56248

EBMUD

BORING NO MM -4

SURFACE ELEV. : 376'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown sandy CLAY (CL), hard (fill)
LL=36, PI=16	12.6		36		SPT-1	
				5		tan silty SAND (SM), medium dense, with gravel (fill)
FINES=39.2%	23.8		22		SPT-2	
LL=45, PI=17	33.0		31		SPT-3	
				10		
TX-CU=1800 (1200)	32.9	84.0			P-4	
FINES=23.1%						
	32.9		27		SPT-5	reddish brown
				15		
LL=58, PI=29	35.3		27		SPT-6	reddish brown gravelly CLAY (CH) with sand, very stiff (fill)
LL=55, PI=28	31.9		25		SPT-7	silt layer
TX-CU=2650 (2600)	33.4	87.9		20		
SG=2.72 FINES=18.4% LL=55, PI=22					P-8	alternating layers of brown silty SAND (SM), medium dense; and grey sandy SILT (ML), stiff, both with gravel and some cobbles (fill)
	36.8		28		SPT-9	
				25		
FINES=51.2%	24.3		41		SPT-10	
LL=38, PI=9	27.3		35		SPT-11	
				30		

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
DATE : November 5, 1997
LOCATION : Walnut Creek Clearwell
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NUMBER : 56248

EBMUD

BORING NO MM -4

SURFACE ELEV. : 376'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-CU=4300 (4100) 7050 (5000) 9750 (7000)	25.3	98.1	50/5"	30 35 40 45 50 55 60	P-12 SPT-13	brown sandy CLAY (CL), hard (fill) tan SILTSTONE, weak to moderately strong, deeply weathered Bottom of Boring at 34.0'

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LOG OF BORING

PROJECT : Dam Seismic Evaluation
DATE : November 6, 1997
LOCATION : Walnut Creek Clearwell
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 1500
CHECKED BY : Derek Kawaii
JOB NUMBER : 56248

EBMUD

BORING NO MM -5

SURFACE ELEV. : 315'

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown gravelly CLAY (CL), very stiff, with some sand (fill)
			25		SPT-1	orange-brown sandstone COBBLES and GRAVEL (GP),medium dense (fill)
				5		
LL=47, PI=18	27.5		21		SPT-2	brown gravelly SILT (ML), very stiff (fill)
					SPT-3	
LL=45, PI=16	32.7		11			
				10	P-4	brown SANDSTONE, moderately strong, moderately weathered
					P-5	
			50/4"		SPT-6	
				15		Bottom of Boring at 14.0'
				20		
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : November 4, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NUMBER : 25692

EBMUD

BORING NO MN-2

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		tan, sandy, silty CLAY (CL)
LL = 36, PI = 5	14		78		SPT-1	tan, deeply to moderately weathered, sandy SILTSTONE
% fines = 74.2 LL = 34, PI = 1	17		80	5	SPT-2	
						Bottom of Boring at 6.5'
				10		
				15		
				20		
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 30, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NUMBER : 25692

EBMUD

BORING NO MN-3

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown, sandy CLAY (CL)
% fines = 35.9			40		SPT-1	
						gravelly, silty SAND (SC)
				5		brown, moderately to deeply weathered SILTSTONE
% fines = 60.4			42/6"		SPT-2	
TX-UU =1619 (1195) SG = 2.62	21.6	95.9		10	P-3	tan, moderately weathered and fractured SANDSTONE, very fine grained
				15		
				20	P-4	
TX-UU = 853 (2405) SG = 2.62	23.1	100.3				
				25		Bottom of Boring at 23.5'
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 27, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NUMBER : 25692

EBMUD

BORING NO MN-4

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		ASPHALT CONCRETE
						BASE ROCK
						dark brown CLAY
LL = 52, PI = 14	27		37		SPT-1	
						brown, deeply weathered and fractured CLAYSTONE
						with sand
SG = 2.55			30/4"	5	MC-2	
						brown to orange, deeply weathered and fractured SANDSTONE, with calcite seams, fine grained,
% fines = 45.7			40/4"	10	SPT-3	
				15		
TX-UU = 4449 (1800) SG = 2.57	22.1	100.8			P-4	very dark grey, slightly weathered SILTSTONE
				20	P-5	
				25		
				30		harder drilling at 29.5'

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LOG OF BORING

PROJECT :WC WTP Improvements
DATE : October 27, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR : Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NUMBER : 25692

EBMUD

BORING NO MN-4

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				30	P-6	very dark grey, slightly weathered SILTSTONE with organic and calcite seams
						Bottom of Boring at 32.5'
				35		
				40		
				45		
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : November 4, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-8

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		ASPHALT CONCRETE
						BASE ROCK
			50/4"		SPT-1	tan, friable, silty SANDSTONE, fine grained
			50/4"	5	SPT-2	tan, friable, deeply weathered SANDSTONE with a lot of oxidized seams
TX-UU = 9945 (1195) SG = 2.71	19.8	104.0		10	P-3	
			50/6"		SPT-4	
				15		Bottom of Boring at 13.0'
				20		
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 31, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-9

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		4" ASPHALT CONCRETE 6" BASE ROCK
LL = 38, PI = 18	20		25		SPT-1	brown, sandy CLAY (fill) (CL) bluish grey, gravelly
LL = 43, PI = 21	25		11	5	SPT-2	greyish brown, stiff, sandy SILT (ML), with clay
% fines = 65.6			15		SPT-3	
				10		with gravels
% fines = 44.2	22		63		SPT-4	mottled brown , deeply weathered, SANDSTONE, with organics, fine grained,
				15		
TX-UU = 382 (2203) SG = 2.57	25.6	96.4			P-5	brown, deeply weathered and fractured SILTSTONE cuttings with clay
				20		
			50/4"		SPT-6	grey, moderately weathered, CLAYSTONE, with calcite seams
				25		Bottom of Boring at 24.0'
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 31, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-10

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		3" ASPHALT CONCRETE
						BASE ROCK
			51		SPT-1	grey, very dense, silty SAND (SM) with cemented gravels, (fill)
	17.2		32	5	SPT-2	
	18.3		54	10	SPT-3	grey, friable, deeply weathered and friable, clayey SANDSTONE, with bluish black clay seams
SG = 2.61	16.0			15	P-4	harder drilling at 14.5'
						brown
			50/5"		SPT-5	with oxidized seams
				20		Bottom of Boring at 18.0'
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : November 6, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

TEST RESULTS

MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.
			0	
			5	
			10	
			15	
			20	
			25	
			30	

BORING NO MN-11

SURFACE ELEV. :

DESCRIPTION

ASPHALT CONCRETE
BASE ROCK
tan, very stiff, clayey SAND, gravelly

brown, deeply weathered SANDSTONE, with clay seams

grey, fine to medium grained

Bottom of Boring at 9.0'

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 27, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-13

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-UU = 3581 (605) SG = 2.63	17.8	109.3	50/5" 50/5"	0 5 10 15 20 25 30	SPT-1 P-2 P-3 SPT-4 P-4	tan-grey, moderately weathered and fractured SANDSTONE, fine grained, Bottom of Boring at 22.5'

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 28, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-14

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown, sandy CLAY (CL) (fill)
LL =52, PI = 33	15.0		41		SPT-1	dark brown, hard, sandy CLAY, (CH)
			50/4"	5	SPT-2	tan, deeply weathered SANDSTONE, fine grained,
SG = 2.63	19.8	112.7		10	P-3	slightly to moderately weathered
				15		
SG = 2.55	18.9	103.4			P-4	soft zone between 17.5' and 18.0'
				20		Bottom of Boring at 20.0'
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 23, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-15

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		4" ASPHALT CONCRETE
						4" BASE ROCK
						brown, sandy CLAY (CL) (fill)
	17		15		SPT-1	dark brown, stiff, sandy CLAY (CH)
						grey gravel (GP)
				5		brown, clayey SAND (SC) (fill)
LL = 43, PI = 26	23.6	104.3	25		MC-2	gravelly
						dark brown, stiff CLAY (CH)
LL = 58, PI = 29	23		16	10	SPT-3	
				15		
SG = 2.5	28.7	93.7	16		MC-4	dark greyish brown, with calcite
				20		
	19.3		8		SPT-5	brown, very stiff
						orange brown, deeply weathered silty CLAYSTONE
				25		
LL = 68, PI = 43	28		31		MC-6	
				30		

LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 23, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-15

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
	26.1		43	30	SPT-7	orange brown, deeply weathered and fractured, silty CLAYSTONE harder drilling between 31' and 34' dark green cuttings at 34'
TX-UU = 3316 (4205) SG = 2.6	25.1	99.7	66	35	MC-8	dark grey SILTSTONE / SHALE, vertical fractures started to use rock bit at 35'
TX-CU = 4617 (5400) SG = 2.63	13.5	116.8		45	P-9	Bottom of Boring at 47.5'
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 23, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-16

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		dark brown, sandy CLAY
LL = 62, PI = 34 SG = 2.71	28.8	92.1	29		MC-1	orange brown , deeply weathered and fractured CLAYSTONE
LL = 65, PI = 36	23		35	5	SPT-2	harder drilling at 7'
LL =66, PI = 36	29		29	10	SPT-3	greyish brown to orange brown
TX-CU = 7044 (1800)	19.9	103.4	16	15	MC-4	
	19.3		50/6"	20	SPT-5	mottled brown and orange brown, moderately weathered changed to rock bit at 20'
TX-UU = 3409 (2995)	18.9	107.3		25	P-6	very dark grey SILTSTONE / SHALE
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 22, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-16

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
			30/3"	30	SPT-7	very dark grey SILTSTONE/SHALE
			35	35		harder drilling at 38'
TX-CU = 4970 (2995) = 5900 (4003) = 7063 (4997) SG = 2.64	11.9	116.5		40	P-8	
				45		Bottom of Boring at 42.5'
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 23, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-17

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown, stiff, gravelly sandy CLAY (CL)
LL = 51, PI = 32	14		20		STP-1	
				5		orange brown, deeply weathered , silty CLAYSTONE
TX-CU = 857 (504) = 992 (994)	22.9	84.2	33		MC-2	
LL = 79, PI = 41	34		30	10	SPT-3	
TX-CU = 1853 (1800) SG = 2.53	32.7	87.2	42	15	MC-4	
	32.8		38	20	SPT-5	moderately weathered
TX-UU = 5564 (2995) SG = 2.5	30.4	88.8	70	25	MC-6	
				30		dark grey SILTSTONE/SHALE

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 23, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-17

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
	27.2		45/6"	30	SPT-7	very dark grey SILTSTONE/SHALE
				35		harder drilling at 35'
TX-CU = 13358 (4997) SG = 2.43	12.7	112.7		40	P-8	
				45		Bottom of Boring at 42.5'
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 21, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-18

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown, sandy, silty CLAY (CL) with few gravels (fill)
LL = 40, PI = 20			38		SPT-1	
						with sand
LL = 38, PI = 13	21		33	5	SPT-2	
						greenish grey
SG = 2.58	23.3	104.8	21	10	MC-3	
LL = 45, PI = 24	28		17	15	SPT-4	mottled grey
						stiffer drilling at 19.0'
TX-CU 2007 (2405) SG = 2.47	29.3	88.9	23	20	MC-5	greyish brown, deeply weathered and fractured CLAYSTONE
LL = 64, PI = 30	34		28	25	SPT-6	mottled dark tan and orange
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
DATE : October 21, 1997
LOCATION : Walnut Creek Filter Plant
CONTRACTOR: Pitcher Drilling
LOGGED BY : Catherine Anderson
EQUIPMENT : Failing 750
CHECKED BY : Derek Kawaii
JOB NO. : 25692

EBMUD

BORING NO MN-18

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-UU = 1528 (3600)	33.1	86.9	61/16"	30	MC-7	dark grey and mottled orange, moderately weathered and fractured, silty CLAYSTONE
						light grey
	48.4		32	35	SPT-8	
						dark grey, slightly to moderately weathered SHALE
			50/4"	40	MC-9	
						changed to rock bit at 40'
	24.4		63	45	SPT-10	slightly clayey, fractured
TX-UU = 901 (6005) SG = 2.62	20.4	109.6		50	P-11	
						harder drilling at 53'
	18.9		50/5"	55	SPT-12	
						softer drilling and with brown rock fragments at 59'
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 21, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-18

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				60	P-13	harder drilling at 60.5'
TX-CU = 2508 (4997) = 3070 (6005) = 3270 (6998) SG = 2.58	20.3	105.4	50/5"	70	MC-14	
				75		
TX-UU = 1708 (8006)	18.1	110.1		80	P-15	dark grey to black silty CLAYSTONE and SHALE
						Bottom of Boring at 82.0'
				90		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 22, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-19

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		dark brown, sandy CLAY (CH) (fill)
LL = 85, PI = 54	24		9		SPT-1	
						orange brown, silty CLAY (CH) (fill)
TX-CU = 4384 (605) SG = 2.58	21.7	90.4	33	5	MC-2	mottled tan orange brown, deeply weathered SILTSTONE with calcite on fracture surfaces
LL = 68, PI = 36	34		28	10	SPT-3	greenish tan, deeply weathered CLAYTONE, with organic clay seams
TX-CU = 2215 (1800) = 4217 (2405) = 5347 (3600)	25.9	90.3	72	15	MC-4	greyish brown
	28.2		53	20	SPT-5	light brown
TX-UU = 6837 (2995) SG = 2.59	30.4	90.6	40/4"	25	MC-6	moderately weathered
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 22, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-19

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
	32		48	30	SPT-7	brown silty CLAYSTONE, with fractures at 45 degrees, deeply weathered
				35		
						dark grey, SHALE, with shell fragments
TX-CU = 5738 (4795) SG = question	28.7	93.0	50/5"	40	MC-8	Bottom of Boring at 40.7'
				45		
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : November 5, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-20

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		brown, gravelly, sandy CLAY (CL) (fill)
LL = 68, PI= 38	24		38		SPT-1	tan, deeply weathered SILTSTONE
LL = 47, PI = 17	17		43/6"	5	SPT-2	Bottom of Boring at 7'
				10		
				15		
				20		
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 24, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-21

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		BASE ROCK
LL = 78, PI = 52	21		25		SPT-1	brown, stiff, sandy CLAY (CH)
						orange brown, deeply weathered SILTSTONE
LL = 48, PI =27	19		13	5	SPT-2	
LL = 71, PI = 37 TX-UU = 2545 (1195) SG = 2.58	30.5	88.2	21	10	MC-3	orange brown, deeply weathered and fractured CLAYSTONE becomes harder drilling at 13.5'
LL = 64, PI = 29	34		24	15	SPT-4	rock fragments, calcite and carbonaceous materials
TX-UU 4235 (2390) SG = 2.66	22.3	100.1	58	20	MC-5	dark grey to tan orange, deeply weathered SILTSTONE / SHALE with oxidized and calcareous seams
	20.7		59/16"	25	SPT-6	
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 24, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-21

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-UU = 4328 (3499) SG = 2.71	26.5	98.1	33/6"	30	MC-7	brown, moderately weathered and fractured CLAYSTONE
						dark grey SILTSTONE chips in drilling fluid
				35		very hard drilling at 35'
						Bottom of Boring at 35'
				40		
				45		
				50		
				55		
				60		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 30, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-22

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
				0		tan, silty SAND (SM) (fill)
	10.5		35/6"		SPT-1	
	5.8		50/6"	5	STP-2	
TX-UU = 1085 (1195) SG =2.58	17.5	113.2		10	P-3	clay seam
				15		
TX-UU 9735 (2405) SG = 2.57				20	P-4	brown, moderately weathered and fractured SANDSTONE, fine grained
				25		
				30		

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LOG OF BORING

PROJECT : WC WTP Improvements
LOCATION : Walnut Creek Filter Plant
LOGGED BY : Catherine Anderson
CHECKED BY : Derek Kawaii

DATE : October 30, 1997
CONTRACTOR: Pitcher Drilling
EQUIPMENT : Failing 750
JOB NO. : 25692

EBMUD

BORING NO MN-22

SURFACE ELEV. :

TEST RESULTS	MOISTURE CONTENT %	DRY DENSITY (PCF)	BLOWS/FT*	DEPTH (FT)	SAMPLE NO.	DESCRIPTION
TX-UU = 2282* (3600) SG = 2.63 * sample stopped deforming at 0.7% strain	14.8	114.5		30	P-5	slightly to moderately weathered SANDSTONE, fine-grained
						Bottom of Boring at 32.0'
				35		
				40		
				45		
				50		
				55		
				60		

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APPENDIX B

LOGS OF BORINGS (Olivia Chen Consultants)

LOG OF BORING MN23	DRILLING DATE: 2-12-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: CT
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

Olivia Chen Consultants, Inc.
Civil • Environmental • Geotechnical

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	87		LEAN CLAY with Sand (CL), light brownish gray, hard, dry to moist, gravel-sized sandstone fragments (fill).	83.5	18.0	41	19	72.7
5		2	39		SANDY LEAN CLAY (CL-ML), sandy.		20.9	40	15	69.4
10		3	52		SANDY LEAN CLAY, dark gray with rust striations, hard, dry, sandy.		20.3	35	9	54.2
15		4	37		LEAN CLAY with Sand (CL), dark greenish gray, hard, moist, medium to high toughness, plastic, organic odor (colluvium).		25.0	39	18	82.7
20		5	17				22.2			
25		6			Olive brown with rust striations, moist, strongly cemented.	106.3	21.4	37	17	83.9
30		7	50/2"		Yellowish brown, hard, weakly cemented.					
35		8			SANDSTONE, dark gray, moist, silty, closely fractured, slightly to moderately weathered, weak to moderately strong.		17.1			
		9	50/3"		Brownish beige with rust striations, dry, weakly cemented.					76.4
					SILTSTONE, dark gray, moist, closely to moderately fractured, strong.					

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 2	FIGURE 1

LOG OF BORING MN23	DRILLING DATE: 2-12-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: CT
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

Olivia Chen Consultants, Inc.
Civil • Environmental • Geotechnical

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		10			SILTSTONE, dark gray, moist, closely to moderately fractured, strong. *(Continued)*		18.9			
		11	50/3"		Bottom of boring at 43.25' below ground surface.					
45										
50										
55										
60										
65										
70										
75										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 2 of 2	FIGURE 1

LOG OF BORING MN 23A	DRILLING DATE: 1-4-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: SI
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

Olivia Chen Consultants, Inc.
Civil • Environmental • Geotechnical

DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	50/ 5.5"		LEAN CLAY with Sand (CL), light brownish gray, very dense, dry, (fill).		12.6	45	22	84.3
5		2	49		Small rock fragments present.					
10		3	50/3"		LEAN CLAY with Sand (CL), dark brown, hard, moist, medium toughness, none to low dilatency (fill).					
15		4	50/3"							
20		5	50/3"		SANDSTONE, greenish gray, moist, silty, fine-grained, moderately weathered, friable to moderately strong, weakly cemented.		18.8			
25		6	50/3"							
30		7	50/2"				17.8			
35		8	50/3"							

LOG OF BORING L:\EBMUD\1320\WA~1\BORINGS\GINTWPROJECTS\FINAL\1132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 2	FIGURE 1a

LOG OF BORING MN 23A	DRILLING DATE: 1-4-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: SI
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		9	50/2.5		SANDSTONE, greenish gray with rust striations, moist, weakly cemented.		20.1			
					Bottom of boring at 40.25' below ground surface. Piezometer installed on 1/4/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					
45										
50										
55										
60										
65										
70										
75										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320901A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 2 of 2	FIGURE 1a

LOG OF BORING MN 24	DRILLING DATE: 1-4-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: SI
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
					4" ASPHALT.					
		1	50/6"		SILTY SAND / CLAYEY SAND (SC-SM), light brownish beige some rust striations, dry, sandstone fragments.		13.4	33	9	47.9
5		2	50/4"				17.2			
10		3	50/4"		SANDSTONE, beige, dry, silty, fine-grained, moderate cementation, slight to moderately weathered, moderately strong.		21.0			45.0
15		4	50/4.5"		SILTSTONE, brownish orange, dry to moist, closely fractured, rust striations (iron stains), slight to moderately weathered, moderately strong.					
20		5	50/6"				25.8			
25		6	50/4"							
30		7			Moderately fractured.	102.6	21.2			
35					Bottom of boring at 33' below ground surface. Piezometer installed on 1/4/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320 01A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 2

LOG OF BORING MN 25	DRILLING DATE: 1-3-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

Olivia Chen Consultants, Inc.
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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	46		LEAN CLAY with Sand (CL), grayish brown with white & orange mottles, hard, moist, (fill).		19.8	43	20	70.2
5		2	52		LEAN CLAY with Sand (CL), dark gray, hard, dry to moist, (fill).		20.2	40	18	74.1
10		3	25		CLAYSTONE, tannish beige, moist, deeply to moderately weathered, weak to moderately strong, moderate cementation.		28.6			
15		4	46		Tannish beige with orange striations.					
20		5	29				29.9			
25		6			Friable to plastic.	80.1	38.4			
30		7	68		CLAYSTONE, dark gray, moist, slightly to moderately weathered. moderately strong, moderate cementation.		20.9			
35		8	93		CLAYSTONE, silty, slightly weathered, moderately strong.					

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 2	FIGURE 3

LOG OF BORING MN 25	DRILLING DATE: 1-3-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		9	88		CLAYSTONE, tannish beige, moist, deeply to moderately weathered, weak to moderately strong, moderate cementation. *(Continued)*					
					CLAYSTONE, silty, slightly weathered, moderately strong.					
45		10				121.5	14.3			
					Bottom of boring at 48' below ground surface.					
50					Piezometer installed on 1/3/01; refer to completion diagram.					
					Groundwater encountered at 23 feet below ground surface during field visit on 1/22/01.					
55										
60										
65										
70										
75										

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 2 of 2	FIGURE 3

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTW\PROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

LOG OF BORING MN 26	DRILLING DATE: 1-2-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
					4" ASPHALT.					
					6" CONCRETE.					
		1	27		CLAYSTONE, reddish brown with rust striations, dry to moist, silty, slightly to moderately fractured, weak to moderate cementation.		29.7			
5		2	36		Slightly to moderately weathered, weak to moderately strong. ▼		28.9			
10		3	52							
15		4				93.0	28.9			
20		5	80				28.6			
25		6	50/6"							
30		7	50/5.5"		Bottom of boring at 30.5' below ground surface. Piezometer installed on 1/2/01; refer to completion diagram. Groundwater encountered at 6 feet below ground surface during field visit on 1/22/01.					
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 4

LOG OF BORING MN 27

DRILLING DATE: 1-9-01
DRILLING METHOD: Mud Rotary
DRILL RIG TYPE: Failing 1500
HAMMER TYPE: 140 LBS. SAFETY HAMMER

SURFACE ELEV: N/A
DATUM: Ground Surface
LOGGED BY: KG
CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	39		SANDY LEAN CLAY (CL), greenish brown with orange and gray mottles, dense, dry, (fill).		14.8	46	25	66.7
5		2	28		SANDY LEAN CLAY, medium dense, silty.		19.6	44	23	
10		3	9		FAT CLAY (CH), dark gray, stiff, moist, none to low dilatency, low to medium toughness, highly plastic (colluvium).		36.2	72	50	89.8
		4	17		FAT CLAY.	88.5	32.5	76	52	89.8
15		5	15			85.9	34.5			
20		6	62		CLAYSTONE, dark gray, moist, slightly to moderately weathered, rust striations, friable to weak.	91.1	30.7			
25		7			Weak to moderately strong.	97.9	26.7			
30		8	50/4.5		Bottom of boring at 30.4' below ground surface. Piezometer installed on 1/9/01; refer to completion diagram. Groundwater encountered at 21 feet below ground surface during field visit on 1/22/01.					
35										

LOG OF BORING L:\EBMUD\1320\WA~1\BORINGS\GINTW\PROJECTS\FINAL\1132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01 | PROJECT: Walnut Creek Water Treatment Plant | SHEET 1 of 1 | FIGURE 5

LOG OF BORING MN 28A	DRILLING DATE: 1-3-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	26		LEAN CLAY with Sand (CL), brownish yellow, very stiff, dry, (fill).		14.0	38	17	71.6
5		2	45		LEAN CLAY with Sand (CL), brownish yellow with orange and white mottles, hard, dry, (fill).		17.6	46	21	77.2
10		3	19		NO RECOVERY, very stiff.					
15		4	30		CLAYSTONE, grayish brown with orange, gray, and white mottles, dry to moist, moderate cementation, moderately weathered, calcite veins, weak to moderately strong.		29.8			
20		5				87.3	35.4			
25		6	44		CLAYSTONE/SILTSTONE, grayish brown with orange, gray, and white mottles, rust striations, dry to moist, moderate cementation, moderately weathered, calcite seams, closely to intensely fractured, moderately strong.		24.3			
30		7	90		CLAYSTONE, silty.		24.5			
35					Bottom of boring at 31.5' below ground surface. Piezometer installed on 1/3/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 6

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\132001A.GPJ OLV_CHEN.GDT 4/10/01

LOG OF BORING MN 29A	DRILLING DATE: 1-9-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
					2" ASPHALT.					
		1	22		CLAYSTONE, brownish yellow with rust striations, moist, silty, moderately weathered, moderate cementation, weak.		30.3			
5		2	38		SILTSTONE, brownish yellow with rust striations, dry to moist, clayey, moderately weathered, moderate cementation, weak.		30.7			
10		3	31		Closely fractured. ▼		29.3			
15		4	51				29.8			
20		5			CLAYSTONE, dark gray, moist, silty, closely fractured, moderately weathered, weak to moderately strong, weak cementation.	94.3	27.3			98.1
25		6	50/4"		Platy.		25.7			
30		7	50/3.5"		SILTSTONE, clayey, platy, slightly to moderately weathered, moderately strong.		25.1			
					Bottom of boring at 30.3' below ground surface. Piezometer installed on 1/9/01; refer to completion diagram. Groundwater encountered at 11.5 feet below ground surface during field visit on 1/22/01.					
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 7

LOG OF BORING MN 30	DRILLING DATE: 1-2-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	65		SANDY LEAN CLAY (CL), grayish brown with white mottles, dry to moist, sandstone fragments (fill).		12.8	47	26	67.5
5		2	39		LEAN CLAY with Sand (CL).		8.5	32	13	76.4
10		3	24		CLAYSTONE, brownish beige with rust striations, moist, moderately weathered, friable to weak, moderate cementation.		31.4			
15		4	26				32.0			
20		5	38		Closely fractured, moderately strong.		30.8			
25		6	52		Calcareous clay seams.		31.7			
30		7	57		SILTSTONE, clayey, slightly to moderately weathered, closely fractured, moderately strong.		29.9			
					Bottom of boring at 31.5' below ground surface. Piezometer installed on 1/2/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 8

LOG OF BORING MN 31	DRILLING DATE: 1-8-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: XS
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	50/3"		SANDY LEAN CLAY (CL), grayish brown, hard, moist.		21.6			56.2
5		2	50/4"		SANDSTONE, grayish brown with rust striations, moderately weathered, weak to moderately strong.		19.6			
10		3	50/3"		More gray in color.					
15		4	50/2"		Slightly weathered.		14.9			
20		5	50/2"		Moderately strong to strong.					
25		6			Closely fractured.	113.4	17.4			
30		7	50/4"							
35		8	50/3"		Rust color striations.		18.6			

Bottom of boring at 41.33' below ground surface.
Piezometer installed on 1/8/01; refer to completion diagram.
Groundwater not encountered during field visit on 1/22/01.

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 2	FIGURE 9

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTW\PROJECTS\FINAL\1132001A.GPJ OLV_CHEN.GDT 4/10/01

LOG OF BORING MN 31	DRILLING DATE: 1-8-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: XS
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		9	50/4"							
45										
50										
55										
60										
65										
70										
75										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 2 of 2	FIGURE 9

LOG OF BORING MN 32	DRILLING DATE: 1-5-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	50/1"		NO RECOVERY.					
5		2	50/4.5"		CLAYEY SAND (SC), dark brown, very dense, moist.		36.4			34.0
10		3	50/3.5"		SILTSTONE, fine grained, grayish yellow with rust striations, dry, silty, moderate to strong cementation, slightly weathered, moderately strong.		19.8			
15		4	50/4"		Closely fractured.		17.0			56.6
20		5			Strong.	108.5	18.0			
25					Bottom of boring at 23' below ground surface. Piezometer installed on 1/5/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					
30										
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 10

LOG OF BORING MN 33	DRILLING DATE: 1-5-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: KG
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	50/6"		SILTSTONE, fine grained, brownish yellow beige, dry to moist, moderate cementation, closely fractured, slightly weathered, moderately strong.		13.0			65.6
5		2	50/6"		Dark gray with rust striations, dry to moist.					
10		3	50/4.5"				22.0			52.5
15		4	50/3.5"							
20		5			Strong.	110.5	17.6			
25					Bottom of boring at 23' below ground surface. Piezometer installed on 1/5/01; refer to completion diagram. Groundwater not encountered during field visit on 1/22/01.					
30										
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTWPROJECTS\FINAL\132001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 11

LOG OF BORING MN 34	DRILLING DATE: 1-5-01	SURFACE ELEV: N/A
	DRILLING METHOD: Mud Rotary	DATUM: Ground Surface
	DRILL RIG TYPE: Failing 1500	LOGGED BY: XS
	HAMMER TYPE: 140 LBS. SAFETY HAMMER	CHECKED BY: CBK

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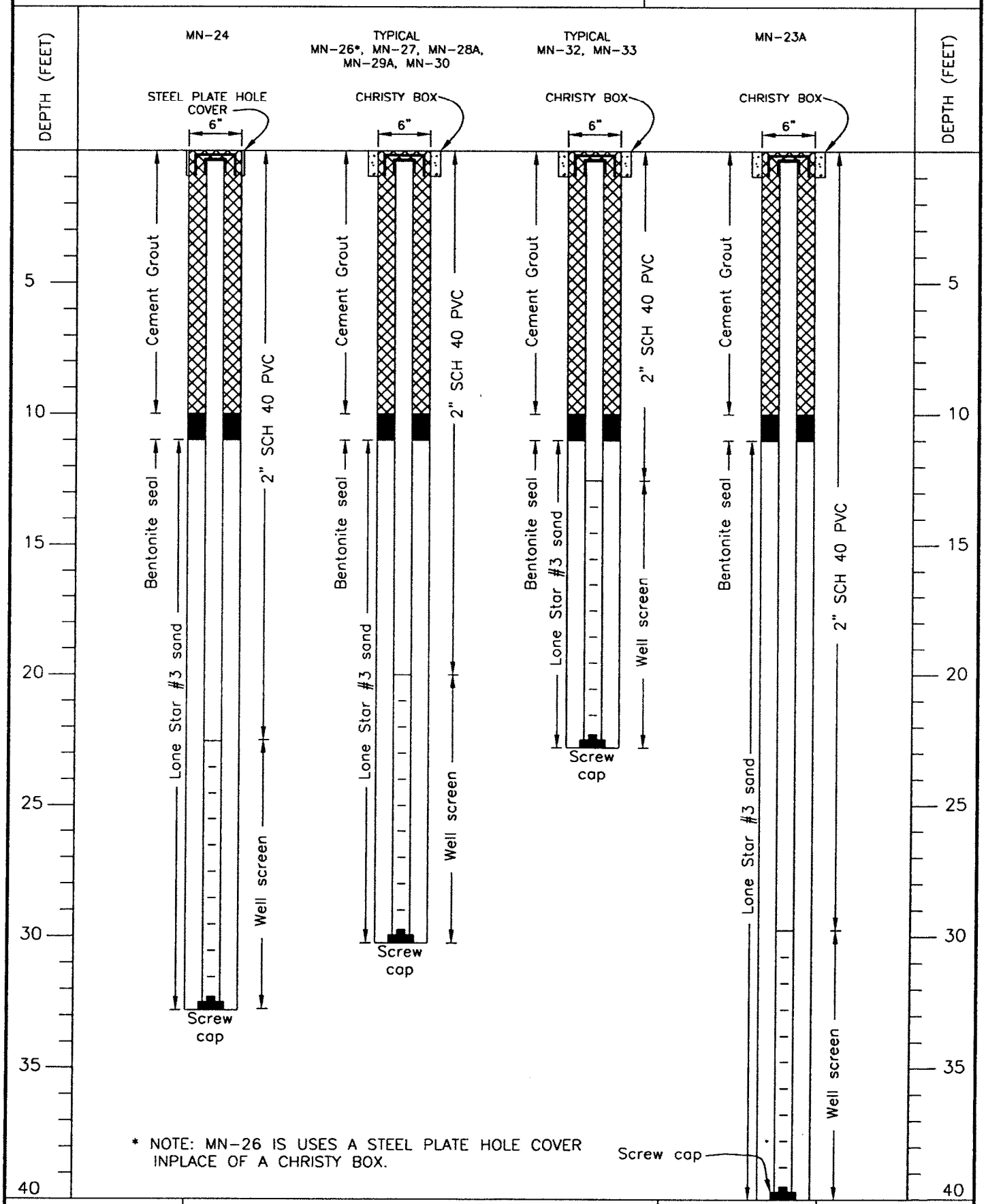
DEPTH (FEET)	SAMPLE TYPE	SAMPLE NO.	BLOW COUNT	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	% PASSING #200 SIEVE
		1	76		SILTSTONE, fine grained, brownish yellow with rust striations, dry to moist, weak to moderate cementation, slightly to moderately weathered, moderate strong to strong.		16.2			60.2
5		2	50/2"				17.0			
10		3	50/5"				15.0			
		4	50/3"				11.3			
15					Bottom of boring at 14.25' below ground surface. Piezometer installed on 2/12/01; refer to completion diagram. Groundwater not encountered during drilling.					
20										
25										
30										
35										

LOG OF BORING L:\EBMUD\1320WA~1\BORINGS\GINTW\PROJECTS\FINAL\1320001A.GPJ OLV_CHEN.GDT 4/10/01

JOB NO. 1320.01	PROJECT: Walnut Creek Water Treatment Plant	SHEET 1 of 1	FIGURE 12

PIEZOMETER COMPLETION DIAGRAM

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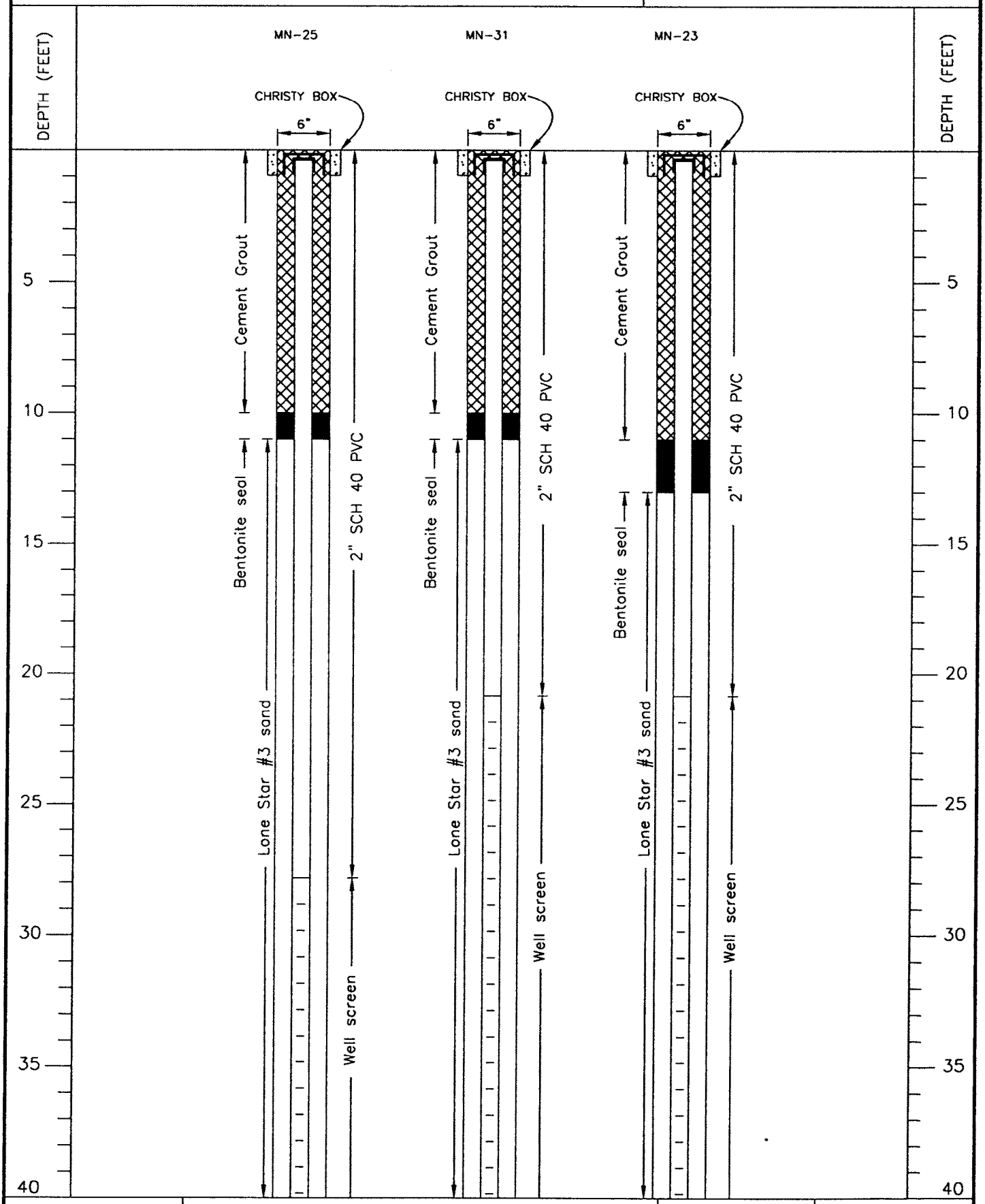


JOB NO. 1320	PROJECT: WALNUT CREEK WTP	SHEET 1 OF 1	FIGURE 13

L:\EBMUD\1320 WALNUT CREEK WTP\BORINGS\WELL DIAGRAM.DWG

PIEZOMETER COMPLETION DIAGRAM

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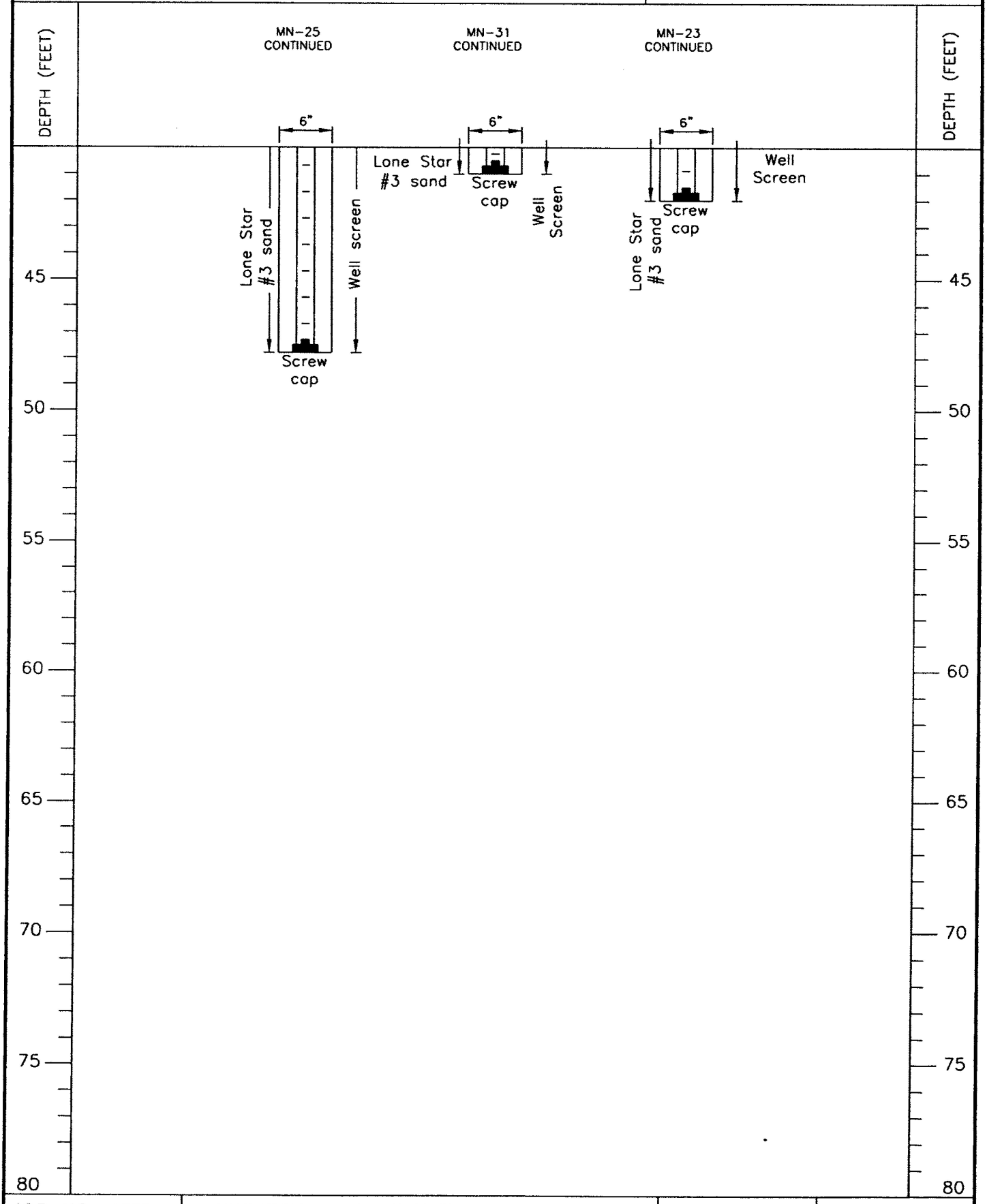


JOB NO. 1320	PROJECT: WALNUT CREEK WTP	SHEET 1 OF 2	FIGURE 14

L:\EBMUD\1320 WALNUT CREEK WTP\BORINGS\WELL DIAGRAM.DWG

PIEZOMETER COMPLETION DIAGRAM

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JOB NO. 1320	PROJECT: WALNUT CREEK WTP	SHEET 2 OF 2	FIGURE 14

L:\EBMUD\1320 WALNUT CREEK WTP\BORINGS\WELL DIAGRAM.DWG

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

NOTE: $Cu = \frac{D_{60}}{D_{10}}$; $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

BLOW COUNT

THE NUMBER OF BLOWS OF THE SAMPLING HAMMER REQUIRED TO DRIVE THE SAMPLER THE LAST 12 IN. OF AN 18-IN. DRIVE. THE NOTATION 100/9 INDICATES 9 IN. OF PENETRATION ACHIEVED IN 100 BLOWS. THE NUMBER "50+" INDICATES THAT >50 BLOWS WERE REQUIRED TO DRIVE THE SAMPLER THE LAST 12 INCHES.

CEMENTATION

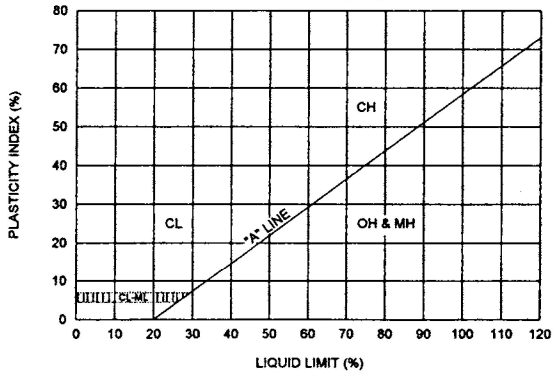
WEAK - CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE

MODERATE - CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE

STRONG - WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE

SOURCE: U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION; PUB. YEAR, NOT AVAILABLE; ENGINEERING GEOLOGY FIELD MANUAL, P. 37.

PLASTICITY CHART



SAMPLE TYPES

- STANDARD PENETRATION
- ROCK CORE
- PITCHER SAMPLE
- MODIFIED CALIFORNIA
- PUSHED SHELBY TUBE

ADDITIONAL TESTS

CA	-	CHEMICAL ANALYSIS (CORROSIVITY)	(200)	-	(WITH % PASSING NO. 200 SIEVE
CD	-	CONSOLIDATED DRAINED TRIAXIAL			
CN	-	CONSOLIDATION	SW	-	SWELL TEST
CU	-	CONSOLIDATED UNDRAINED TRIAXIAL	TC	-	CYCLIC TRIAXIAL
DS	-	DIRECT SHEAR	TV	-	TORVANE SHEAR
PP	-	POCKET PENETROMETER (TSF)	UC	-	UNCONFINED COMPRESSION
(3.0)	-	(WITH SHEAR STRENGTH IN KSF)	(1.5)	-	(WITH SHEAR STRENGTH IN KSF)
RV	-	R-VALUE			
SA	-	SIEVE ANALYSIS: % PASSING #200 SIEVE	UU	-	UNCONSOLIDATED UNDRAINED TRIAXIAL
▽	-	WATER LEVEL (WITH DATE OF) MEASUREMENT	WA	-	WASH ANALYSIS
			(200%)	-	(WITH % PASSING NO. 200 SIEVE)

PENETRATION RESISTANCE
(RECORDED AS BLOWS / 0.5 FT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	FIRM	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

Olivia Chen Consultants, Inc.
Civil • Environmental • Geotechnical

Job No. 1320.01

LEGEND TO SOIL DESCRIPTIONS

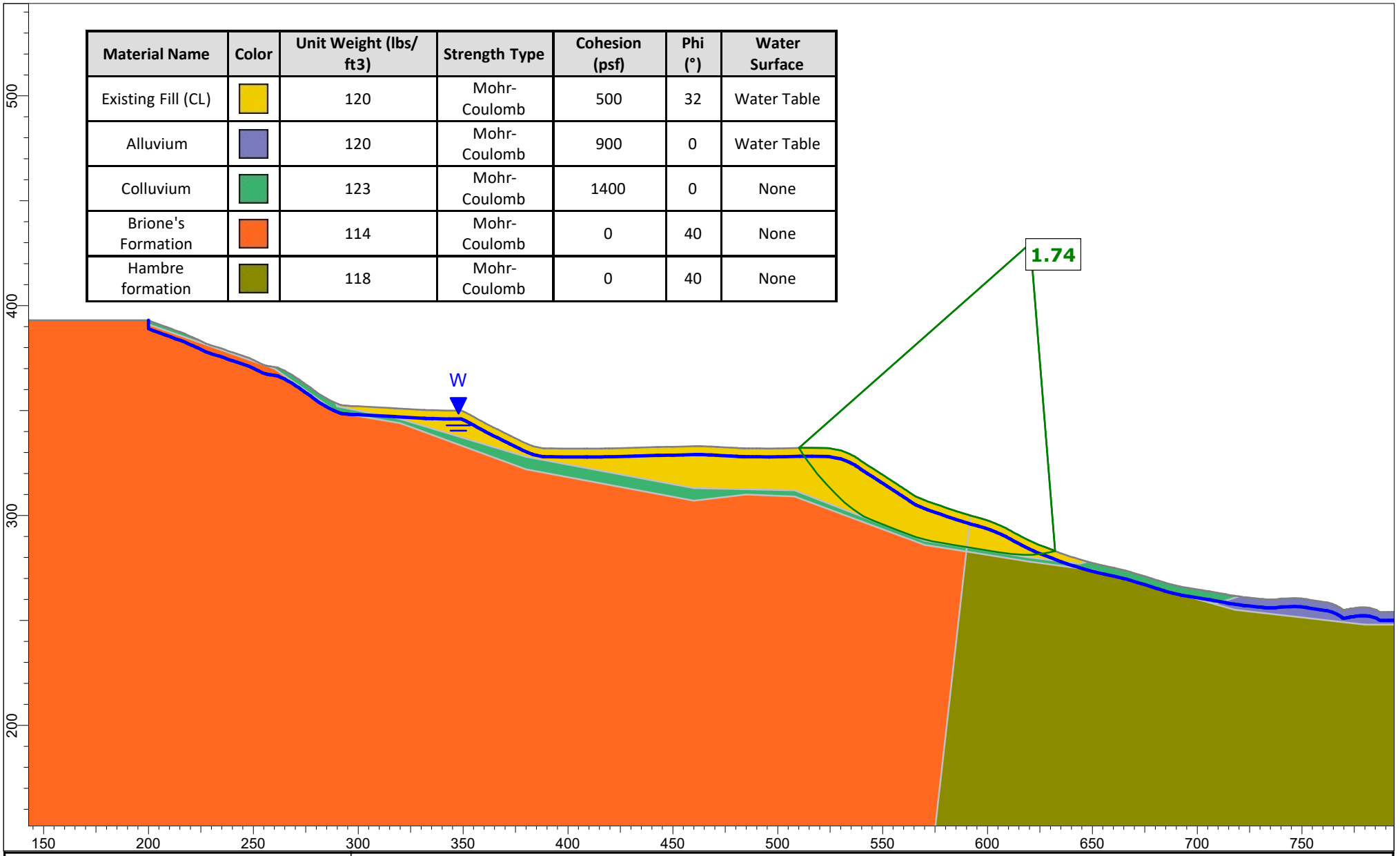
FIGURE 15

LEGEND L:\EBMUD\1320WA~1\BORINGS\GINTW\PROJECTS\FINAL\132001A.GPJ OLV_CHEN.GDT 4/10/01

APPENDIX D

SLOPE STABILITY ANALYSES

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Existing Fill (CL)		120	Mohr-Coulomb	500	32	Water Table
Alluvium		120	Mohr-Coulomb	900	0	Water Table
Colluvium		123	Mohr-Coulomb	1400	0	None
Brione's Formation		114	Mohr-Coulomb	0	40	None
Hambre formation		118	Mohr-Coulomb	0	40	None

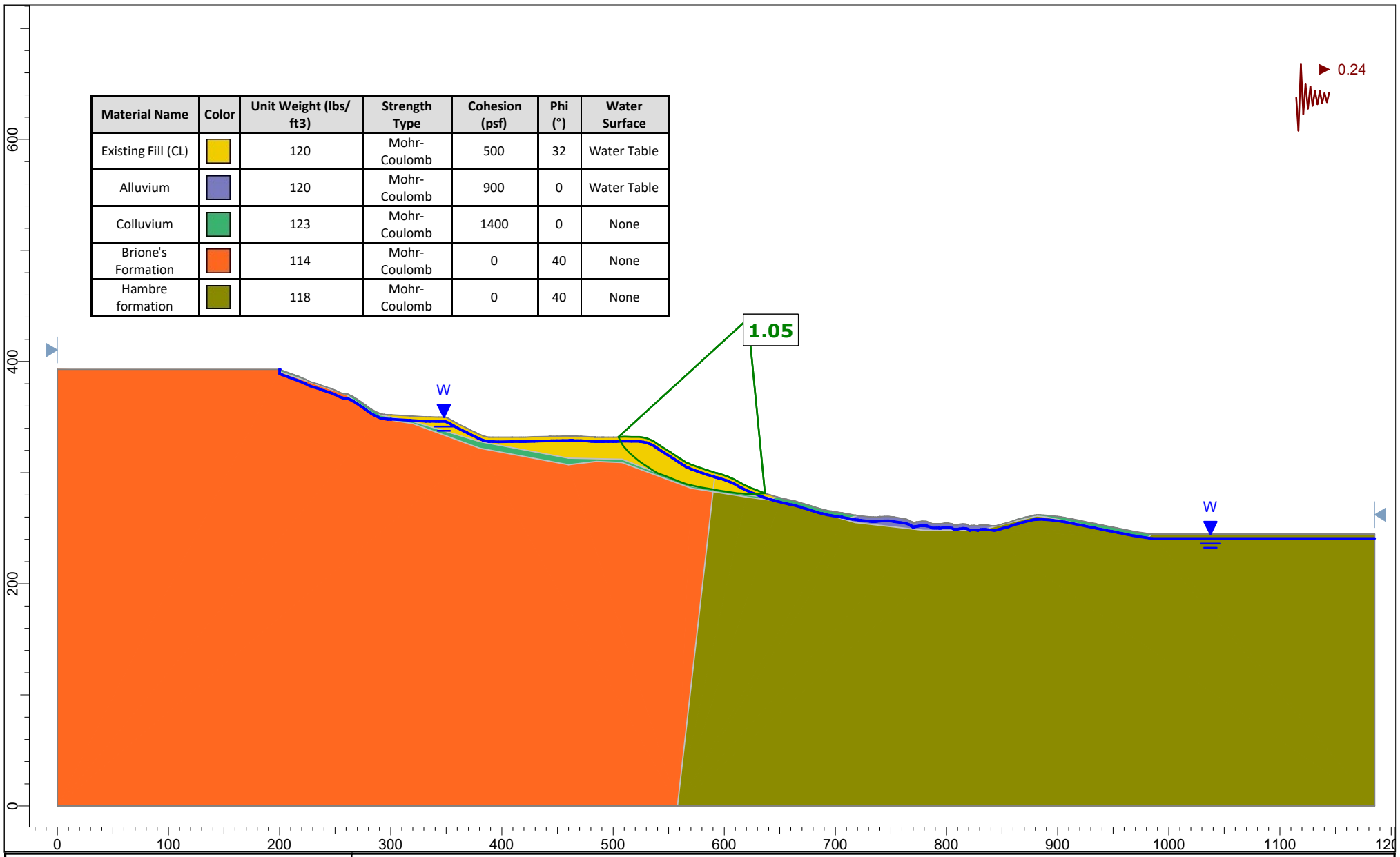


AGS

Cross-Section A-A' - before Building construction - Static Condition

Walnut Creek Water Treatment Plant Pretreatment Project		Location	WALNUT CREEK, CALIFORNIA
Job Number	AGS 23-006	Plate	PLATE D1
Date	NOV 2024	Drawn by	LL

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Existing Fill (CL)		120	Mohr-Coulomb	500	32	Water Table
Alluvium		120	Mohr-Coulomb	900	0	Water Table
Colluvium		123	Mohr-Coulomb	1400	0	None
Brione's Formation		114	Mohr-Coulomb	0	40	None
Hambre formation		118	Mohr-Coulomb	0	40	None



AGS

Cross-Section A-A' - before Building Construction - Seismic Condition

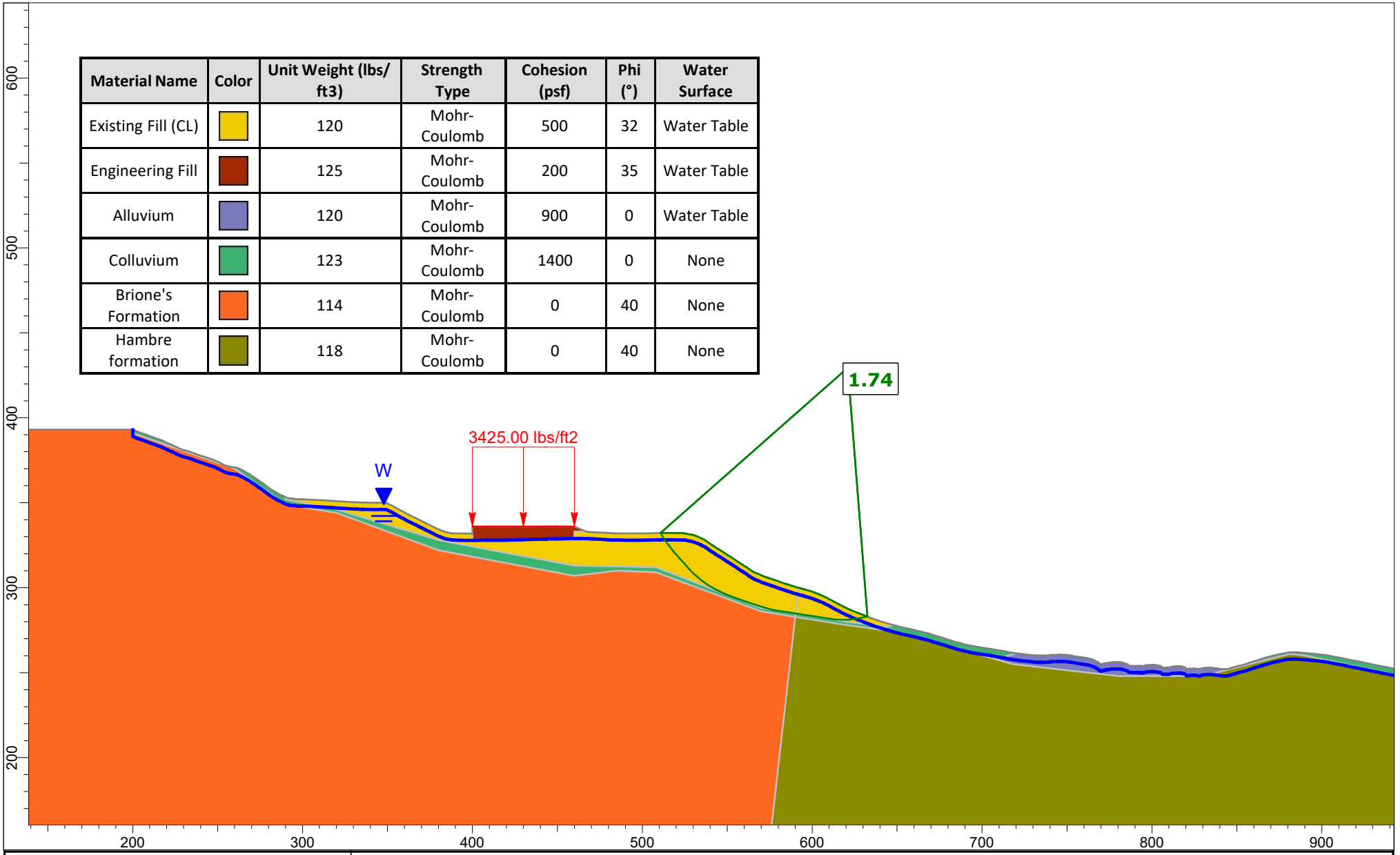
Walnut Creek Water Treatment Plant Pretreatment Project

Location WALNUT CREEK, CALIFORNIA

Date July 2025

Plate PLATE D2

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Existing Fill (CL)		120	Mohr-Coulomb	500	32	Water Table
Engineering Fill		125	Mohr-Coulomb	200	35	Water Table
Alluvium		120	Mohr-Coulomb	900	0	Water Table
Colluvium		123	Mohr-Coulomb	1400	0	None
Brione's Formation		114	Mohr-Coulomb	0	40	None
Hambre formation		118	Mohr-Coulomb	0	40	None

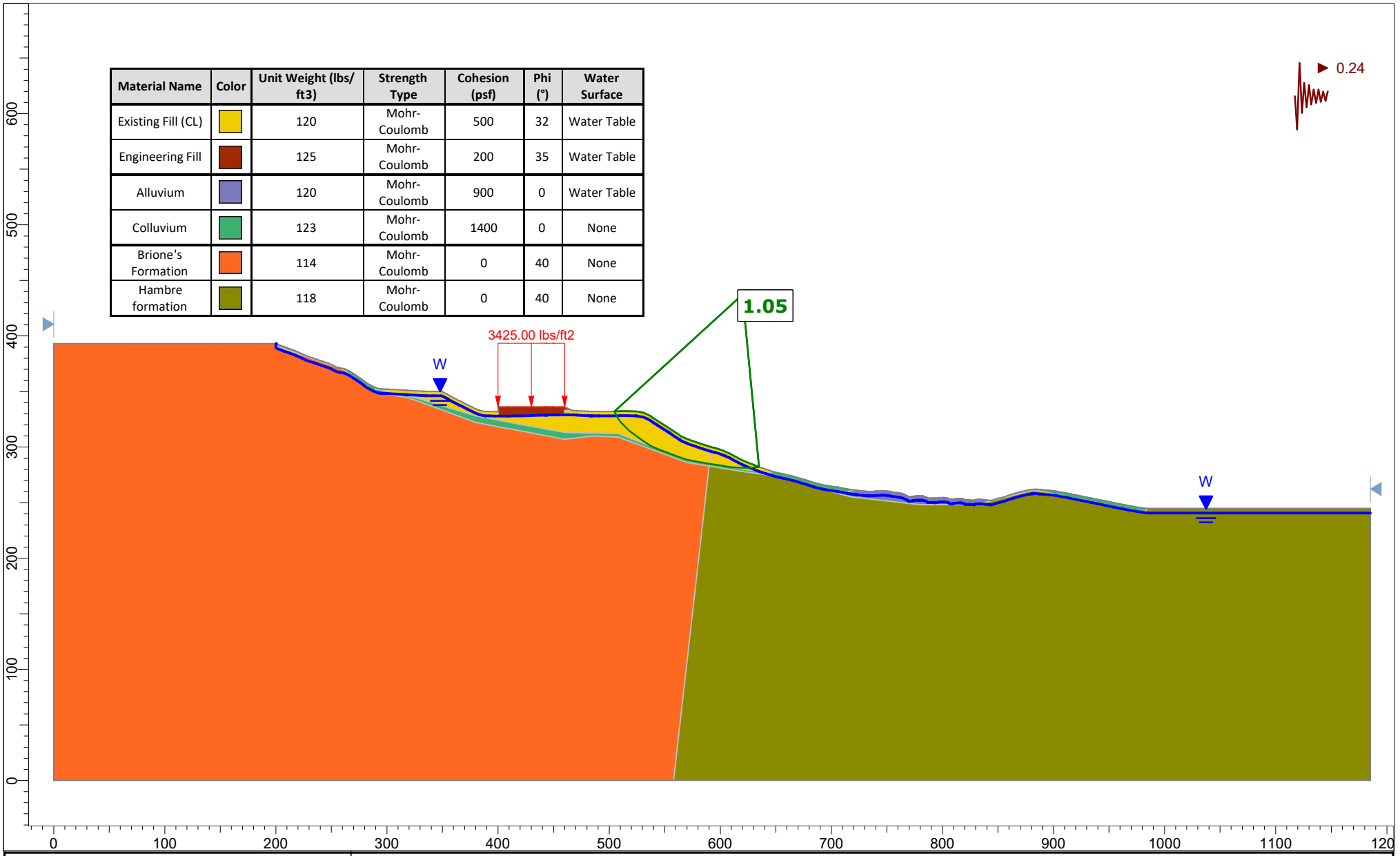


AGS

Cross-Section A-A' - after Building Construction - Static Condition

Walnut Creek Water Treatment Plant Pretreatment Project		Location	WALNUT CREEK, CALIFORNIA
Job Number	AGS 23-006	Plate	PLATE D3
Date	NOV 2024	Drawn by	LL

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (°)	Water Surface
Existing Fill (CL)		120	Mohr-Coulomb	500	32	Water Table
Engineering Fill		125	Mohr-Coulomb	200	35	Water Table
Alluvium		120	Mohr-Coulomb	900	0	Water Table
Colluvium		123	Mohr-Coulomb	1400	0	None
Brione's Formation		114	Mohr-Coulomb	0	40	None
Hambre formation		118	Mohr-Coulomb	0	40	None



AGS

Cross-Section A-A' - After Building Construction - Seismic Condition

Walnut Creek Water Treatment Plant Pretreatment Project

Location WALNUT CREEK, CALIFORNIA

Date July 2025

Plate PLATE D4

APPENDIX E

CHEMICAL TESTING REPORT

Enthalpy Analytical
931 West Barkley Ave
Orange, CA 92868
(714) 771-6900

enthalpy.com

Lab Job Number : 520812
Report Level : II
Report Date : 12/04/2024

Analytical Report *prepared for:*

Chloe Gednov
AGS, Inc.
5 Freelon Street
San Francisco, CA 94107

Project: AGS-23-006 - WCWTP

Authorized for release by:

Sophia Baughman, Project Manager
sophia.baughman@enthalpy.com

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the above signature which applies to this PDF file as well as any associated electronic data deliverable files. The results contained in this report meet all requirements of NELAP and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

CA ELAP# 1338, NELAP# 4038, SCAQMD LAP# 18LA0518, LACSD ID# 10105

ENTHALPY ANALYTICAL

Sample Summary

Chloe Gednov
AGS, Inc.
5 Freelon Street
San Francisco, CA
94107

Lab Job #:	520812
Project No:	AGS-23-006
Location:	WCWTP
Date Received:	11/20/24

Sample ID	Lab ID	Collected	Matrix
23-006-DRUM	520812-001	11/15/24 09:35	Soil

ENTHALPY ANALYTICAL

Case Narrative

AGS, Inc. 5 Freelon Street San Francisco, CA 94107 Chloe Gednov	Lab Job Number: 520812 Project No: AGS-23-006 Location: WCWTP Date Received: 11/20/24

This data package contains sample and QC results for one soil sample, requested for the above referenced project on 11/21/24. The sample was received cold and intact.

TPH-Extractables by GC (EPA 8015M):

- Low recoveries were observed for diesel C10-C28 in the MS/MSD for batch 356313; the parent sample was not a project sample, the LCS was within limits, the associated RPD was within limits, and these low recoveries were not associated with any reported results.
- No other analytical problems were encountered.

Volatile Organics by GC/MS (EPA 8260B):

- Many analytes were analyzed outside of hold time; affected data was qualified with "H".
- No other analytical problems were encountered.

Metals (EPA 6010B and EPA 7471A):

- Low recoveries were observed for antimony in the MS/MSD for batch 356165; the parent sample was not a project sample, the LCS was within limits, and the associated RPD was within limits. High recovery was observed for lead in the MSD for batch 356165; the LCS was within limits. High RPD was also observed for lead in the MS/MSD for batch 356165.
- No other analytical problems were encountered.

ENTHALPY ANALYTICAL

Chain of Custody Record

Lab No: 520812

Page: _____ of _____

Turn Around Time (rush by advanced notice only)

Standard:	X	5 Day:		3 Day:	
2 Day:		1 Day:		Custom TAT:	

#N/A
#N/A

Matrix: **A** = Air **S** = Soil/Solid **W** = Water **DW** = Drinking Water **P** = Product **O** = Oil **SD** = Sediment **T** = Tissue **WP** = Wipe **WW** = Wastewater **X** = Other

Sample Type: **C** = Composite **G** = Grab or Discrete **B** = Blank **O** = Other

Preservatives: **0** = none **1** = $Na_2S_2O_3$ **2** = HCl **3** = HNO_3 **4** = H_2SO_4 **5** = NaOH **6** = Other

Sample Receipt Temp and Notes: (lab use only)

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company:	AGS, INC.	Name:	WCWTP
Report To:	CHLOE GEDNOV	Number:	AGS-23-006
Email:	CHLOE.GEDNOV@AGSINC.COM	P.O. #:	
Address:	5 FREELON STREET, SF, CA, 94107	Address:	2201 LARKEY LANE, WC, CA
Phone:	714-204-7917	Global ID:	
Fax:		Sampled By:	

	Sample ID	Sampling Date	Sampling Time (24 hr)	Matrix	Sample Type	Pres.	Cont. No.	Cont. Size	Initials	CA TITLE 22 METALS BY EPA 6010	VOCs + TPHg + BTEX by EPA 8260B	TPHd, TPHmo, & TPHho by EPA 8015B						Test Instructions / Comments
1	23-006-drum	11/15/24	9:35a	S	C	0	1	modcal	cg	x	x	x						
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

	Signature	Print Name	Company / Title	Date / Time
1 Relinquished By:		Chloe Gednov	AGS / Project Geo	11/20/24
1 Received By:				11/20/24 17:40
2 Relinquished By:				11/21/24 14:50
2 Received By:		VETH CO	ENTHALPY	11/21/24 10:40
3 Relinquished By:				
3 Received By:				

SAMPLE RECEIPT CHECKLIST

ENTHALPY

Section 1: General Info

Date Received: 11/20/24 WO# 520812 Client: AGI

Section 2: Shipping / Custody **Are custody seals present? ☐ Yes ☑ No**

Custody seals intact on arrival? ☑ N/A ☐ Yes ☐ No ☐ On cooler / box ☐ On samples

Shipping Info: _____

Section 3a: Condition / Packaging ☐ **Outside 0.0 - 6.0°C (0.0 - 10.0°C for microbiology) (PM notified)**

Date Opened 11/20/24 By (initials) MM Type of ice used : ☐ Wet ☐ Blue/Gel ☑ None

☐ Samples received on ice directly from the field; cooling process had begun. (if checked, skip temperatures)

☐ Sample matrix doesn't require cooling (e.g. air, bulk PCB). (if checked, skip temperatures)

If no cooler: Observed/Adjusted Temp (°C): ____ / ____ Thermometer/IR Gun: 09 CF: -0.6

Cooler Temp (°C) #1: 15.9 / 15.5 #2: ____ / ____ #3: ____ / ____ #4: ____ / ____ #5: ____ / ____ #6: ____ / ____

Section 3b: Microbiology Samples ☑ **No microbiology samples submitted (skip 3b)**

☐ Within temp range 0.0 - 10.0°C or received on ice directly from field.

☐ Adequate headspace for microbiology analysis.

Section 3c: Air Samples ☑ **No air samples submitted (skip 3c)**

☐ 1.4L Canisters ☐ 6L Canisters ☐ Tedlar Bags ☐ MCE Cassettes ☐ Sorbent Tubes ☐ Other ____

Section 4: Containers / Labels / Samples	YES	NO	N/A
1) Were custody papers present, filled properly, and legible?	✓		
2) Is the sampler's name present on the CoC?		✓	
3) Were containers received in good condition (unbroken / unopened / uncompromised)?	✓		
4) Were the samples bagged? (required for microbiology samples; recommended for soil samples)		✓	
5) Were all of, and only, the correct samples received?	✓		
6) Are sample labels present, legible, and in agreement with the CoC?	✓		
7) Does the container count match the CoC?	✓		
8) Was sufficient sample volume / mass received for the analyses requested?	✓		
9) Were samples received in proper containers for the analyses requested?	✓		
10) Were samples received with > 1/2 holding time remaining?	✓		
11) Are samples properly preserved as indicated by CoC / labels?	✓		
12) Unpreserved VOAs received - If necessary, was the hold time changed in LIMS?			✓
13) Are VOA vials free from headspace/bubbles > 6mm?			✓

Section 5: Explanations / Comments ☑ **PM notified**

Client informed of temp issue at counter & wants to proceed.

Date Logged 11/20/24 **By (print)** MM **(sign)** _____

Date Labeled 11/20/24 **By (print)** MM **(sign)** _____

SAMPLE RECEIPT CHECKLIST

ENTHALPY ANALYTICAL

Section 1: General Info

Date Received: 11/21/24 WO# 520812 Client: AGS

Section 2: Shipping / Custody **Are custody seals present?** ☑ Yes ☐ No

Custody seals intact on arrival? ☐ N/A ☑ Yes ☐ No ☑ On cooler / box ☐ On samples

Shipping Info: SOUTHWEST AIRLINES

Section 3a: Condition / Packaging ☐ **Outside 0.0 - 6.0°C (0.0 - 10.0°C for microbiology) (PM notified)**

Date Opened 11/21/24 By (initials) NCM Type of ice used : ☑ Wet ☐ Blue/Gel ☐ None

☐ Samples received on ice directly from the field; cooling process had begun. (if checked, skip temperatures)

☐ Sample matrix doesn't require cooling (e.g. air, bulk PCB). (if checked, skip temperatures)

If no cooler: Observed/Adjusted Temp (°C): ____/____ Thermometer/IR Gun: IR-01 CF: -0.5

Cooler Temp (°C) #1: 3.1 / 2.6 #2: ____/____ #3: ____/____ #4: ____/____ #5: ____/____ #6: ____/____

Section 3b: Microbiology Samples ☑ **No microbiology samples submitted (skip 3b)**

☐ Within temp range 0.0 - 10.0°C or received on ice directly from field.

☐ Adequate headspace for microbiology analysis.

Section 3c: Air Samples ☑ **No air samples submitted (skip 3c)**

☐ 1.4L Canisters ☐ 6L Canisters ☐ Tedlar Bags ☐ MCE Cassettes ☐ Sorbent Tubes ☐ Other____

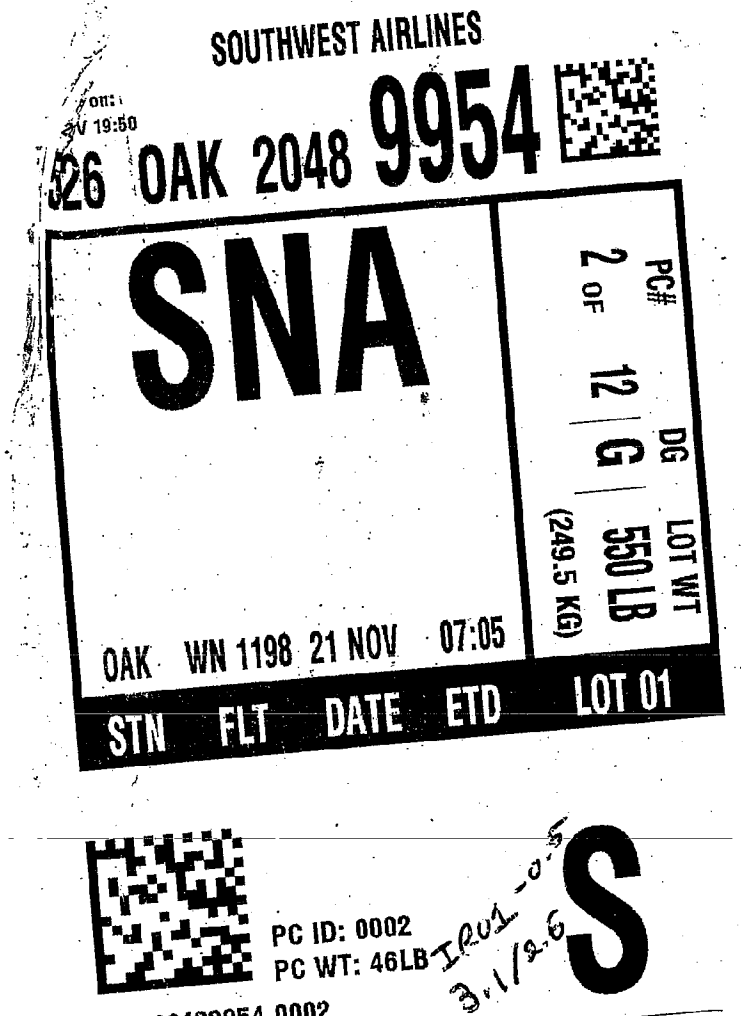
Section 4: Containers / Labels / Samples	YES	NO	N/A
1) Were custody papers present, filled properly, and legible?	✓		
2) Is the sampler's name present on the CoC?		✓	
3) Were containers received in good condition (unbroken / unopened / uncompromised)?	✓		
4) Were the samples bagged? (required for microbiology samples; recommended for soil samples) JKC 11/21	✓	✓	
5) Were all of, and only, the correct samples received?	✓		
6) Are sample labels present, legible, and in agreement with the CoC?	✓		
7) Does the container count match the CoC?	✓		
8) Was sufficient sample volume / mass received for the analyses requested?	✓		
9) Were samples received in proper containers for the analyses requested?	✓		
10) Were samples received with > 1/2 holding time remaining?	✓		
11) Are samples properly preserved as indicated by CoC / labels?	✓		
12) Unpreserved VOAs received - If necessary, was the hold time changed in LIMS?			✓
13) Are VOA vials free from headspace/bubbles > 6mm?			✓

Section 5: Explanations / Comments ☐ **PM notified**

PLEASE REFER TO BERKELEY'S SHEET

Date Logged 11/20/24 **By (print)** BERKELEY **(sign)** ____

Date Labeled 11/20/24 **By (print)** BERKELEY **(sign)** ____


SOUTHWEST AIRLINES
526 OAK 2048 9954
SNA
PC# 2 OF 12
DG G
LOT WT 550 LB (249.5 KG)
OAK WN 1198 21 NOV 07:05
STN FLT DATE ETD LOT 01
PC ID: 0002
PC WT: 46LB
526 20489954 0002
S

ENTHALPY ANALYTICAL

Analysis Results for 520812

Chloe Gednov
AGS, Inc.
5 Freelon Street
San Francisco, CA 94107

Lab Job #: 520812
Project No: AGS-23-006
Location: WCWTP
Date Received: 11/20/24

Sample ID: 23-006-DRUM **Lab ID: 520812-001** **Collected: 11/15/24 09:35**
Matrix: Soil

520812-001 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA 6010B Prep Method: EPA 3050B									
Antimony	ND		mg/Kg	2.9	0.96	356165	11/22/24	11/22/24	KCD
Arsenic	**3.6**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Barium	**110**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Beryllium	**0.62**		mg/Kg	0.48	0.96	356165	11/22/24	11/22/24	KCD
Cadmium	ND		mg/Kg	0.48	0.96	356165	11/22/24	11/22/24	KCD
Chromium	**19**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Cobalt	**6.3**		mg/Kg	0.48	0.96	356165	11/22/24	11/22/24	KCD
Copper	**24**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Lead	**7.7**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Molybdenum	ND		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Nickel	**15**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Selenium	ND		mg/Kg	2.9	0.96	356165	11/22/24	11/22/24	KCD
Silver	ND		mg/Kg	0.48	0.96	356165	11/22/24	11/22/24	KCD
Thallium	ND		mg/Kg	2.9	0.96	356165	11/22/24	11/22/24	KCD
Vanadium	**30**		mg/Kg	0.96	0.96	356165	11/22/24	11/22/24	KCD
Zinc	**36**		mg/Kg	4.8	0.96	356165	11/22/24	11/22/24	KCD
Method: EPA 7471A Prep Method: METHOD									
Mercury	**0.28**		mg/Kg	0.15	1.1	356093	11/21/24	11/22/24	MLL
Method: EPA 8015M Prep Method: EPA 3580M									
Hydraulic Oil C20-C39	ND		mg/Kg	30	0.99	356313	11/24/24	11/27/24	KMB
DRO C10-C28	ND		mg/Kg	9.9	0.99	356313	11/24/24	11/26/24	KMB
ORO C28-C44	ND		mg/Kg	20	0.99	356313	11/24/24	11/26/24	KMB
Surrogates				**Limits**					
n-Triacontane	106%		%REC	70-130	0.99	356313	11/24/24	11/26/24	KMB
Method: EPA 8260B Prep Method: EPA 5030B									
TPH Gasoline	ND	H	ug/Kg	100	1	356845	12/03/24	12/03/24	TCN
Freon 12	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Chloromethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Vinyl Chloride	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Bromomethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Chloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Trichlorofluoromethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Acetone	ND	H	ug/Kg	100	1	356845	12/03/24	12/03/24	TCN
Freon 113	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1-Dichloroethene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Methylene Chloride	ND	H	ug/Kg	20	1	356845	12/03/24	12/03/24	TCN
MTBE	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN

Results for any subcontracted analyses are not included in this section.

ENTHALPY ANALYTICAL

Analysis Results for 520812

520812-001 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
trans-1,2-Dichloroethene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1-Dichloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
2-Butanone	ND	H	ug/Kg	100	1	356845	12/03/24	12/03/24	TCN
cis-1,2-Dichloroethene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
2,2-Dichloropropane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Chloroform	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Bromochloromethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1,1-Trichloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1-Dichloropropene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Carbon Tetrachloride	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2-Dichloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Benzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Trichloroethene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2-Dichloropropane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Bromodichloromethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Dibromomethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
4-Methyl-2-Pentanone	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
cis-1,3-Dichloropropene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Toluene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
trans-1,3-Dichloropropene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1,2-Trichloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,3-Dichloropropane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Tetrachloroethene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Dibromochloromethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2-Dibromoethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Chlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1,1,2-Tetrachloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Ethylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
m,p-Xylenes	ND	H	ug/Kg	10	1	356845	12/03/24	12/03/24	TCN
o-Xylene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Styrene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Bromoform	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Isopropylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,1,2,2-Tetrachloroethane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2,3-Trichloropropane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Propylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Bromobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,3,5-Trimethylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
2-Chlorotoluene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
4-Chlorotoluene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
tert-Butylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2,4-Trimethylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
sec-Butylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
para-Isopropyl Toluene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,3-Dichlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,4-Dichlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
n-Butylbenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2-Dichlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2-Dibromo-3-Chloropropane	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
1,2,4-Trichlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Hexachlorobutadiene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Naphthalene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN

Results for any subcontracted analyses are not included in this section.

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Analysis Results for 520812

520812-001 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
1,2,3-Trichlorobenzene	ND	H	ug/Kg	5.0	1	356845	12/03/24	12/03/24	TCN
Surrogates				**Limits**					
Dibromofluoromethane	87%		%REC	70-145	1	356845	12/03/24	12/03/24	TCN
1,2-Dichloroethane-d4	92%		%REC	70-145	1	356845	12/03/24	12/03/24	TCN
Toluene-d8	106%		%REC	70-145	1	356845	12/03/24	12/03/24	TCN
Bromofluorobenzene	96%		%REC	70-145	1	356845	12/03/24	12/03/24	TCN

H Holding time was exceeded
ND Not Detected

Results for any subcontracted analyses are not included in this section.

ENTHALPY ANALYTICAL

Batch QC

Type:	**Blank**	**Lab ID:**	**QC1206372**	**Batch:**	**356165**
Matrix:	**Soil**	**Method:**	**EPA 6010B**	**Prep Method:**	**EPA 3050B**

QC1206372 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Antimony	ND		mg/Kg	3.0	11/22/24	11/22/24
Arsenic	ND		mg/Kg	1.0	11/22/24	11/22/24
Barium	ND		mg/Kg	1.0	11/22/24	11/22/24
Beryllium	ND		mg/Kg	0.50	11/22/24	11/22/24
Cadmium	ND		mg/Kg	0.50	11/22/24	11/22/24
Chromium	ND		mg/Kg	1.0	11/22/24	11/22/24
Cobalt	ND		mg/Kg	0.50	11/22/24	11/22/24
Copper	ND		mg/Kg	1.0	11/22/24	11/22/24
Lead	ND		mg/Kg	1.0	11/22/24	11/22/24
Molybdenum	ND		mg/Kg	1.0	11/22/24	11/22/24
Nickel	ND		mg/Kg	1.0	11/22/24	11/22/24
Selenium	ND		mg/Kg	3.0	11/22/24	11/22/24
Silver	ND		mg/Kg	0.50	11/22/24	11/22/24
Thallium	ND		mg/Kg	3.0	11/22/24	11/22/24
Vanadium	ND		mg/Kg	1.0	11/22/24	11/22/24
Zinc	ND		mg/Kg	5.0	11/22/24	11/22/24

Type:	**Lab Control Sample**	**Lab ID:**	**QC1206373**	**Batch:**	**356165**
Matrix:	**Soil**	**Method:**	**EPA 6010B**	**Prep Method:**	**EPA 3050B**

QC1206373 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Antimony	105.9	100.0	mg/Kg	106%		80-120
Arsenic	108.8	100.0	mg/Kg	109%		80-120
Barium	115.2	100.0	mg/Kg	115%		80-120
Beryllium	107.2	100.0	mg/Kg	107%		80-120
Cadmium	104.8	100.0	mg/Kg	105%		80-120
Chromium	113.1	100.0	mg/Kg	113%		80-120
Cobalt	116.0	100.0	mg/Kg	116%		80-120
Copper	95.27	100.0	mg/Kg	95%		80-120
Lead	117.1	100.0	mg/Kg	117%		80-120
Molybdenum	106.5	100.0	mg/Kg	106%		80-120
Nickel	109.0	100.0	mg/Kg	109%		80-120
Selenium	99.35	100.0	mg/Kg	99%		80-120
Silver	48.96	50.00	mg/Kg	98%		80-120
Thallium	117.6	100.0	mg/Kg	118%		80-120
Vanadium	98.96	100.0	mg/Kg	99%		80-120
Zinc	120.0	100.0	mg/Kg	120%		80-120

ENTHALPY ANALYTICAL

Batch QC

Type:	Matrix Spike	Lab ID:	QC1206374	Batch:	356165
Matrix (Source ID):	Soil (520810-001)	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC1206374 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Antimony	34.32	ND	95.24	mg/Kg	36%	*	75-125	0.95
Arsenic	95.99	4.068	95.24	mg/Kg	97%		75-125	0.95
Barium	179.0	84.32	95.24	mg/Kg	99%		75-125	0.95
Beryllium	100.5	0.4394	95.24	mg/Kg	105%		75-125	0.95
Cadmium	94.20	ND	95.24	mg/Kg	99%		75-125	0.95
Chromium	115.9	17.84	95.24	mg/Kg	103%		75-125	0.95
Cobalt	107.8	10.25	95.24	mg/Kg	102%		75-125	0.95
Copper	117.6	41.98	95.24	mg/Kg	79%		75-125	0.95
Lead	127.6	34.97	95.24	mg/Kg	97%		75-125	0.95
Molybdenum	84.82	ND	95.24	mg/Kg	89%		75-125	0.95
Nickel	122.9	23.57	95.24	mg/Kg	104%		75-125	0.95
Selenium	86.98	ND	95.24	mg/Kg	91%		75-125	0.95
Silver	47.37	ND	47.62	mg/Kg	99%		75-125	0.95
Thallium	96.80	ND	95.24	mg/Kg	102%		75-125	0.95
Vanadium	163.3	56.40	95.24	mg/Kg	112%		75-125	0.95
Zinc	150.2	71.60	95.24	mg/Kg	83%		75-125	0.95

Type:	Matrix Spike Duplicate	Lab ID:	QC1206375	Batch:	356165
Matrix (Source ID):	Soil (520810-001)	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC1206375 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Antimony	34.87	ND	95.24	mg/Kg	37%	*	75-125	2	41	0.95
Arsenic	98.48	4.068	95.24	mg/Kg	99%		75-125	3	35	0.95
Barium	182.0	84.32	95.24	mg/Kg	103%		75-125	2	20	0.95
Beryllium	102.3	0.4394	95.24	mg/Kg	107%		75-125	2	20	0.95
Cadmium	95.60	ND	95.24	mg/Kg	100%		75-125	1	20	0.95
Chromium	117.6	17.84	95.24	mg/Kg	105%		75-125	1	20	0.95
Cobalt	107.0	10.25	95.24	mg/Kg	102%		75-125	1	20	0.95
Copper	123.3	41.98	95.24	mg/Kg	85%		75-125	5	20	0.95
Lead	329.3	34.97	95.24	mg/Kg	309%	*	75-125	88*	20	0.95
Molybdenum	84.89	ND	95.24	mg/Kg	89%		75-125	0	20	0.95
Nickel	122.4	23.57	95.24	mg/Kg	104%		75-125	0	20	0.95
Selenium	89.21	ND	95.24	mg/Kg	94%		75-125	3	20	0.95
Silver	48.65	ND	47.62	mg/Kg	102%		75-125	3	20	0.95
Thallium	98.17	ND	95.24	mg/Kg	103%		75-125	1	20	0.95
Vanadium	161.5	56.40	95.24	mg/Kg	110%		75-125	1	20	0.95
Zinc	154.4	71.60	95.24	mg/Kg	87%		75-125	3	20	0.95

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Batch QC

Type:	Post Digest Spike	Lab ID:	QC1206376	Batch:	356165
Matrix (Source ID):	Soil (520810-001)	Method:	EPA 6010B	Prep Method:	EPA 3050B

QC1206376 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Antimony	90.59	ND	95.24	mg/Kg	95%		75-125	0.95
Arsenic	95.69	4.068	95.24	mg/Kg	96%		75-125	0.95
Barium	175.2	84.32	95.24	mg/Kg	95%		75-125	0.95
Beryllium	94.29	0.4394	95.24	mg/Kg	99%		75-125	0.95
Cadmium	89.17	ND	95.24	mg/Kg	94%		75-125	0.95
Chromium	108.5	17.84	95.24	mg/Kg	95%		75-125	0.95
Cobalt	101.3	10.25	95.24	mg/Kg	96%		75-125	0.95
Copper	130.8	41.98	95.24	mg/Kg	93%		75-125	0.95
Lead	127.6	34.97	95.24	mg/Kg	97%		75-125	0.95
Molybdenum	89.78	ND	95.24	mg/Kg	94%		75-125	0.95
Nickel	117.7	23.57	95.24	mg/Kg	99%		75-125	0.95
Selenium	88.12	ND	95.24	mg/Kg	93%		75-125	0.95
Silver	45.13	ND	47.62	mg/Kg	95%		75-125	0.95
Thallium	94.61	ND	95.24	mg/Kg	99%		75-125	0.95
Vanadium	143.0	56.40	95.24	mg/Kg	91%		75-125	0.95
Zinc	165.7	71.60	95.24	mg/Kg	99%		75-125	0.95

Type:	Blank	Lab ID:	QC1206178	Batch:	356093
Matrix:	Soil	Method:	EPA 7471A	Prep Method:	METHOD

QC1206178 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Mercury	ND		mg/Kg	0.14	11/21/24	11/22/24

Type:	Lab Control Sample	Lab ID:	QC1206179	Batch:	356093
Matrix:	Soil	Method:	EPA 7471A	Prep Method:	METHOD

QC1206179 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Mercury	0.7981	0.8333	mg/Kg	96%		80-120

Type:	Matrix Spike	Lab ID:	QC1206180	Batch:	356093
Matrix (Source ID):	Soil (520661-004)	Method:	EPA 7471A	Prep Method:	METHOD

QC1206180 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Mercury	0.8458	ND	0.8772	mg/Kg	96%		75-125	1.1

Type:	Matrix Spike Duplicate	Lab ID:	QC1206181	Batch:	356093
Matrix (Source ID):	Soil (520661-004)	Method:	EPA 7471A	Prep Method:	METHOD

QC1206181 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Mercury	0.9093	ND	0.9259	mg/Kg	98%		75-125	2	20	1.1

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Batch QC

Type: Blank	Lab ID: QC1206880	Batch: 356313
Matrix: Soil	Method: EPA 8015M	Prep Method: EPA 3580M

QC1206880 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Hydraulic Oil C20-C39	ND		mg/Kg	30	11/24/24	11/27/24
DRO C10-C28	ND		mg/Kg	9.9	11/24/24	11/25/24
ORO C28-C44	ND		mg/Kg	20	11/24/24	11/25/24
Surrogates				**Limits**		
n-Triacontane	85%		%REC	70-130	11/24/24	11/25/24

Type: Lab Control Sample	Lab ID: QC1206881	Batch: 356313
Matrix: Soil	Method: EPA 8015M	Prep Method: EPA 3580M

QC1206881 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Diesel C10-C28	233.8	248.0	mg/Kg	94%		76-122
Surrogates						
n-Triacontane	8.679	9.921	mg/Kg	87%		70-130

Type: Matrix Spike	Lab ID: QC1206882	Batch: 356313
Matrix (Source ID): Soil (520248-001)	Method: EPA 8015M	Prep Method: EPA 3580M

QC1206882 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
Diesel C10-C28	405.8	381.0	249.6	mg/Kg	10%	*	62-126	50
Surrogates								
n-Triacontane	9.069		9.985	mg/Kg		DO	70-130	50

Type: Matrix Spike Duplicate	Lab ID: QC1206883	Batch: 356313
Matrix (Source ID): Soil (520248-001)	Method: EPA 8015M	Prep Method: EPA 3580M

QC1206883 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
Diesel C10-C28	354.2	381.0	249.8	mg/Kg	-11%	*	62-126	14	35	50
Surrogates										
n-Triacontane	7.948		9.990	mg/Kg		DO	70-130			50

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Batch QC

Type:	**Blank**	**Lab ID:**	**QC1208884**	**Batch:**	**356845**
Matrix:	**Soil**	**Method:**	**EPA 8260B**	**Prep Method:**	**EPA 5030B**

QC1208884 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
TPH Gasoline	ND		ug/Kg	100	12/03/24	12/03/24
Freon 12	ND		ug/Kg	5.0	12/03/24	12/03/24
Chloromethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Vinyl Chloride	ND		ug/Kg	5.0	12/03/24	12/03/24
Bromomethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Chloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Trichlorofluoromethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Acetone	ND		ug/Kg	100	12/03/24	12/03/24
Freon 113	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1-Dichloroethene	ND		ug/Kg	5.0	12/03/24	12/03/24
Methylene Chloride	ND		ug/Kg	20	12/03/24	12/03/24
MTBE	ND		ug/Kg	5.0	12/03/24	12/03/24
trans-1,2-Dichloroethene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1-Dichloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
2-Butanone	ND		ug/Kg	100	12/03/24	12/03/24
cis-1,2-Dichloroethene	ND		ug/Kg	5.0	12/03/24	12/03/24
2,2-Dichloropropane	ND		ug/Kg	5.0	12/03/24	12/03/24
Chloroform	ND		ug/Kg	5.0	12/03/24	12/03/24
Bromochloromethane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1,1-Trichloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1-Dichloropropene	ND		ug/Kg	5.0	12/03/24	12/03/24
Carbon Tetrachloride	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2-Dichloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Benzene	ND		ug/Kg	5.0	12/03/24	12/03/24
Trichloroethene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2-Dichloropropane	ND		ug/Kg	5.0	12/03/24	12/03/24
Bromodichloromethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Dibromomethane	ND		ug/Kg	5.0	12/03/24	12/03/24
4-Methyl-2-Pentanone	ND		ug/Kg	5.0	12/03/24	12/03/24
cis-1,3-Dichloropropene	ND		ug/Kg	5.0	12/03/24	12/03/24
Toluene	ND		ug/Kg	5.0	12/03/24	12/03/24
trans-1,3-Dichloropropene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1,2-Trichloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,3-Dichloropropane	ND		ug/Kg	5.0	12/03/24	12/03/24
Tetrachloroethene	ND		ug/Kg	5.0	12/03/24	12/03/24
Dibromochloromethane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2-Dibromoethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Chlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1,1,2-Tetrachloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
Ethylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
m,p-Xylenes	ND		ug/Kg	10	12/03/24	12/03/24
o-Xylene	ND		ug/Kg	5.0	12/03/24	12/03/24
Styrene	ND		ug/Kg	5.0	12/03/24	12/03/24
Bromoform	ND		ug/Kg	5.0	12/03/24	12/03/24
Isopropylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,1,2,2-Tetrachloroethane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2,3-Trichloropropane	ND		ug/Kg	5.0	12/03/24	12/03/24

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Batch QC

QC1208884 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Propylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
Bromobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,3,5-Trimethylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
2-Chlorotoluene	ND		ug/Kg	5.0	12/03/24	12/03/24
4-Chlorotoluene	ND		ug/Kg	5.0	12/03/24	12/03/24
tert-Butylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2,4-Trimethylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
sec-Butylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
para-Isopropyl Toluene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,3-Dichlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,4-Dichlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
n-Butylbenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2-Dichlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2-Dibromo-3-Chloropropane	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2,4-Trichlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
Hexachlorobutadiene	ND		ug/Kg	5.0	12/03/24	12/03/24
Naphthalene	ND		ug/Kg	5.0	12/03/24	12/03/24
1,2,3-Trichlorobenzene	ND		ug/Kg	5.0	12/03/24	12/03/24
Surrogates				**Limits**		
Dibromofluoromethane	94%		%REC	70-130	12/03/24	12/03/24
1,2-Dichloroethane-d4	97%		%REC	70-145	12/03/24	12/03/24
Toluene-d8	102%		%REC	70-145	12/03/24	12/03/24
Bromofluorobenzene	98%		%REC	70-145	12/03/24	12/03/24

Type: Lab Control Sample **Lab ID:** QC1208885 **Batch:** 356845
Matrix: Soil **Method:** EPA 8260B **Prep Method:** EPA 5030B

QC1208885 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
1,1-Dichloroethene	45.84	50.00	ug/Kg	92%		70-131
MTBE	39.39	50.00	ug/Kg	79%		69-130
Benzene	41.76	50.00	ug/Kg	84%		70-130
Trichloroethene	44.55	50.00	ug/Kg	89%		70-130
Toluene	47.28	50.00	ug/Kg	95%		70-130
Chlorobenzene	48.22	50.00	ug/Kg	96%		70-130
Surrogates						
Dibromofluoromethane	46.81	50.00	ug/Kg	94%		70-130
1,2-Dichloroethane-d4	50.78	50.00	ug/Kg	102%		70-145
Toluene-d8	51.84	50.00	ug/Kg	104%		70-145
Bromofluorobenzene	50.68	50.00	ug/Kg	101%		70-145

ENTHALPY ANALYTICAL

Batch QC

Type:	**Lab Control Sample Duplicate**	**Lab ID:**	**QC1208886**	**Batch:**	**356845**
Matrix:	**Soil**	**Method:**	**EPA 8260B**	**Prep Method:**	**EPA 5030B**

QC1208886 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
1,1-Dichloroethene	43.04	50.00	ug/Kg	86%		70-131	6	33
MTBE	38.49	50.00	ug/Kg	77%		69-130	2	30
Benzene	42.13	50.00	ug/Kg	84%		70-130	1	30
Trichloroethene	41.82	50.00	ug/Kg	84%		70-130	6	30
Toluene	44.02	50.00	ug/Kg	88%		70-130	7	30
Chlorobenzene	44.86	50.00	ug/Kg	90%		70-130	7	30
Surrogates								
Dibromofluoromethane	47.63	50.00	ug/Kg	95%		70-130		
1,2-Dichloroethane-d4	50.06	50.00	ug/Kg	100%		70-145		
Toluene-d8	51.66	50.00	ug/Kg	103%		70-145		
Bromofluorobenzene	48.97	50.00	ug/Kg	98%		70-145		

ENTHALPY ANALYTICAL

Batch QC

Type:	**Blank**	**Lab ID:**	**QC1208887**	**Batch:**	**356845**
Matrix:	**Soil**	**Method:**	**EPA 8260B**	**Prep Method:**	**EPA 5030B**

QC1208887 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
TPH Gasoline	ND		ug/Kg	5,000	12/03/24	12/03/24
Freon 12	ND		ug/Kg	250	12/03/24	12/03/24
Chloromethane	ND		ug/Kg	250	12/03/24	12/03/24
Vinyl Chloride	ND		ug/Kg	250	12/03/24	12/03/24
Bromomethane	ND		ug/Kg	250	12/03/24	12/03/24
Chloroethane	ND		ug/Kg	270	12/03/24	12/03/24
Trichlorofluoromethane	ND		ug/Kg	250	12/03/24	12/03/24
Acetone	ND		ug/Kg	5,000	12/03/24	12/03/24
Freon 113	ND		ug/Kg	250	12/03/24	12/03/24
1,1-Dichloroethene	ND		ug/Kg	250	12/03/24	12/03/24
Methylene Chloride	ND		ug/Kg	1,000	12/03/24	12/03/24
MTBE	ND		ug/Kg	250	12/03/24	12/03/24
trans-1,2-Dichloroethene	ND		ug/Kg	250	12/03/24	12/03/24
1,1-Dichloroethane	ND		ug/Kg	250	12/03/24	12/03/24
2-Butanone	ND		ug/Kg	5,000	12/03/24	12/03/24
cis-1,2-Dichloroethene	ND		ug/Kg	250	12/03/24	12/03/24
2,2-Dichloropropane	ND		ug/Kg	250	12/03/24	12/03/24
Chloroform	ND		ug/Kg	250	12/03/24	12/03/24
Bromochloromethane	ND		ug/Kg	250	12/03/24	12/03/24
1,1,1-Trichloroethane	ND		ug/Kg	250	12/03/24	12/03/24
1,1-Dichloropropene	ND		ug/Kg	250	12/03/24	12/03/24
Carbon Tetrachloride	ND		ug/Kg	250	12/03/24	12/03/24
1,2-Dichloroethane	ND		ug/Kg	250	12/03/24	12/03/24
Benzene	ND		ug/Kg	250	12/03/24	12/03/24
Trichloroethene	ND		ug/Kg	250	12/03/24	12/03/24
1,2-Dichloropropane	ND		ug/Kg	250	12/03/24	12/03/24
Bromodichloromethane	ND		ug/Kg	250	12/03/24	12/03/24
Dibromomethane	ND		ug/Kg	250	12/03/24	12/03/24
4-Methyl-2-Pentanone	ND		ug/Kg	250	12/03/24	12/03/24
cis-1,3-Dichloropropene	ND		ug/Kg	250	12/03/24	12/03/24
Toluene	ND		ug/Kg	250	12/03/24	12/03/24
trans-1,3-Dichloropropene	ND		ug/Kg	250	12/03/24	12/03/24
1,1,2-Trichloroethane	ND		ug/Kg	250	12/03/24	12/03/24
1,3-Dichloropropane	ND		ug/Kg	250	12/03/24	12/03/24
Tetrachloroethene	ND		ug/Kg	250	12/03/24	12/03/24
Dibromochloromethane	ND		ug/Kg	250	12/03/24	12/03/24
1,2-Dibromoethane	ND		ug/Kg	250	12/03/24	12/03/24
Chlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,1,1,2-Tetrachloroethane	ND		ug/Kg	250	12/03/24	12/03/24
Ethylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
m,p-Xylenes	ND		ug/Kg	500	12/03/24	12/03/24
o-Xylene	ND		ug/Kg	250	12/03/24	12/03/24
Styrene	ND		ug/Kg	250	12/03/24	12/03/24
Bromoform	ND		ug/Kg	250	12/03/24	12/03/24
Isopropylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,1,2,2-Tetrachloroethane	ND		ug/Kg	250	12/03/24	12/03/24
1,2,3-Trichloropropane	ND		ug/Kg	250	12/03/24	12/03/24

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Batch QC

QC1208887 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Propylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
Bromobenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,3,5-Trimethylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
2-Chlorotoluene	ND		ug/Kg	250	12/03/24	12/03/24
4-Chlorotoluene	ND		ug/Kg	250	12/03/24	12/03/24
tert-Butylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,2,4-Trimethylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
sec-Butylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
para-Isopropyl Toluene	ND		ug/Kg	250	12/03/24	12/03/24
1,3-Dichlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,4-Dichlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
n-Butylbenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,2-Dichlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
1,2-Dibromo-3-Chloropropane	ND		ug/Kg	250	12/03/24	12/03/24
1,2,4-Trichlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
Hexachlorobutadiene	ND		ug/Kg	250	12/03/24	12/03/24
Naphthalene	ND		ug/Kg	250	12/03/24	12/03/24
1,2,3-Trichlorobenzene	ND		ug/Kg	250	12/03/24	12/03/24
Surrogates				**Limits**		
Dibromofluoromethane	92%		%REC	70-130	12/03/24	12/03/24
1,2-Dichloroethane-d4	97%		%REC	70-145	12/03/24	12/03/24
Toluene-d8	101%		%REC	70-145	12/03/24	12/03/24
Bromofluorobenzene	97%		%REC	70-145	12/03/24	12/03/24

Type: Lab Control Sample **Lab ID:** QC1208888 **Batch:** 356845
Matrix: Soil **Method:** EPA 8260B **Prep Method:** EPA 5030B

QC1208888 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
TPH Gasoline	594.1	500.0	ug/Kg	119%		70-130
Surrogates						
Dibromofluoromethane	49.75	50.00	ug/Kg	100%		70-130
1,2-Dichloroethane-d4	48.73	50.00	ug/Kg	97%		70-145
Toluene-d8	51.30	50.00	ug/Kg	103%		70-145
Bromofluorobenzene	49.35	50.00	ug/Kg	99%		70-145

Type: Lab Control Sample Duplicate **Lab ID:** QC1208889 **Batch:** 356845
Matrix: Soil **Method:** EPA 8260B **Prep Method:** EPA 5030B

QC1208889 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
TPH Gasoline	542.4	500.0	ug/Kg	108%		70-130	9	20
Surrogates								
Dibromofluoromethane	48.47	50.00	ug/Kg	97%		70-130		
1,2-Dichloroethane-d4	48.84	50.00	ug/Kg	98%		70-145		
Toluene-d8	50.76	50.00	ug/Kg	102%		70-145		
Bromofluorobenzene	48.70	50.00	ug/Kg	97%		70-145		

ENTHALPY ANALYTICAL

Batch QC

Type:	Matrix Spike	Lab ID:	QC1208929	Batch:	356845
Matrix (Source ID):	Soil (521264-004)	Method:	EPA 8260B	Prep Method:	EPA 5030B

QC1208929 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	DF
1,1-Dichloroethene	47.31	ND	50.00	ug/Kg	95%		70-141	1
MTBE	38.74	ND	50.00	ug/Kg	77%		59-130	1
Benzene	45.89	ND	50.00	ug/Kg	92%		70-130	1
Trichloroethene	46.66	ND	50.00	ug/Kg	93%		69-130	1
Toluene	47.24	ND	50.00	ug/Kg	94%		70-130	1
Chlorobenzene	48.46	ND	50.00	ug/Kg	97%		70-130	1
Surrogates								
Dibromofluoromethane	49.64		50.00	ug/Kg	99%		70-145	1
1,2-Dichloroethane-d4	51.89		50.00	ug/Kg	104%		70-145	1
Toluene-d8	50.80		50.00	ug/Kg	102%		70-145	1
Bromofluorobenzene	49.60		50.00	ug/Kg	99%		70-145	1

Type:	Matrix Spike Duplicate	Lab ID:	QC1208930	Batch:	356845
Matrix (Source ID):	Soil (521264-004)	Method:	EPA 8260B	Prep Method:	EPA 5030B

QC1208930 Analyte	Result	Source Sample Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim	DF
1,1-Dichloroethene	41.47	ND	50.00	ug/Kg	83%		70-141	13	43	1
MTBE	34.41	ND	50.00	ug/Kg	69%		59-130	12	30	1
Benzene	40.93	ND	50.00	ug/Kg	82%		70-130	11	30	1
Trichloroethene	41.73	ND	50.00	ug/Kg	83%		69-130	11	30	1
Toluene	42.01	ND	50.00	ug/Kg	84%		70-130	12	30	1
Chlorobenzene	43.89	ND	50.00	ug/Kg	88%		70-130	10	30	1
Surrogates										
Dibromofluoromethane	50.25		50.00	ug/Kg	100%		70-145			1
1,2-Dichloroethane-d4	49.11		50.00	ug/Kg	98%		70-145			1
Toluene-d8	51.29		50.00	ug/Kg	103%		70-145			1
Bromofluorobenzene	50.48		50.00	ug/Kg	101%		70-145			1

* Value is outside QC limits
DO Diluted Out
ND Not Detected