HALEY ALDRICH

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REPORT ON

GEOTECHNICAL EVALUATION
VULCAN MATERIALS COMPANY AREA Q PROJECT
2400 WEST HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

by Haley & Aldrich, Inc.
Walnut Creek, California

for Harrison, Temblador, Hungerford & Johnson LLP
Sacramento, California

File No. 132051-002
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Attention: Mr. Adam Guernsey
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Subject: Geotechnical Evaluation
Vulcan Materials Company Area Q Project
2400 West Highland Avenue
San Bernardino, California

Ladies and Gentlemen:

We are pleased to submit this geotechnical evaluation report for Vulcan Materials Company's (Vulcan) proposed Area Q mining project (Project). The report summarizes our field data collection, provides our interpretation of the subsurface data based on current and previous investigations, and includes geotechnical recommendations for the proposed Project.

The Project site is located in unincorporated San Bernardino County, east of Cajon Creek and north of the community of Muscoy. The Project site is bounded by residential neighborhoods to the south, a Union Pacific rail line to west, Historic Route 66 to the east and Vulcan's existing Cajon Creek aggregates mine, specifically Area L, to the north. The Project site is located approximately 2.5 miles away from Vulcan's existing San Bernardino facility, which is located directly north of State Route 210 and Highland Avenue. Nearby communities include Muscoy, the City of San Bernardino (adjacent to the east/north), and the City of Rialto (1.25 miles west).

The Project calls for aggregate material extraction and ancillary activities on 186.7 acres within the 196.0-acre Area Q property. Specifically, Vulcan is requesting that the County of San Bernardino approve a Conditional Use Permit (CUP) authorizing the following uses and activities on the Project site, for a 12-hour period between the hours of 6:00 AM and 10:00 PM, Monday through Saturday:

- Mineral resource extraction activities in one (1) phase. The maximum depth of mining would be 120 feet below natural ground surface (bgs). The design incorporates a standard final reclaimed slope configuration of 2:1 (horizontal to vertical).
- Construction of a minimum 10-foot tall vegetated earthen berm along the southeastern portion of the Project site (along the Devil Creek Diversion Channel) using topsoil and subsoil from the Project site, and planting of landscape screening along the berm; and extending the existing berm on Area L to the southern end of Area Q.

- Construction and operation of an elevated conveyor system arm across the Project site, connecting with Vulcan's existing conveyor system located on the Cajon Creek extraction site.
- Construction and maintenance of on-site roads.
- Operation of loaders, conveyors, and related equipment as necessary to move material from the Project site to the conveyor system that will transport materials to Vulcan's existing conveyor system located on the Cajon Creek extraction site.
- Conduct all activities as described above and herein on approximately 186.7 acres of the Project site.

Based on our evaluation of the subsurface conditions at the site, we conclude that mining and future reclamation of the proposed Area Q mine to a depth of 120 feet bgs at a standard slope configuration of 2:1 (horizontal to vertical) is geotechnically feasible. Based on our slope stability analysis, the static and seismic factors of safety for the Project's proposed mine slopes are 1.87 and 1.34, respectively. These factors of safety are considered acceptable for the proposed project design features and are considered stable slope configurations.

Our findings and recommendations regarding geotechnical aspects of this project are presented in the sections that follow.

Sincerely yours,
HALEY & ALDRICH, INC.

Katy Decker, P.G.
Project Manager

Catherine H. Ellis
Geotechnical Engineer

Voytek Bajsarowicz
Senior Client Leader

Enclosures

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1. Introduction

This report presents the results of our geotechnical evaluation for the proposed Area Q Project (Site). The Project allows for the continued operation of Vulcan's Cajon Creek and San Bernardino facilities through sand and gravel mining operations and reclamation at Area Q.

The Project site is located in unincorporated San Bernardino County, east of Cajon Creek and north of the community of Muscoy. The Project site is bounded by residential neighborhoods to the south, a Union Pacific rail line to west, Historic Route 66 to the east and Vulcan's existing Cajon Creek aggregates mine, specifically Area L, to the north. The Project site is located approximately 2.5 miles away from Vulcan's existing San Bernardino facility, which is located directly north of State Route 210 and Highland Avenue. Nearby communities include Muscoy, the City of San Bernardino (adjacent to the east/north), and the City of Rialto (1.25 miles west), as shown on Figures 1 and 2. The approximate Site coordinates are 34.17°N and 117.36°W.

Vulcan currently operates two distinct yet integrated operations adjacent to the Project site. Vulcan transports pit run material from its Cajon Creek extraction site, located within the City of San Bernardino, to the San Bernardino facility, located within the County, for processing. Materials are transported via an existing 2.5-mile-long haul road running through the Cajon Creek Wash. Please note, these existing operations are part of the environmental baseline conditions and are not part of the proposed Project.

The Project will provide a high-quality source of local aggregate materials to serve the regional market. The Project will also allow for the continued operation of Vulcan's Cajon Creek and San Bernardino facilities. These existing operations are not part of the Project. All mined materials will be transported via conveyor from the Project site to Vulcan's existing Cajon Creek extraction site. Material will then be processed and shipped at Vulcan's existing and/or permitted locations. No haul trucks would enter or exit the Project site from public roads.

1.1 BACKGROUND AND EXISTING SITE CONDITIONS

The Area Q Site includes some houses and general storage buildings and yards. The land is currently zoned for residential use, and several lots within the site are occupied by single-story residential structures. Signs of active dumping of trash including the presence of deleterious materials are evident.

Based on our review of historical aerial photographs, the Area Q site and surrounding area was generally vacant and unimproved in 1938, with the exception of Route 66 to the northeast. By 1959, several houses had been constructed within the limits of Area Q, and the currently existing dike was built along a portion of the Site's western boundary. The Devil Creek Diversion Channel appears to have been converted to a trapezoidal concrete-lined channel. By 1966, the Southern Pacific Railroad Tracks along the western boundary of Area Q were under construction, and construction of these tracks appears to have been completed by 1968. The 1966 and 1968 historical photos also show several new houses within the limits of Area Q. In 1995, excavation of Area M (northwest of Area Q) appears to have been initiated. Between 2005 and 2009, mining operations had also begun at Area L (north of Area Q).

1.2 PROJECT DESCRIPTION

The Project calls for aggregate material extraction and ancillary activities on 187.6 acres within the approximately 196.0-acre Area Q property. Specifically, Vulcan is requesting that the County of San Bernardino approve a Conditional Use Permit (CUP) authorizing the following uses and activities on the Project site, for a 12-hour period between the hours of 6:00 AM and 10:00 PM, Monday through Saturday:

- Mineral resource extraction activities in one (1) phase. The maximum depth of mining would be 120 feet below natural ground surface (bgs). The design incorporates a standard final reclaimed slope configuration of 2:1 (horizontal to vertical).
- Construction of a minimum 10-foot tall vegetated earthen berm along the southeastern portion of the Project site (along the Devil Creek Diversion Channel) using overburden and top soil from the Project site, and planting of landscape screening along the berm; and extending the existing berm in Area L to the southern end of Area Q.
- Construction and operation of an elevated conveyor system arm across the Project site, connecting with Vulcan's existing conveyor system located on the Cajon Creek extraction site.
- Construction and maintenance of on-site roads.
- Operation of loaders, conveyors, and related equipment as necessary to move material from the Project site to the conveyor system that will transport materials to Vulcan's existing conveyor system located on the Cajon Creek extraction site.
- Conduct all activities as described above and herein on approximately 187.6 acres of the Project site.

2. Scope of Services

Haley & Aldrich's approved services were presented in our proposal dated 23 March 2018 and included: 1) performing site visits to collect data and observe existing Area Q Site conditions and surrounding features as they pertain to the proposed Project, 2) geologic logging of soil strata as exposed at the adjacent mining Areas L and M, and 3) collection of physical samples for laboratory testing. The results of our field exploration and laboratory testing were evaluated and engineering analyses were performed to develop conclusions and recommendations regarding:

- soil and groundwater conditions at the site;
- comparison of the design topography to flooding from design storm events as required for compliance with County of San Bernardino standards;
- site seismicity and seismic hazards including landslide potential;
- slope stability analysis using limit-equilibrium methods;
- site grading, including criteria for fill quality and compaction;
- seismic design parameters in accordance with the 2016 California Building Code; and
- mine operational considerations (as appropriate).

3. Field Investigation and Laboratory Testing

This investigation comprised compilation of existing geologic and geotechnical data, field observations and evaluation of current Site conditions, limited laboratory testing, and analysis to evaluate the stability of the proposed cut slopes and post-mining slope configurations. The methods and rationale are introduced in this section.

3.1 LITERATURE REVIEW

We performed a review of readily available documents pertaining to subsurface conditions at Area Q and the immediately surrounding areas. Documents reviewed during our study include boring logs for six air-rotary borings (named SB-04-01 through SB-04-06), prepared by Cleath & Associates (CA, 2004), and a brief data report titled, "Preliminary drilling results for 'Area Q', Muscoy, San Bernardino County, California," dated 11 November 2004, prepared by TerraMins, Inc. The borings described in these documents were advanced to depths ranging from 110 to 230 feet bgs. These documents are presented in Appendix A.

3.2 FIELD OBSERVATION AND LABORATORY TESTING

We visited Area Q and the existing Vulcan Materials operations on 12 April 2018 to collect physical samples of the native soils for laboratory testing. Two bulk samples were collected from the southern sidewall of Area L north of Area Q, as shown on Figure 2. These samples were shipped to Geo-Logic Associates of Grass Valley, California for shear strength testing. Due to the coarse nature of the material, a large-box direct shear test (ASTM D-3080 Modified) was performed on remolded 12-inch-square samples. Each remolded test sample was passed through a sieve prior to direct shear testing, to remove particles greater than 1.5 inches in size. Laboratory test results are presented in Appendix B.

Our Certified Engineering Geologist performed a Site visit on Saturday, 5 May 2018 to evaluate geologic conditions within Area Q and adjacent Areas L and M. Areas L and M showed slope walls consisting of similar alluvium material. However, most of the Area M slopes were smoothly graded and vegetated.

4. Physical and Geologic Setting

4.1 TOPOGRAPHY

The Area Q property consists of a 196.0-acre, low-lying, relatively flat area. The elevations range from a high of approximately 1,574 feet above mean sea level (amsl) to a low of 1,495 feet amsl. The Site gently slopes to the south-southeast at an average gradient of less than 2 percent.

4.2 REGIONAL GEOLOGY

The eastern San Gabriel Mountains are to the north of the Site. The uplift of the San Gabriel Mountains is the result of north-south compression. East-west extension is another minor tectonic factor of this area. In the area of the Site, the San Gabriel Mountains are bounded on the south by the Cucamonga Thrust Fault and the San Andreas Strike-Slip Fault to the northeast, with the San Jacinto Fault trending between the two aforementioned faults up Lytle and Glen Helen washes and canyons. This area of the San Gabriel Mountains is highly fractured by the San Jacinto Fault, including the Glen Helen and Lytle Creek fault segments of the San Jacinto Fault system.

Rocks exposed in the eastern San Gabriel Mountains include metamorphic schist, gneiss, granulite, and areas of marble. Quartz monzonite and quartz diorite rock types intrude into large areas of the metamorphic complexes. Many areas of the igneous plutonic rock are foliated with cataclastic textures. Tertiary conglomerates, sandstones and mudstones unconformably lie on top of, or at fault contact with, the metamorphic and igneous rock masses.

The alluvial process in the area is illustrated by mid to late Pleistocene fans, having well developed incisions, while the latest Pleistocene to Holocene fan incisions are not as greatly developed. Fan geomorphology helps determine relative age of faulting in this area where the faults cut the different aged alluvial fans. A regional geology map is presented as Figure 3.

4.3 LOCAL GEOLOGIC UNITS

The Area Q Site subsurface consists primarily of alluvial deposits of various ages and thicknesses, which correspond to different flood events during large rainstorms. The San Gabriel Mountains to the north, and San Bernardino Mountains to the east, consist of mostly granitic and metamorphic rock types. The sands and gravels at the Vulcan Area L and Area M operations consist mostly of similar rock compositions, suggesting that the sands and gravels originated from the local mountains to the north and east.

Based on boring logs from TerraMins Inc. (2004), from the surface to a depth of 200 feet bgs, sediments were found to consist of moist to slightly moist sands and gravels with cobbles as large as 6 inches. Though not encountered, larger cobbles and even boulders could be present throughout the sediment layers. The boring samples' colors had a hue of Munsell 10YR with a value ranging from 4 to 5 and a chroma ranging from 2 to 3 from the surface to 200 feet bgs. One gravel layer color was estimated to be Munsell 10YR 6/1. These Munsell colors are in the range of the local soils in the Soil Survey Map for this Site, as discussed in detail in Section 4.6.2.

The samples collected by TerraMins Inc. in the upper portion of the borings consisted mostly of clean sand with silt with some gravels and clay from the surface to about 30 feet bgs. From about 40 feet to 90 feet and between 100 and 200 feet bgs, the sands were cleaner with an increase in gravel and clean sand layers indicating a greater wash gradient or lower baseline during their deposition. Some of the interbeds showed broken clasts and clays indicating moderate weathering. There was no indication of the sands and gravels being cemented or indurated from clays filling the pore spaces between the sands and gravels. Some clay coated gravels were mentioned indicating a mild pedogenic development of deeper sediments. No diluted hydrochloric acid was applied to determine if there was any carbonate formation within the samples.

After evaluating the boring logs and reports by others, the alluvial deposits of the area, the Munsell 10YR colors, lack of good clay development around the in situ clasts and thick zones of clay, it was determined the quarry materials are likely the result of basin deposition of the San Bernardino Valley with Holocene sands, along with gravel deposition from the Cajon Creek wash during the Holocene.

4.3.1 Exposed Conditions in Adjacent Areas

During our visit on 5 May 2018, a limited walkover was performed to evaluate the quarry materials, existing slope conditions within Area Q and adjacent Areas L and M. The existing Area L and M cut slopes exhibit large tabular beds and lenses of clean sand with some traces of silt and clay, cobbles and a few small boulders. The clasts were comprised mostly of metamorphic gneiss, schists and white marble with some granitic clasts. The sands were generally clean of fines, with a cemented matrix holding the sand grains in place but friable. A small talus pile consisting mostly of sand with some gravel and cobbles was forming at the toe of the slopes. The exposed slope showed evidence of having water flow across the face.

Active mine slopes at Area L held a high angle of repose with some slopes being vertical to nearly vertical. Washout erosional gullies in the central portion of Area L had high vertical cut slopes within the gullies with large fans of cobbles and large gravels on the gully bottom and spreading across the quarry bottom after exiting the gully. The fans were washed nearly clean of sand due to the velocity of water running across the mid slopes. After the sands were deposited onto the floor away from the cobble-gravel fans, the sand matrix hardened. When 10 percent HCl was applied to the sands, they effervesced, indicating that a fraction of carbonate was present in the sands giving a hardening effect to the slopes. The material in Area M appeared compositionally similar to Area L.

A small section of alluvial tabular and lens shaped deposits along the south slope above the sand conveyor in Area M and northwest of Area Q was exposed undisturbed. The remaining portion of the slopes were mechanically smoothed out and planted and did not show any significant slope failures or stability issues during the visit. In both Areas L and M, a levee system was constructed around the top of the quarry slopes and along the edges of the access roads to prevent surface waters from pouring over the edge and eroding the existing slopes. Levees were also observed along elevated areas along the top of inter-quarry slopes.

4.3.2 Exposed Faulting

Evidence of faulting was assessed during the 5 May 2018 visit. No faulting was seen offsetting exposed beds and lenses in the Area L slopes. A small section of alluvial tabular and lens shaped deposits along the south slope above the sand conveyor in Area M and northwest of Area Q was exposed, so that portion was examined for faulting and none was observed present.

4.4 LOCAL GROUNDWATER

The Site groundwater level is expected to be over 200 feet bgs. Groundwater levels measured from 2011 to 2017 ranged between elevations 1328.5 and 1263.1 feet (217.5 to 282.9 feet bgs), as reported by the State of California Department of Water Resources for a well approximately 200 feet south of the Site. Similarly, data provided by San Bernardino Valley Municipal Water District reports that the depth to groundwater at the Site in Fall 2010 was between 250 and 300 feet bgs (SBVMWD, 2011). Groundwater levels may fluctuate with time due to seasonal rainfall changes.

4.5 REGIONAL AND LOCAL HOLOCENE FAULTS

Southern California is a very active seismic area consisting of many Holocene faults, and there are three major faults near the Vulcan San Bernardino operation. Many of the Holocene faults in the region have been designated as being in Alquist-Priolo (AP) Special Studies Zones (Earthquake Fault Zones as known today), as these faults exhibit evidence of surface rupture in the last 11,000 years (Holocene Epoch) or are "sufficiently active and/or well-defined." Only the active faults and strands of the Cucamonga Thrust Fault and the San Andreas Fault are discussed briefly, since they are nearest the Site. Since the San Jacinto Fault's Glen Helen Fault strand trends through the south end of the proposed Area Q Site, the San Jacinto Fault and especially the Glen Helen Fault Strand will be discussed in greater detail. Below in Table I, known Holocene faults within 100 km of Area Q are listed.

TABLE I
Active Faults within 100 km of the Area Q Site (from USGS, 2008).

Fault Name	Distance (km)
San Jacinto	1
S. San Andreas	4.5
Cucamonga	7.6
Cleghorn	12
North Frontal (West)	18
San Jose	31
Sierra Madre	35
Sierra Madre Connected	35
Chino, alt 2	39
Chino, alt 1	39
Elsinore	43
Clamshell-Sawpit	45
Helendale-So Lockhart	48

Fault Name	Distance (km)
North Frontal (East)	55
Puente Hills (Coyote Hills)	56
Raymond	58
Pinto Mtn	60
Puente Hills (Santa Fe Springs)	66
San Joaquin Hills	68
Lenwood-Lockhart-Old Woman Springs	69
Elysian Park (Upper)	69
Verdugo	73
Johnson Valley (No)	74
Puente Hills (LA)	74
Newport Inglewood Connected alt 1	80
Newport Inglewood Connected alt 2	80
Hollywood	80
Landers	82
Newport-Inglewood (Offshore)	82
So Emerson-Copper Mtn	85
Santa Monica Connected alt 2	85
San Gabriel	86
Sierra Madre (San Fernando)	87
Burnt Mtn	88
Gravel Hills-Harper Lk	88
Eureka Peak	89
Calico-Hidalgo	95
Palos Verdes	95
Northridge	95
Santa Monica Connected alt 1	98
Blackwater	98

4.5.1 Cucamonga Fault

The Cucamonga Fault is a thrust fault that trends along the southern front of the San Gabriel Mountains and terminates in the bedrock on the west side of Lytle Creek Wash. The thrust faulting component of the Cucamonga Fault and the uplift of the San Gabriel Mountains further illustrates the north-south tectonic compression in this area.

Historically, this fault has not been seismically active but past studies illustrate that the Cucamonga Fault is defined by large scarps that displace Holocene to latest Pleistocene alluvial sediments with all the scarps offsetting Holocene alluvial fan deposits. Eighteen recognizable seismic events were inferred within the last 12,600 years on three major strands of the Cucamonga Fault, as discussed in the California Department of Mines and Geology (CDMG) Fault Evaluation Report FER-240 (1994). The scarps that cut older alluvium sediments had greater displacements and progressively were found to have lesser displacements in the younger alluvium sediments. In the last 13,000 years, the Cucamonga

Fault showed a slip rate of about 5 mm/year but it could be greater (CDMG, 1994). The Cucamonga Fault near the Vulcan San Bernardino operation has produced earthquakes resulting in vertical displacements of approximately 6 feet, occurring every 625 years (Matti and others, 1992). This fault is not considered a fault rupture hazard that would impact the proposed project. This fault and other seismogenic faults in the area could create a local earthquake with the possibility of ground lurching on the Site's quarry perimeter where the surface seismic waves meet the quarry slopes (though not common in sandy and gravelly materials) generating parallel cracks forming rough blocks on the ground and minor slope failures such as dislodging of cobbles and boulders along the side slopes.

4.5.2 San Andreas Fault

The San Andreas Fault is a right-lateral strike-slip fault that is less than 3 miles from the Site and considered to be one of the most active faults in California. Seismicity associated with the 744-mile long San Andreas Fault system varies significantly, with observed recurrence intervals ranging from 20 to more than 300 years. Seismic events occurring along the San Andreas Fault near Area Q tend to occur at longer recurrence intervals but may be less than other strand locations in the higher range of return intervals. According to Weldon and Seih, 1985, the San Andreas Fault has a slip rate of approximately 24.5 +/- 3.5 mm/year during the last 14,000 years in the nearby Cajon Pass. In past studies, in order to include the San Andreas Fault in the State of California AP zone, it was concluded that the fault consisted of a series of parallel and subparallel branches more than a mile wide.

The main trace is defined by linear scarps and fault displacement of Holocene alluvium. The branches are defined as high angle strike-slip faults and low angle thrust faults displacing rock and alluvium of various ages. Though the fault does not intersect with Area Q at the Vulcan Quarry, it could create local earthquakes with a moment magnitude (M_w) as high as 8.1 or slightly greater if most, if not all, of the fault's strands were to break during one event (United States Geological Survey [USGS], 2008). During the month of December 2015, a swarm of earthquakes and two earthquakes of M_w=2.7 and 4.4 were monitored in the Devore area north of the Site near the intersection of the San Andreas and San Jacinto Faults. Earthquakes on the San Andreas Fault have had pre-historic seismic events that shook the study area numerous times with high ground accelerations during the Holocene and Pleistocene periods.

4.5.3 San Jacinto Fault

The San Jacinto Fault is a right-lateral strike-slip fault that trends from below the Mexican border for about 135 miles where it terminates to the north, near the Site, where it meets the San Andreas Fault in the San Gabriel Mountains. This fault has a slip rate of approximately 7 to 17 mm/year with a return interval estimated in the 100- to 300-year range which can produce an earthquake in the M_w 6.5 to 7.5 range (Southern California Earthquake Data Center (SCEDC), Significant Earthquakes and Faults); (USGS, 2008a). The Lytle Creek Fault Strand of the San Jacinto Fault system was found trending north through Lytle Creek into the San Gabriel Mountains approximately 3.5 miles west from the Site.

4.6 FAULT RUPTURE HAZARDS

To illustrate the active nature of the San Jacinto Fault, the five historic earthquakes along the southern section of the fault, but not in the area of the Site, are as follows:

1. The 1889 Earthquake near the city of San Jacinto. Though the epicenter was not well located, the major damage in the cities of San Jacinto and Hemet suggests that the epicenter was close to these two towns.
2. The 1918 Earthquake near the city of San Jacinto. This earthquake had an estimated local magnitude (M_L) approximately 6.5. The earthquake was late Sunday afternoon so casualties were low though damage to unreinforced brick buildings was high.
3. The 1937 Earthquake in the Terwilliger Valley some 20 miles south of the city of Indio. This earthquake had an estimated M_L approximately 6.0. Since the Terwilliger Valley was in a sparsely populated area, little damage was noted except for a few chimneys, cracked plaster and broken windows near the area where the most intense shaking was experienced.
4. The 1954 Earthquake, sometimes known as the Arroyo Salada earthquake. The epicenter was about 30 miles south of the city of Indio. This M_L approximately 6.4 earthquake cracked plaster in San Diego and Los Angeles.
5. The 1968 Coyote Creek Fault Earthquake near the city of Borrego Springs and surrounding cities. This seismic event generated an M_w=6.5 earthquake. The Coyote Creek Fault Earthquake is mentioned since it is probably a strand of the San Jacinto Fault.

At the Site, the Glen Helen Fault strand of the San Jacinto Fault is likely the most active strand of the San Jacinto Fault. Most of the fault studies done to determine if the Glen Helen strand was active were performed north of the Site in the Glen Helen area. The portion of the fault that trends by the Site is mapped on published geology maps (e.g., California Geological Survey [CGS] Fault Evaluation Report [FER-240]) as a "concealed" fault trending though the southwest portion of the Vulcan Cajon Creek Area Q San Bernardino quarry. The fault near the Site is mapped in an active wash and as crossing the Site at the southwest tip. If any pre-historic breaks of the Glen Helen Fault had broken the surface, forming a scarp displacing the ground, rainstorm flooding, sedimentation, wind and/or anthropogenic processes may have covered or concealed the fault's trace. This portion of the Glen Helen Fault (see Figure 3) is listed as a State of California AP Earthquake Fault Zone. Though the fault trace is not well defined near Area Q, the City and County of San Bernardino Department of Building and Safety considers the concealed fault trend of the Glen Helen Fault a Holocene Fault and suggests that this strand is the most active portion of the San Jacinto Fault system.

Given the seismic characteristics of the San Jacinto Fault and in particular its surface rupture history, relevant topographic, soils and geologic maps, as well as aerial photos were analyzed as part of this geotechnical evaluation, as discussed below.

4.6.1 Topographic Maps

Two topographic quadrangle maps, the Arrowhead Quadrangle 7.5-Minute (USGS, 1941) and the San Bernardino North Quadrangle 7.5-Minute (USGS, 1996), were examined and compared to determine whether there was a topographic expression of the Glen Helen Fault. The quadrangles were used to demonstrate changes during the period of time between 1941 and 1996. The topographic maps show two large washes that are linear in a northerly to southerly direction. Older topographic quadrangles did not express enough detail to delineate geomorphology of the fault trace.

In general, the Arrowhead and San Bernardino North 7.5-Minute quadrangle maps do not show lineations in the active washes of the Cajon or Lytle Creeks, but linear drainages are well defined in the bedrock to the north of the Site indicating a fault trace or other lineament type.

4.6.2 Soil Survey Map

The USDA Soil Survey Map (USDA, 2018) of the site area mapped two surficial soil units in the general area of Area Q, the Soboba Stony Loamy Sand (SoC) and the Tujunga Gravelly Loamy Sand (TvC). The Soboba Stony Loamy Sand consists of an A horizon's dry color of grayish brown, brown or pale brown coarse sand, sand to loamy sand to fine loamy sand with gravels, cobbles having a hue of Munsell 2.5Y or 10YR with a value of 4 or 6 dry and 4 or 5 moist with a chroma of 2 or 3. The moist, dark grayish brown (Munsell 2.5Y), stony loamy sand is generally loose, very friable, with abundant medium to fine roots and interstitial pores. The C horizon's dry color is generally a grayish brown or a bit lighter in color than the A horizon when dry.

The Tujunga Gravelly Loamy Sand (TvC) consists of an A horizon's dry color of brown to grayish brown fine sand, sand to sandy loam having a hue of Munsell 2.5Y or 10YR with a value of 4 or 7 dry and 3 or 5 moist, with a chroma of 1 to 4 dry and 2 to 4 moist. The moist color is Munsell 2.5Y. The C horizon's dry color is generally pale brown with a Munsell hue of 2.5Y or 10YR with a value of 5 to 8 and a chroma of 1 to 6 when dry and a value of 3 to 5 with a chroma of 2 to 4 when moist. These two soil types have a tonal difference that may explain some of the tonal changes found along concealed faults in the area mentioned in the FER-240. During the 5 May 2018 visit, the area near the Site where surficial tonal changes and fault features such as lineations and scarps were mapped in FER-240 was visited. The area was disturbed by anthropogenic processes and changes in the wash morphology.

4.6.3 Geology Map

Three geologic maps: Regional Geology Map Series, San Bernardino Quadrangle (USGS, 2001), Geologic Map of the San Bernardino North 7.5-Minute quadrangle (Miller et. al., OFR 2001-131), and the Dibblee Devore and San Bernardino North 7.5-quadrangle maps (Dibblee, 2003 and 2004), were examined to analyze the geology and fault trends at and near the Area Q Site. The first map does show the San Jacinto and the San Andreas Faults trending near but not through the Site. The Miller geologic map shows the Glen Helen strand of the San Jacinto Fault to the west, while the Dibblee maps show the strand trending through the mid-section of the Site but terminating at the quadrangle boundary between the Devore and San Bernardino North quadrangles. The Miller geologic map locates the Glen Helen strand at nearly parallel to the 1974 AP Earthquake Fault Map, while the AP zone fault has a splay coming off the common Miller and AP strand and crossing the southwest end of the Site (see Figure 4). The Dibblee maps seem to have placed a concealed lineament that was placed on the FER-240 map that trends through the central portion of Area L located in the San Bernardino North quadrangle. During the field visit on 5 May 2018, the south walls of Area L were examined and no fault was seen displacing the alluvium on the slope.

4.6.4 Aerial Photo Analysis

During the compiling of the FER-240, black and white vertical aerial photo stereo pairs from the Department of Agriculture flown in late 1952 and early 1953, and USGS Water Resources Division black

and white vertical photos flown in June 1967 were analyzed to identify any geomorphic changes in the landscape due to geologic and/or other natural processes. Tonal changes in the alluvium noted in these photos coincided with trenches by private consultants in which fault traces were found (FER-240). In the Muscoy area, other linear tonal features coincided with faults reported by the County of San Bernardino that could be explained as surface step-overs between the San Jacinto Fault to the south and the Glen Helen Fault to the north. There was no indication from aerial photos that subsidiary traces of the San Jacinto Fault are active, since they did not show offset or other geomorphic features that are indicative of Holocene movement.

Aerial photos were downloaded from the UC Santa Barbara Frame Finder website and briefly compared to features analyzed during the compiling of FER-240. These photos did show some tonal contrasts, but some of the scarps could well be from changes in the channels in the washes during large rainstorms or from Holocene movement on the San Jacinto Fault. The map from the FER-240 map 2A shows evidence of the active faults identified during our ground reconnaissance and aerial photo analysis. Aerial photo interpretations are shown in purple. A “check-mark” indicates that the features found on the aerial photos could be verified, from other investigations, as traces of a Holocene fault and an “NV” indicates faults which could not be verified as Holocene faults.

5. Geotechnical Evaluation and Slope Stability Analysis

The primary geotechnical aspects considered for this project include:

- site seismicity and potential seismic hazards;
- stability of proposed mine slopes; and
- the potential presence of active faults within the Site limits.

Based on our review of subsurface information for the Site, we conclude that mining and future reclamation of the proposed Area Q mine to a depth of 120 feet bgs at a standard slope configuration of 2:1 (horizontal to vertical) is geotechnically feasible. Based on the Simplified Bishop Method for slope stability analysis, we calculated the static and seismic factors of safety for the proposed mine slopes are or will be in excess of 1.87 and 1.34, respectively. These factors of safety are considered acceptable for the proposed project design features and are considered stable slope configurations.

Our discussion of slope stability of proposed Area Q mine slopes and other geotechnical issues are presented in the remainder of this report.

5.1 SEISMIC HAZARDS

During a major earthquake, very strong to severe shaking has the potential to occur at the Site. Shaking during an earthquake can result in ground failure, such as that associated with soil liquefaction, lateral spreading, and cyclic densification. Haley & Aldrich's assessment of these potential seismic hazards are presented in the following sections.

5.1.1 Site Seismicity

A probabilistic seismic hazard analysis (PSHA) was performed using the USGS deaggregation website (https://earthquake.usgs.gov/hazards/interactive/). The USGS deaggregation utilizes the next generation attenuation (NGA) models and the 2014 USGS/CGS California Fault Model. For our analysis, we used a shear wave velocity over the top 100 feet (30 meters) of the site (V_{s30}) of 360 meters per second. Based on the seismicity of faults that may impact Area Q and the results of the deaggregation analysis, a design earthquake with an M_w of 7.9 was selected for the seismic hazard evaluation. The peak horizontal ground acceleration (PHGA), which is based on the Maximum Considered Earthquake (MCE) with a return interval of 2,500 years, or a 2 percent probability of exceedance in 50 years, is 1.63g. The risk-based site-modified peak ground acceleration (PGA_M) is 0.96g; this value was computed based on procedures outlined in American Society of Civil Engineers (ASCE) 7-16.

5.1.2 Fault Rupture

Historically, ground surface displacements typically follow the trace of Holocene faults; however, in some cases an unknown fault may be located, resulting from a modern historic event. Based on the AP State of California Special Studies Zones Official Map for the San Bernardino North Quadrangle (CGS, 1974), the Glen Helen Fault crosses the southwestern tip of the Site and is located within an Earthquake Fault Zone for a concealed Holocene fault.

The Miller map and the 1974 Special Studies Zones map locate the Glen Helen Fault as being nearly parallel or at the same location at the southwestern corner of the proposed Area Q limits. The Dibblee map shows the Glen Helen Fault passing through the site in a northwestern orientation, trending closer to the geographic center of the Area Q Site (see Figure 4).

The information in the FER-240 shows a branch of the Glen Helen Fault trace a few tens of feet west of Area Q, and the AP map shows a splay of the strand crossing the southwest section of Area Q. Based on this location of the Glen Helen Fault trace and its seismicity, Haley & Aldrich concludes the risk of surface faulting and secondary ground failure due to fault rupture to be high especially in the south end of Area Q.

5.1.3 Other Seismic Hazards

Known faults including the San Jacinto, San Andreas, and Cucamonga Faults are capable of inducing moderate to strong seismic events and geological seismic hazards, such as ground heave and lurching, ridge shattering, land sliding, and avalanches. These hazards could locally dislodge cobbles and boulders from slopes and could break the matrix bonds between sand grains causing local instabilities.

The Site groundwater level is expected to be over 200 feet bgs. Groundwater levels measured from 2011 to 2017 ranged between elevations 1328.5 and 1263.1 feet (217.5 to 282.9 feet bgs), as reported by the State of California Department of Water Resources for a well approximately 200 feet south of the Site. Similarly, data provided by San Bernardino Valley Municipal Water District reports that the depth to groundwater at the Site in Fall 2010 was between 250 and 300 feet bgs. Groundwater levels may fluctuate with time due to seasonal rainfall changes.

Based on the currently proposed excavation depth of 120 feet bgs, we conclude the potential for liquefaction-related secondary effects, such as sand boils, lurch cracking, and lateral spreading to develop at the site following the design seismic event is low, based on the depth of the proposed pit and the depth to groundwater conditions.

5.2 SLOPE STABILITY ANALYSIS

A slope stability analysis was performed on a single, design mine slope cross-section at Area Q, set back at a maximum inclination of 2:1 (horizontal: vertical), as proposed under the current proposed mine and reclamation plan. Although the Project calls for mining to a depth of 120 feet bgs, the excavation modeled in this cross-section was divided into 120-, 150-, and 200-foot-deep mine slope scenarios. The stability analysis was performed using RocScience *Slide* 7.0, a limit-equilibrium software program for analyzing static and pseudo-static (seismic) factors of safety for soil slopes.

5.2.1 Material Properties

Material properties for the slope stability analysis are based on subsurface logs provided by Vulcan, observations of the adjacent Areas L and M, and the results of limited laboratory testing on bulk samples collected from Area L. Subsurface materials within the Area Q mining limits are expected to include granular alluvial deposits consisting of sand, gravel, cobbles, and boulders. For slope stability analysis,

the design subsurface profile has been simplified to consist of layers of well-graded sand with gravel ("Sand") and well-graded gravel with sand ("Gravel"), primarily based on interpretations of the boring logs prepared by TerraMins (2004).

Soil shear strength properties for the Sand and Gravel layers were selected based on laboratory shear strength testing. Samples of the Sand and Gravel materials were retrieved from the southern sidewall of Area L, just north of the Area Q Site. The samples were shipped to Geo-Logic Associates of Grass Valley, California, a specialty geotechnical lab with direct shear testing equipment capable of evaluating the shear strength of normally oversize gravel soils. A design friction angle and adhesion value for each material was selected based on the peak strengths. The unit weight of each soil type was estimated based on typical values for similar materials in this region. The soil properties used for analysis are presented in Table II. Laboratory test results are presented in Appendix B.

TABLE II
Material Properties Used for Slope Stability Analysis

Material Name	Unit Weight (pounds per cubic foot (pcf))	Friction Angle (degrees)	Adhesion (pounds per square foot (psf))
Sand	130	37	180
Gravel	130	41	0

5.2.2 Seismic Coefficient for Pseudo-Static Slope Stability Analysis

The pseudo-static approach involves calculation of a factor of safety against land sliding through limit equilibrium techniques, when an inertial force is applied to the slope. This inertial force is represented by the product of the seismic coefficient and weight of the sliding mass. Although it has been established by researchers that this is a simplification of a very complex process, and in fact is very conservative, it is the most common tool and generally accepted practice for analysis.

The pseudo-static (seismic) stability of the five cross-sections was analyzed in accordance with the recommendations presented in CGS' Special Publication 117A, specifically the method put forward by Seed (1979). In accordance with this method, a horizontal seismic coefficient, k_h, equal to 0.15 was applied to each section to determine that a factor of safety of at least 1.15 had been achieved. This factor of safety marks an acceptable level of pseudo-static slope stability, defined by Seed (1979) as slope movement limited to approximately 3.3 feet (1 meter).

Additionally, a supplemental analysis of seismic slope stability was performed by the Franklin and Chang (1977) Method. In accordance with this method, the yield acceleration of the slope (i.e., pseudo-static acceleration where the slope factor of safety is equal to one) was calculated and compared to a peak ground acceleration (PGA) of 0.82g, or the PGA for a seismic event with a 475-year return period.

5.2.3 Slope Stability Results

The proposed sidewall slopes were analyzed by the limit equilibrium (method of slices) method, using circular searches with Simplified Bishop's Method to calculate the factor of safety against sliding (FOS). A static factor of safety of 1.5 or greater for slopes analyzed using this method is typically considered adequate for demonstrating stability. The minimum factor of safety for each slope height scenario

under static and pseudo-static conditions is shown on Table III. Graphical depictions of each analysis scenario and associated critical failure surface are provided in Appendix C.

TABLE III
Results of Slope Stability Analyses

Slope Height (ft)	Factor of Safety	
	Static	Pseudo-Static
120	1.87	1.34
150	1.76	1.26
200	1.75	1.25

We have analyzed the geotechnical slope stability of the design slopes for the Area Q Project, based on our current field investigation, previous geological investigations, results of geotechnical laboratory testing, and topographic data provided by Vulcan. Through this analysis, the calculated static and seismic factors of safety for the proposed mine slopes are or will be in excess of 1.87 and 1.34, respectively, and indicating stable conditions. These factors of safety are considered acceptable for the proposed project design features and considered representative of stable slope configurations. Although not proposed by the Project, we would anticipate that 2:1 (horizontal to vertical) mine slopes at depths of 150 feet bgs and 200 feet bgs would also generate acceptable stability results.

In summary, the results of the field observations and the slope stability analysis lead us to conclude that the subsurface conditions at the Area Q Site support mine to depths of 120 to 200 feet bgs to be geotechnically feasible.

6. Conclusions

Based on our evaluation of the subsurface conditions at the Area Q Site, we conclude that construction of the proposed Area Q mine to depths of 120 to 200 feet bgs is geotechnically feasible.

We have analyzed the geotechnical slope stability of the design slopes for the Area Q Project, based on our current field investigation, previous geological investigations, results of geotechnical laboratory testing, and topographic data provided by Vulcan. Based on our slope stability analysis, the static and seismic factors of safety for the proposed 120-foot-tall Area Q slopes are 1.87 and 1.34, for static and seismic conditions, respectively. These factors of safety are considered acceptable for the proposed project design features and considered representative of stable slope configurations.

The scope of this report is limited to a geotechnical evaluation of the proposed Area Q project. We understand that the proposed mine and reclamation plan evaluated for this study do not include construction of new temporary or permanent structures. If temporary or permanent structures are subsequently planned at the Site, we recommend that a supplemental study be performed to address geotechnical impacts and provide recommendations for foundation and seismic design, especially if these structures are planned within a State-designated Earthquake Fault Zone.

7. Limitations

The conclusions and recommendations presented in this report result from limited engineering studies and are based on our interpretation of the existing geotechnical conditions and available subsurface data. Actual subsurface conditions may vary. If any variations or unforeseen conditions are encountered during Site development, or if the proposed project differs from that which is described in this report, Haley & Aldrich should be notified so that supplemental recommendations can be made.

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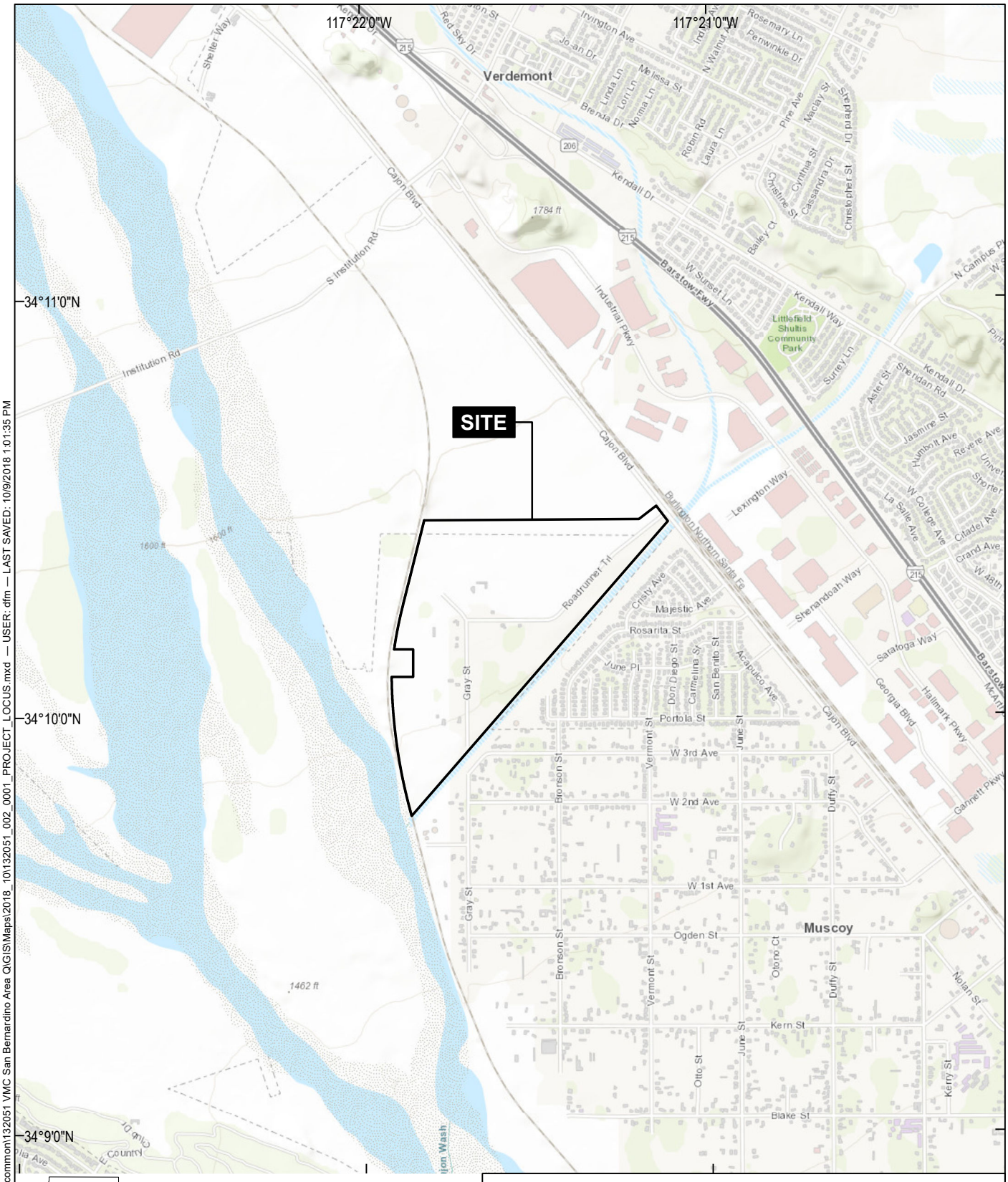
FIGURES



GIS FILE PATH: \\haleyaldrich\share\wnc_common\132051 VMC San Bernardino Area Q\GIS\Maps\2018_10\132051_002_0001_PROJECT_LOCUS.mxd — USER: dfm — LAST SAVED: 10/9/2018 1:01:35 PM

MAP SOURCE: ESRI
SITE COORDINATES: 34°10'13"N, 117°21'36"

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

PROJECT LOCUS

JUNE 2019

FIGURE 1

LEGEND

HOLLOW-STEM AUGER BORINGS (CLEATH & ASSOCIATES, 2004)

HOLLOW-STEM AUGER BORINGS (TERRAMINS, INC. 2004)

NOTES

1. BASEMAP SOURCE PROVIDED BY SESPE CONSULTING, INC., JUNE 2019

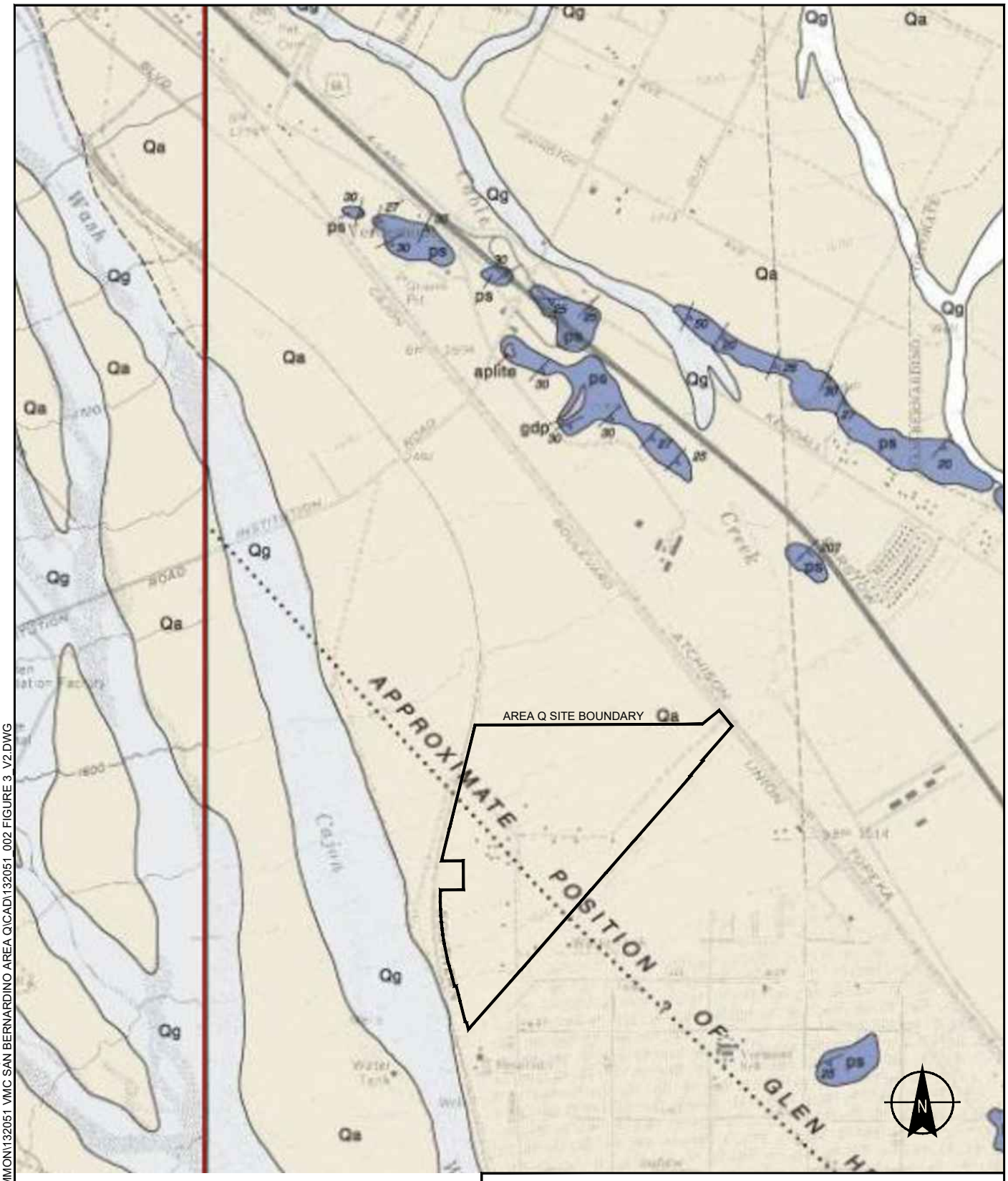
HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

SITE MAP WITH BORING LOCATIONS AND PROPOSED MINE LIMITS

SCALE: AS SHOWN
JUNE 2019

FIGURE 2



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DIBBLEE, T.W., AND MINCH, J.A., 2004, GEOLOGIC MAP OF THE SAN BERNARDINO NORTH/NORTH 1/2 OF SAN BERNARDINO SOUTH QUADRANGLES, SAN BERNARDINO AND RIVERSIDE COUNTY, CALIFORNIA: DIBBLEE GEOLOGICAL FOUNDATION, DIBBLEE FOUNDATION MAP DF-127, SCALE 1:24,000.

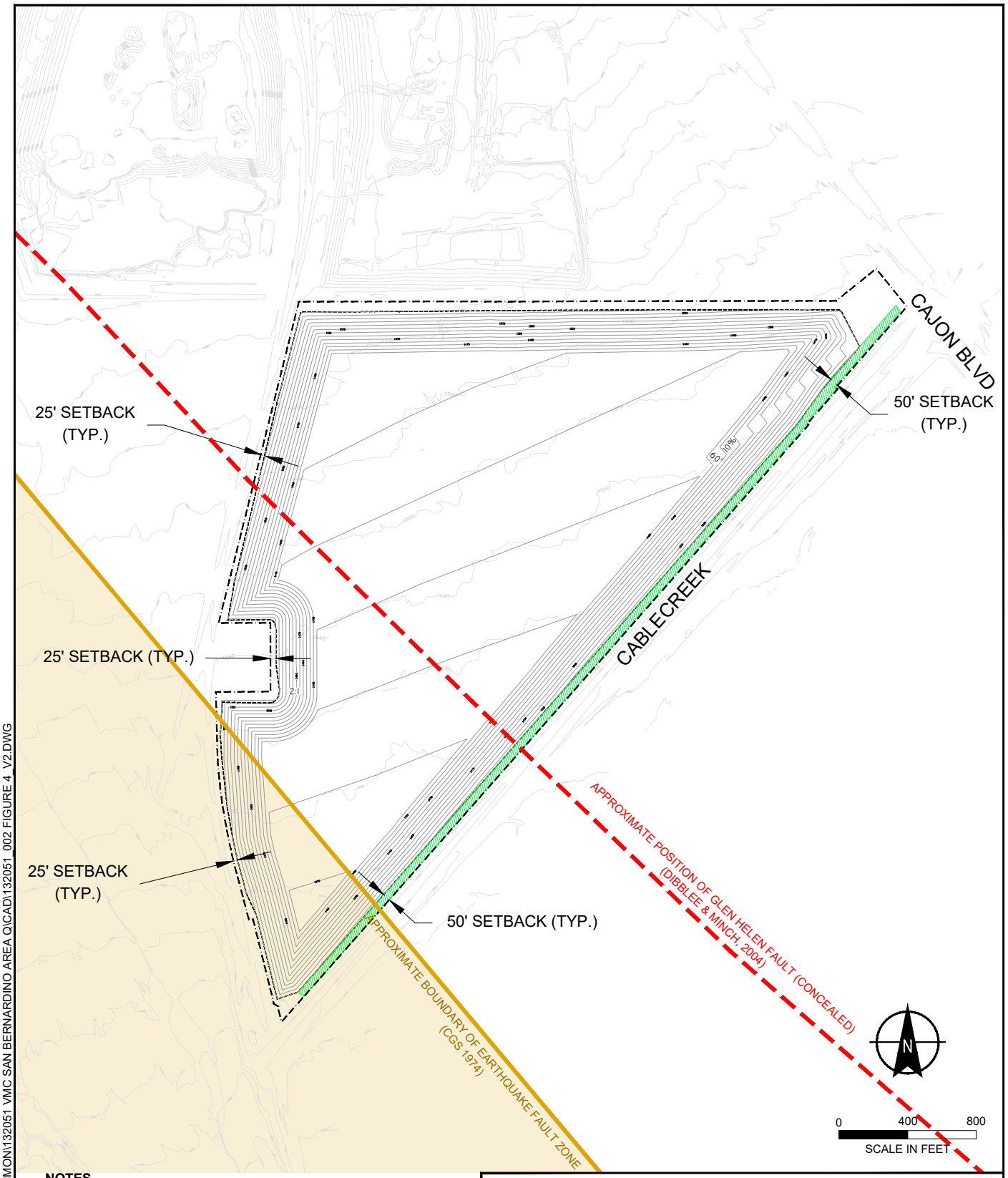
HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

REGIONAL GEOLOGY MAP

SCALE: N.T.S.
MAY 2018

FIGURE 3



NOTES

1. BASEMAP SOURCE PROVIDED BY SESPE CONSULTING, INC., JUNE 2019
2. APPROXIMATE POSITION OF GLEN HELEN FAULT REPRODUCED FROM DIBBLEE, T.W., AND MINCH, J.A., 2004, DIBBLEE FOUNDATION MAP DF-127
3. APPROXIMATE BOUNDARY OF EARTHQUAKE FAULT ZONE FROM CGS (FORMERLY CDMG) 1974, "SPECIAL STUDIES ZONES, SAN BERNARDINO NORTH QUADRANGLE, OFFICIAL MAP."

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

RECLAMATION PLAN FOR AREA Q WITH TOTAL DEPTH OF 120 FEET

SCALE: AS SHOWN
JUNE 2019

FIGURE 4

APPENDIX A

Geotechnical Logs and Reports by Others

TerraMins Inc.
Consulting Mining/Economic Geologists

November 11, 2004

Ed Elkins
Vulcan Materials Company
2400 W. Highland Ave.
San Bernardino, CA 92407

Re: Drilling project at Area Q, Muscoy, CA: TerraMins Inc. Project # 200409

Dear Ed,

Attached is the report: *Preliminary drilling results for "Area Q", Muscoy, San Bernardino County, California*. The preliminary report was e-mailed to you on Sunday, November 7, 2004. This report includes a location map, areal photograph, drill logs, and photograph of samples.

The project began Monday November 1, with coordination with the bio monitor and the Vulcan Highland plant staff. Drilling commenced at 12:30 on Thursday November 4th with the arrival of the drill crew on site. Drilling progressed through Friday November 5th and was completed on Saturday November 6th at 9:30 AM. Final closure of the site, including burial of the drill sites, was done by Vulcan staff.

I thank you for the opportunity to work on this project. Please call or e-mail if you have any questions or comments.

Sincere regards,

Dinah O. Shumway
Principal Geologist
CA R.G. 5818

14360 St. Andrews Drive, Suite 4 • Victorville, CA 92392 • Phone: 760-285-5801 • Fax: 760-843-3488
E-mail: terramins@earthlink.net

Preliminary drilling results for "Area Q", Muscoy, San Bernardino County, California

TerraMins, Inc.
November 11, 2004

Introduction: This memo is a part of due diligence for a consideration of purchase, Vulcan Material Company (VMC) required subsurface information on the quality of the materials located on property, Identified as "Area Q" in Muscoy. The property is adjacent to the south of "Area M", already acquired by VMC (see photo attached).

TerraMins was engaged to oversee the drilling of three planned holes in the property under the direction of Ed Elkins. VMC hired the drilling contractor, Layne Christensen.

TerraMins geologist Dinah Shumway coordinated with the biological monitor, Highland Plant personnel, and the drilling contractor. Drill sites were selected and road grading proceeded with monitoring by Christine Tischer of eCorps environmental consultants. The location of the drill hole sites was partially restricted by the location of Stephens Kangaroo Rat habitat which was previously identified within Area Q (see attached PowerPoint photograph for location of drill sites).

Directions from VMC limited drilling to a 200' foot depth in all three holes. An AP100 percussion drill with a 6" diameter recovery system was used. Largest material recovered is limited to 6" cobbles

Drilling began on Thursday November 4, 2004 at 12:30 PM and was completed Saturday, November 6, 2004 at 9:30 AM. The holes were logged by Shumway. Samples were collected by Dale Dell of VMC labs.

Conclusions: The drilling results confirmed expectations for Area Q. The material in Area Q is fairly uniform with about 60% 70% of the material clean moderately graded sand, silt and gravel with a coarse gravel bed located about 120 to 150 feet. In the northwest part of Area Q, the sands below the 150 foot depth contain a higher percentage of coarse gravel (up to 50%).

Drilling Results:

The materials in Area Q are fluvial sediments within the Cajon Creek outwash system. Area Q grades gently from a 1510 foot elevation in the southern part to a high of 1586 in the northwest corner. The surface, vegetated with brush and various grasses consists of a fine soil with scattered boulders ranging from over 18" to cobbles of 2 to 3 inches. Several gravel bars are exposed on the surface notably in the northwest part of Area Q. Lithologies consist of gneiss, schist and granitic rocks and more rarely marble clasts.

TERRAMINS
14360 St. Andrews Drive, Suite 4 • Victorville, CA 92392 • Phone: 760-285-5801 • Fax: 760-843-3488
E-mail: terramins@earthlink.net

Upper 120': The logs of the three holes indicate that the stratigraphy in Area Q is uniform over the property. The material in the upper 100 feet of all three holes is a dark brown to dark grayish brown clean sand and silt with very minor clay. The sand and gravel is moderately graded. Sand is estimated to range from 60% to 70% overall in the upper 100 feet. Coarse gravel is rounded to sub-rounded with clast sizes up to 4" and averaging between 1" to 2". Very minor clay in the samples is limited to coatings on the coarse gravel. Preliminary screening of samples from the upper 100 feet of Q-04-1, and Q-04-2 indicate that the sand comprises about 50% to 60% by volume of the sample.

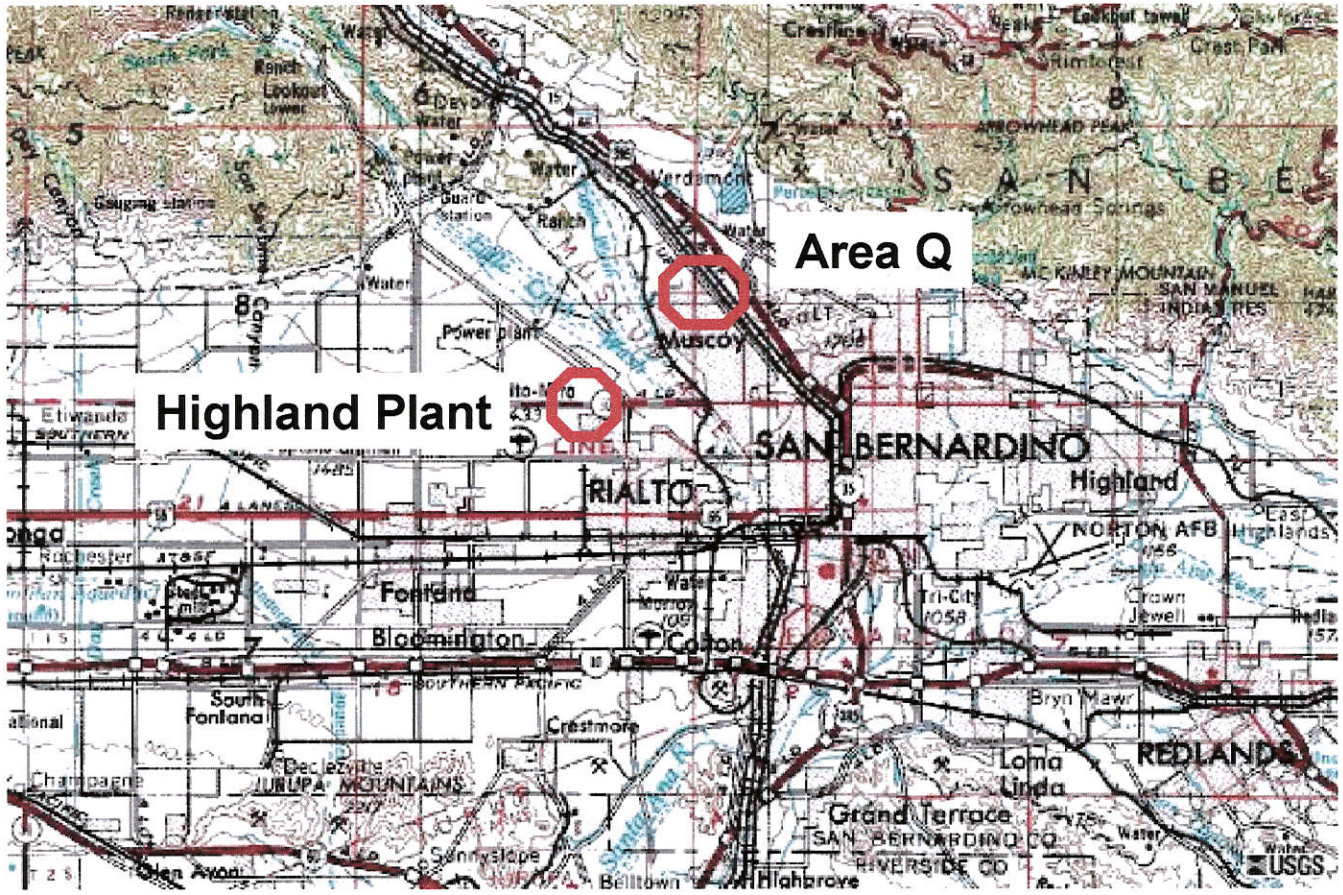
Four samples (about 3 pounds) from the upper 120 feet of drill holes Q-04-2 and Q-04-3 were collected for preliminary screening in TerraMins labs. Screening was limited to > #4 coarse gravel, >#10 fine gravel, < #10 sand and silt. Results of screening indicate that 50% to 60% by volume was < #10 sand and silt. Observation under microscope indicates that the sands are composed of 90% sub angular quartz grains. Only trace clay is present, mostly on coarse gravel clasts.

Lower 80': In all three holes the material from the 120' to 150 foot depths is gravel and sand and silt with coarse gravel comprising 50% to 60% of the material. Very minor clay is limited to coatings on clasts. Coarse gravel ranges in size from 1/2 inch to over 6". Gravels exhibit subrounded to angular textures. The samples below 120' included more broken rock chips. Some broken clasts exhibited moderate weathering. The sand lenses interbedded within these gravel beds was very clean and moderately graded.

The gravels between the 120' and 130' depths slowed drilling but the first hole (Q-01-1) was completed to the planned 200 foot depth in 3 hours. In holes 2 and 3 however, the gravel bed slowed drilling considerably and the higher presence of coarse gravel and cobbles in holes 2 (Q-01-2) and 3 (Q-01-3) required 6 hours each to complete drilling to the planned 200 foot depth. This likely indicates that the gravel bar thins or lenses out to the south.

Below 145' to 150' feet depths the logs indicate that the material is composed sand and gravels with 60% to 70% clean sand and silt and clay limited to coatings on the large clasts. The samples collected from the 2nd and 3rd holes (Q-04-2 and Q-01-3), contain a higher percentage of coarse gravel, cobbles and broken material (e.g. see photos of samples 180' to 190' attached).

Three samples (about 3 pounds) from the lower 80 feet of drill holes Q-04-2 and Q-04-3 were collected for preliminary screening in TerraMins labs. Screening was limited to > #4 coarse gravel, >#10 fine gravel, < #10 sand and silt. Results of screening indicate that 50% to 70% by volume was < #10 sand and silt. Observation under microscope indicates that the sands are composed of 90% sub angular quartz grains. Only trace clay is present, mostly on coarse gravel clasts.



Area Q, Muscoy, California

TerraMins Inc.
Consulting Mining/Economic Geologists
14360 St. Andrews Drive, Suite 4
Victorville, CA 92392

Drill Hole Log Q-04-1

Project:	Area Q	34° 10' 20.4"	Terramins Project No.: 200409
Location:	Muscoy, San Bernardino County	117° 21' 19.1"	1,885,722 N 6,756,670 E NAD 83
Client:	Vulcan Materials		

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1544
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-04-04	12:30PM
Drilling Contractor:	Layne Christensen			Date Completed: 11-04-04	4:30 PM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	
LAB: Dale Dell					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1544			easy drilling		moist	0' SW 10 YR 4 / 3	Lt Brn clean sand and silt (75%) and gravel (25%); sand crs to medium grained, some fine; coarse gravel (mostly 1/2", ranging 1" to 4"); minor clay on coarse gravel clasts; sub-rounded to sub-angular	
1534						10'	As Above	
1524						20' SW 10 YR 4/2	Grayish Brn clean Sand and silt (70%) and Gravel (20% to 30%); Crs Gravel; Minor clay on gravel clasts; Crs gravel sub-rounded to sub-angular ; minor clay on coarse gravel clasts.	
1214						30'	As Above	
1504						40' SW 10YR 5/2	Grayish Brn clean sand (60%) and Gravel (30%-40%); sand crs to medium, some silt; Gravel ranges 1.2" to 6"; some elongate clasts	

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Drill Hole Log Q-04-1

Project:	Area Q		Terramins Project No.: 200409
Location:	Muscoy, San Bernardino County		
Client:	Vulcan Materials		

Location:	NW Corner 5th Avenue and Cajon Blvd.				Collar Elevation and Datum: 1544
Coordinates:	Lat:	Long:	Depth to Groundwater (ft)	First:	Total Depth (ft): 200
Drilling Equipment/Method:	AP 1000 Percussion			Static:	Date Started: 11-04-04 12:30PM
Drilling Contractor:	Layne Christensen				Date Completed: 11-04-04 4:30 PM
Borehole Diameter:	6"		Logged by: D. Shumway		Checked by:
LAB: Dale Deil					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1494			easy drilling		moist	**50'** SW 10yr 4/2	Drk Brn clean sand and silt (60%) and Gravel (30%); clasts to 6"; sand crs to medium, some silt; clasts sub-rounded to sub angular; minor clay on clasts.	
1484						**60'** SW 10yr 4/2	As above: Gravel about 30% ; crs gravel to 2"	
1474						**70'** SW - GW 10yr 4/2	Drk brown clean sand (50%) and Gravle (40% to 50%); crs gravel to 4"; minor clay on clasts; moderately to poorly graded; gravel sub-rounded to sub angular	
1464						**80'** SW	Clean gravel (50% to 60% and sand and silt (50%); crs gravel clasts to 6"; sub-rounded ; minor clay on clasts; clasts sub-rounded; sand mostly crs.	
1454						**90'** SW	AS above: Note: no apprecdiable weathering 0-90'.	

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Drill Hole Log Q-04-1

Project:	Area Q	Terramins Project No.:	200409
Location:	Muscoy, San Bernardino County		
Client:	Vulcan Materials		

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1544
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-04-04	12:30PM
Drilling Contractor:	Layne Christensen			Date Completed: 11-04-04	4:30 PM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	
LAB: Dale Dell					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1444			Slow drilling		moist	**100'** GW / SW 10YR 5/3	Drk Brn clean gravel (50% - 60%) and Sand; clasts to 6"; clasts sub-rounded to sub-angular; sand crs to medium, some silt; moderately to poorly graded; minor clay on clasts	
1434						**110'** GW / SW	Brn clean sand, silt (50%) and gravel (50%); crs gravel rounded to sub-rounded; clasts to 2"; sand mostly coarse, some silt. Moderately graded.	
1424					slightly moist	**120'** SW 10 YR 4 / 2	Drk grayish Brn gravel (+60%) and sand (40%); gravel sub-rounded to sub-angular; clasts to >6"; abundant broken clasts in sample; some flat and elongated clasts;	
1414						**130'** GW / SW 10 YR 4/2	Drk Brn Gravel (50%) and sand; clasts sub-rounded to sub-angular ; minor clay on clasts; silt 5%?; abundant borken clasts in sample.	
1404						**140'**	As above: Note: some large broken clasts show moderate weathering	

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Drill Hole Log Q-04-1

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials

Terramins Project No.: 200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1544
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-04-04	12:30PM
Drilling Contractor:	Layne Christensen			Date Completed: 11-04-04	4:30 PM
Borehole Diameter:	6"		Logged by: D. Shumway	Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1394			easy drilling		slightly moist	**150'** SW	Drk Brn sand (60% to 70%) and gravel (20% -30%); clasts to 2" rounded to sub-rounded; sand medium to crs; some silt (5%)?; minor clay on clasts	
1384						**160'** SW-SP 10YR 5/3	Drk Brn clean sand (60% to 70%) and gravel (30%); sand crs to fine; some silt; clay on clasts; clasts to 6"; some elongae; sub-rounded to sub-angular	
1374						**170'**	As above: clasts to 2"	
1364						**180'** GW - SP 10YR 5/3	Drk Brn clean sand (60% to 70%) and gravel (30%); sand crs to fine; some silt; clay on clasts; clasts to 6"; some elongate; sub-rounded to sub-angular	

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Drill Hole Log Q-04-1

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials
Terramins Project No.:	200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1544
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-04-04	12:30PM
Drilling Contractor:	Layne Christensen			Date Completed: 11-04-04	4:30 PM
Borehole Diameter:	6"		Logged by: D. Shumway	Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon . Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1354			easy drilling		slightly moist	**190'**	
						SW 10YR 5/3 Drk Brnsand (70% - 80%) and gravel (20%); clasts to 4" rounded to sub-rounede; minor clay on clasts	
1344						**200'**	
						TD = 200'	

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Drill Hole Log Q-04-2

Project:	Area Q	34° 10' 26.5"	Terramins Project No.: 200409
Location:	Muscoy, San Bernardino County	117° 21' 19.5"	1,886,339N
Client:	Vulcan Materials		6,756,633E

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1557
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-05-04	7:30 AM
Drilling Contractor:	Layne Christensen			Date Completed: 11-06-04	1:30 AM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	
LAB: Dale Dell					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments
1557	0				moist	SW 10YR 4/3	Drk brn very clean sand (70% - 80%) and gravel (20%); clasts to 2", rounded to sub-angular; minor clay o
1547	10'						As Above
1537	20'		easy drilling			SW 10YR 4/3	very clean sand (70% - 80%) and gravel (20%) crs gravel clasts to 4"(1%), sub-rounded to sub-angular; minor clay on clasts
1527	30'				moist	SW	As Above: crs gravel 5% - 10%
1517	40'	SW				10yr 5/3	Drk Brn clean sand (60%-70%) and gravel (30%-40%); moderate well sorted; clasts to 4"; sub-rounede to sub-angular; minor clay on clasts; some elongate clasts.

CRS Gravel = > #4
Gravel = > #10
Sand / silt = < #10

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Drill Hole Log Q-04-2

Project:	Area Q	Terramins Project No.:	200409
Location:	Muscoy, San Bernardino County		
Client:	Vulcan Materials		

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1557
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-05-04	7:30AM
Drilling Contractor:	Layne Christensen			Date Completed: 11-06-04	1:30 PM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	
LAB: Dale Dell					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon . Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1507			easy drilling	screened; see photo	moist	**50'** SW 10YR 5/3 — Drk Brown clean sand and silt (60% - 70%) and gravel (30% - 40%); crs gravel to 6" (1%); pea gravel (10%); minor clay on clasts	
1497						**60'** SW 10yr 5/3 — **As above**	
1487						**70'** SW — Drk Brown sand and silt (60%) and gravel (50%); crs gravel to 4"; sub-rounded to sub-angular; minor clay on clasts	
1477						**80'** SW — Drk Brown sand and silt (60%) and gravel (50%); crs gravel to 4"; crs gravel (10%?); sub-rounded to sub-angular; crs gravel to 8"; some elongate; crs gravel exhibits some minor weathering; minor clay on clasts.	
1467				screened		**90'** GW/SW 10YR 5/2 — Drk gry Brn clean sand (60%) and gravel (40%); crs gravel (10%) sub-roundd to sub-angular; minor clay on clasts; clasts include marbel and hornfels;	

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Drill Hole Log Q-04-2

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials

Terramins Project No.: 200409

Location:	NW Corner 5th Avenue and Cajon Blvd.				Collar Elevation and Datum: 1557
Coordinates:	Lat:	Long:	Depth to Groundwater (ft)	First:	Total Depth (ft): 200
Drilling Equipment/Method:	AP 1000 Percussion			Static:	Date Started: 11-05-04 7:30 PM
Drilling Contractor:	Layne Christensen				Date Completed: 11-05-04 1:30 PM
Borehole Diameter:	6"		Logged by: D. Shumway		Checked by:

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1457			slow drilling		moist	**100'** SW	Clean sand, silt (70%) and gravel 30%); crs gravel (5%-10%); clasts to 3", sub-rounded to sub-angular	
1447						**110'** SW	Drk Brn sand (60%) and gravel (30%-40%); crs gravel to 2", some flat clasts; minor clay on clasts; crs gravel sub-rounded to sub-rounded; some broken clasts in sample.	
1437					slightly moist	**120'** GW 10YR 5/2	Grayish brn gravel (50%) and sand/silt (50%); moderately poor graded; clasts to 4"; sub-rounded to sub-angular; crs gravel slightly weathered; marble clasts common.	
1427						**130'** GW/SW 10YR 6/1	grayish brn gravel (50%) and sand/silt (40%); clasts to 6"; sub-rounded to sub-angular; minor clay on clasts; abundant marble clasts; broken clasts in sample.	
1417						**140'**	As above	

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Drill Hole Log Q-04-2

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials
Terramins Project No.:	200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1557
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started:	11-05-04 7:30 AM
Drilling Contractor:	Layne Christensen			Date Completed:	11-05-04 1:30 PM
Borehole Diameter:	6"		Logged by: D. Shumway	Checked by:	
LAB: Dale Dell					

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1407			slow drilling		slightly moist	**150'** GW/SW	drk brn Clean sand and silt (50%) and gravel (40%-50%); crs gravel to 6"; sub-rounded to sub-angular; minor clay on clasts; crs gravel slightly weathered	
1397						**160'** GW/SW	Drk Brn; sand and silt (50%) and gravel (40%-50%); crs gravel (10%); crs gravel clasts to 3"; sub-rounded to sub-angular; minor lay on clasts; broken crs gravel slightly weathered	
1387						**170'** GW	Brownish gray gravels (50%) and sand and silt (50%); clasts to 1"; sub-rounded to sub-angular; minor clay on clasts.	
1377						**180'**	Drk Brn Clean sand and silt (80%) and gravel (20%); crs gravel to 1"; sub-rounded to sub-angular; minor clay on clasts; some flat clasts.	

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Drill Hole Log Q-04-2

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials

Terramins Project No.: 200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1557
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started:	11-05-04 7:30 AM
Drilling Contractor:	Layne Christensen			Date Completed:	11-05-04 1:30 PM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1367			slow drilling		slightly moist	190'	Drk Brn Sand and silt (60%) and gravel (30%); clasts fub-rounded to sub-angular; minor clay on clasts	
1377						200'	TD = 200'	

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Drill Hole Log Q-04-3

Project:	Area Q	34° 10' 26.2"	Terramins Project No.: 200409
Location:	Muscoy, San Bernardino County	117° 21' 45.3"	1,886,295 N
Client:	Vulcan Materials		6,754,405 E

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1573
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started:	11-05-04 2:30 PM
Drilling Contractor:	Layne Christensen			Date Completed:	11-06-04 9:30 AM
Borehole Diameter:	6"	Logged by: D. Shumway		Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments
1573	0		easy drilling		moist	SW 10YR 4/3	Drk Brn clean sand and silt (80%) and gravel (20%); crs gravel to 6" but average 4" (1%) rounded to sub-rounded; minor clay on clasts
1563	10'						As above
1553	20'					SW 10YR 4/3	Drk brown clean sand and silt (70%) and gravel (30%); crs gravel to 3" (10%); minor clay on clasts;
1543	30'					SW	As above
1533	40'						Drk Brown clean sand and silt (70%) and gravel (30%); crs gravel to 2" mostly 1"(10%); minor clay on clasts;

CRS Gravel = > #4
Gravel = > #10
Sand / silt = < #10

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Drill Hole Log Q-04-3

Project:	Area Q		Terramins Project No.: 200409
Location:	Muscoy, San Bernardino County		
Client:	Vulcan Materials		
Location:	NW Corner 5th Avenue and Cajon Blvd.	Collar Elevation and Datum:	1573
Coordinates:	Lat: Long: Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion Static:	Date Started:	11-05-04 2:30PM
Drilling Contractor:	Layne Christensen	Date Completed:	11-06-04 9:30 PM
Borehole Diameter:	6" Logged by: D. Shumway	Checked by:	
	LAB: Dale Dell		

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon . Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1523			slow drilling	screened	moist	**50'** SW 10yr 4/2	drk grayish brn Clean sand silt (60%) gravel (30%); crs gravel sub-rounded to sub-angular (10%); clasts to 6"; moderately graded; minor clay on clasts;
1513						**60'** SW 10YR 5/3	Drk grayish Brn sand silt (60%) gravel (30%); crs gravel sub-rounded to sub-angular (5%); clasts to 6"; moderately graded; minor clay on clasts;
1503					slightly moist	**70'** SW	drk brn: sand and gravel; sand (80%) crs gravel 10%; some silt; crs gravel to 8" mostly 2"; rounded to sub-rounded; minor clay on clasts.
1493						**80'** GW	Drk brn Sand (80%) and Gravel (10%); crs gravel sub-rounded to sub-angular; soe large clasts weathered; some flat and elongated; clasts to 6"; most 2".
1483				scrn		**90' SW** 10YR 5/2	Grayish brn clean sand (80%) and gravel (20%); crs gravel mostly 2"; sub-rounded to sub-angular; sand medium to fine; minor clay on clasts

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Drill Hole Log Q-04-3

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials
Terramins Project No.:	200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1573
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started: 11-05-04 2:30 PM	
Drilling Contractor:	Layne Christensen			Date Completed: 11-06-04 9:30 AM	
Borehole Diameter:	6"		Logged by: D. Shumway	Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon .	Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1473			fast drilling	screened	slightly moist	**100'** SW 10YR 5/3	Drk brn sand (80%) and gravel (20%); moderately poorly graded; crs gravel to 3"; rounded to sub-angular; some fine sand; fine gravel 20%?; minor clay on clasts;	
1463						**110'**	as above: more broken clasts in sample	
1453			slow drilling		dry	**120'** SW/GW 10YR 5/2	grayish drk brn gravel (40%) and sand (50%); crs gravel rounded to sub-angular; clasts to 3"; abundant broken clasts in sample; sand medium to fine; some fine sand; fine gravel 20%?; minor clay on clasts; clasts slightly weathred; some elongate	
1443						**130'** GW 10YR 5/2	drk grayish brn sand (30%)and gravel (70%) crs clasts to 6", abundant broken clasts in sample; lg clasts slightly weathered; sub-rounded to sub-angular	
1433						**140'**	grayish brn gravel (70%) and clean sand (30%) silt (10%)?; crs gravel clasts to 6", sub-angular; minor clay on clasts. (note; sand mostly quartz with minor feldspar)	

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Drill Hole Log Q-04-3

Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials
Terramins Project No.:	200409

Location:	NW Corner 5th Avenue and Cajon Blvd.				Collar Elevation and Datum: 1573
Coordinates:	Lat:	Long:	Depth to Groundwater (ft)	First:	Total Depth (ft): 200
Drilling Equipment/Method:	AP 1000 Percussion			Static:	Date Started: 11-05-04 2:30 PM
Drilling Contractor:	Layne Christensen				Date Completed: 11-06-04 9:30 AM
Borehole Diameter:	6"		Logged by: D. Shumway		Checked by:

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Material Description / Comments
1423			slow drilling	screened	slightly moist	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon . CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
						150' SW/GW 10YR 5/2 — Drk brn sand (60%)and gravel (40%) ; crs gravel to 3"; sub-rounded to sub-angular; marble clasts; some clay on clasts.
1413						**160'** SW 10YR 4/3 — drk brn clean sand (70%)and gravel (20%) ; crs gravel to 6" but mostly 3"; sub-rounded ; some flat and elongated clasts; marble clasts; some clay mostly on clasts (1%)?; (note: very slow drilling- but doesn't seem to be the material)
1403						**170'** SW — Drk Brn clean sand (70%) and gravel (30%); crs gravel clasts to 1" most 1/2"; sub-rounded; moderately graded; clay on clasts
1393				screened		**180'** SW — Drk brn clean sand (70%) and gravel (30%); crs gravel to 1" (<10%); sand medium, some silt; crs gravel sub-rounded to sub-angular; crs gravel slightly weathered;

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Drill Hole Log Q-04-3

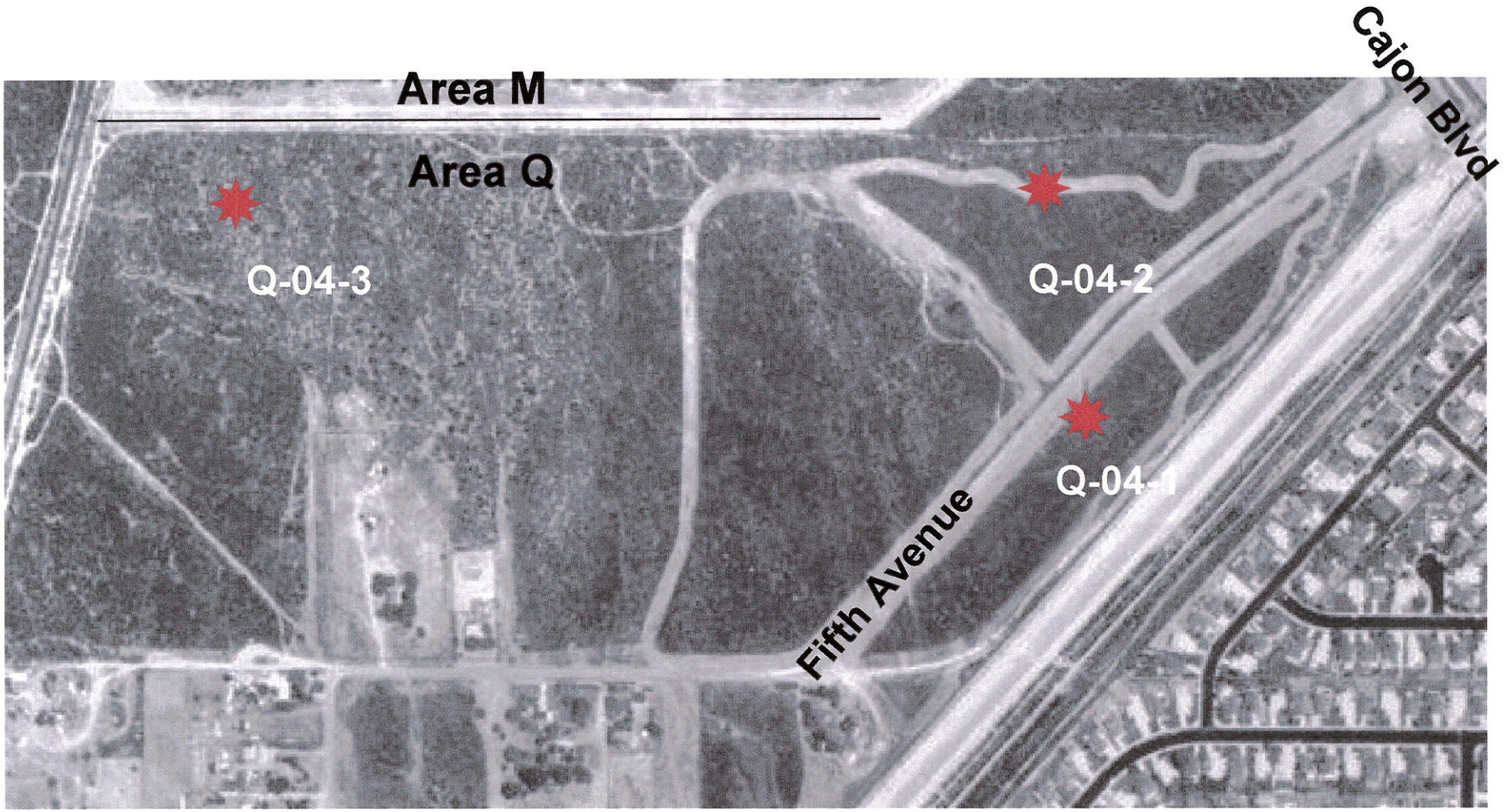
Project:	Area Q
Location:	Muscoy, San Bernardino County
Client:	Vulcan Materials

Terramins Project No.: 200409

Location:	NW Corner 5th Avenue and Cajon Blvd.			Collar Elevation and Datum:	1573
Coordinates:	Lat:	Long:	Depth to Groundwater (ft) First:	Total Depth (ft):	200
Drilling Equipment/Method:	AP 1000 Percussion		Static:	Date Started:	11-05-04 2:30 PM
Drilling Contractor:	Layne Christensen			Date Completed:	11-06-04 9:30 AM
Borehole Diameter:	6"		Logged by: D. Shumway	Checked by:	

LAB: Dale Dell

Elevation (feet MSL)	Depth (feet)	Sample No.	Recovery (%)	Bag Sample	Moisture Content (%)	Lithology, primarily gneiss and schist, with secondary granitic clasts. Marbel and hornfels less comon . Material Description / Comments	CRS Gravel = > #4 Gravel = > #10 Sand / silt = < #10
1383				screened		**190'**	
						Drk brn sand (60%) and gravel (40%) coarse gravel 1" ; sub-rounded to sub-angular; minor clay on clasts;	
1373						**200'**	
						TD = 200'	



Area Q, Muscoy, California

Scale

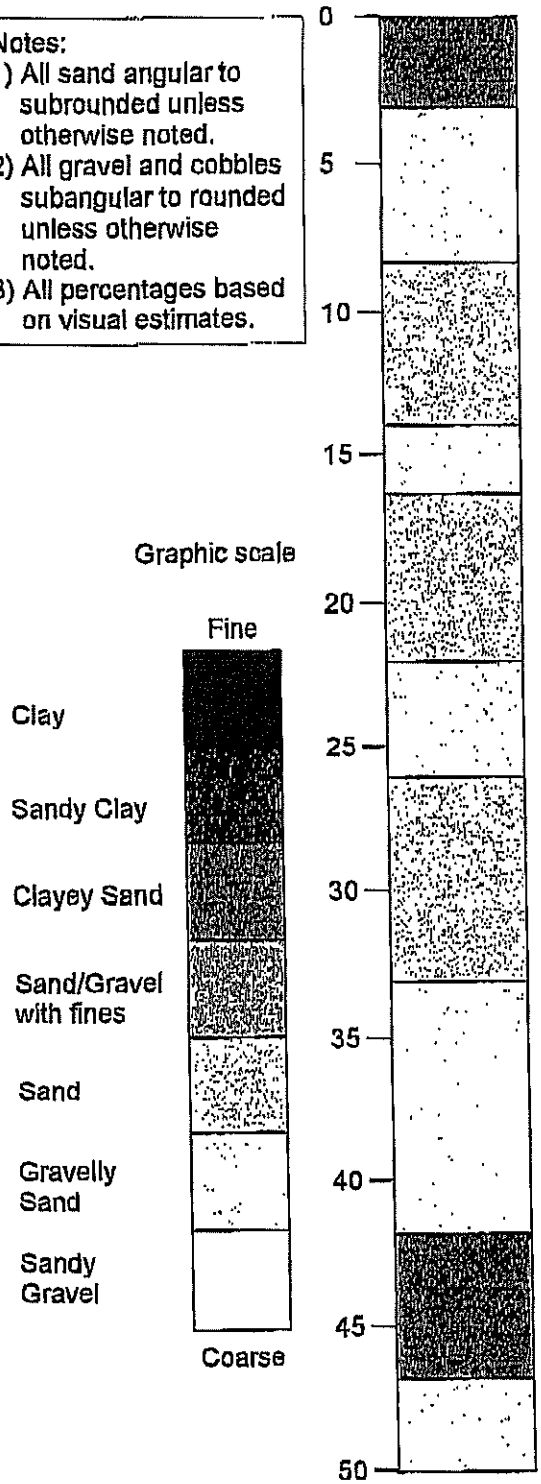
.25 Mile

Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,772 N
6,753,424 E
Ground elevation: 1,546'

Hole: SB-04-01
Date drilled: 2/17/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-3' **Silty Sand (SM);** light yellowish brown (10YR 6/4); 80% fine to medium sand, 15% silt, 5% gravel, humid.

3-8' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel and cobbles, trace silt. Gravel subangular to rounded clasts, fresh to slightly weathered medium to coarse grained granitics, humid.

8-14' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, trace gravel, humid.

14-16' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel with trace cobbles. Mostly slightly weathered granitics and gneiss with some moderately to highly weathered coarse grained, orthoclase-rich granitics, humid.

16-22' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 10% gravel, trace cobbles to 6", humid.

22-26' **Gravelly Sand (SW);** light olive brown (2.5YR 5/6); fine to coarse sand, 30% gravel with trace cobbles, gneiss boulder at 25 feet, trace silt, humid.

26-33' **Sand (SW);** light olive brown (2.5YR 5/6); fine to coarse sand, 15% gravel, trace silt, humid. Gravel clasts include schists and pegmatite that are only slightly weathered but are not resistant to hammer blows.

33-42' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 30% gravel with trace cobbles, gneiss boulder at 40 feet, also schist, fine grained mafics, and coarse grained granitics, damp.

42-47' **Silty Sand (SM);** brown (10YR 5/3); mostly fine to medium sand, 10% gravel, 20% silt, damp.

47-55' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 35% gravel with cobbles to 8", trace silt. Gravel angular to subrounded granitics and schist, fine to medium grained mafics and plagioclase pegmatite, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-01
Site: Highland Avenue Plant, San Bernardino, CA

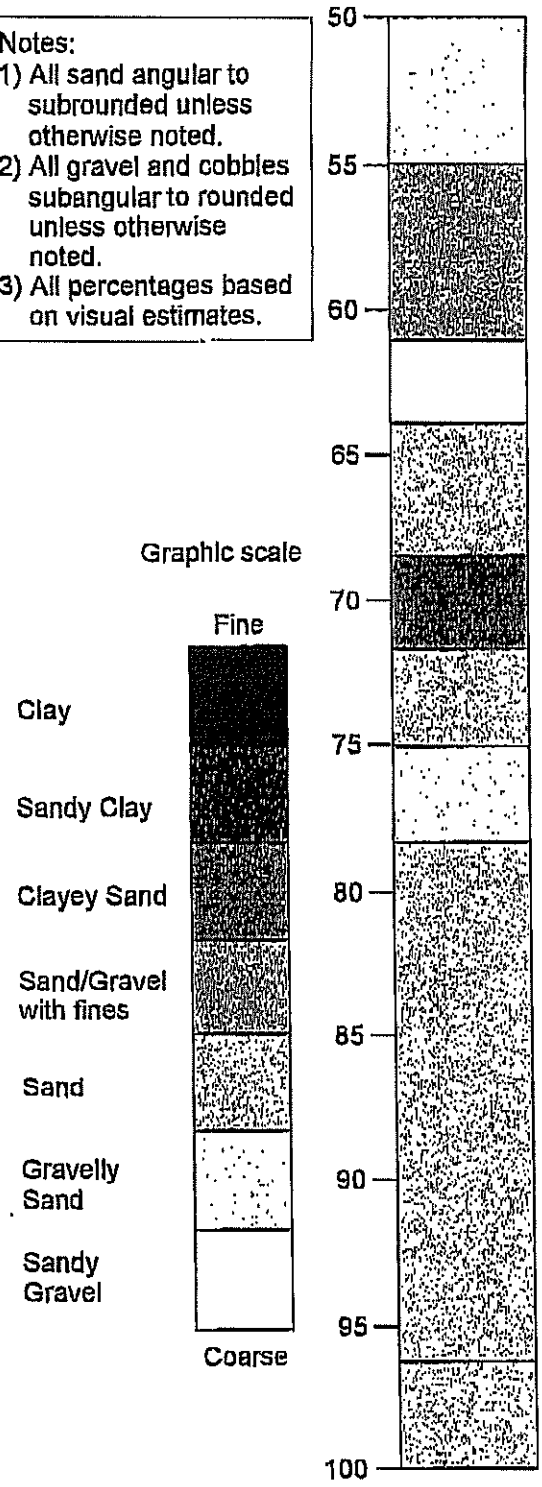
Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,772 N
6,753424 E
Ground elevation: 1,546'

Hole: SB-04-01
Date drilled: 2/17/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



47-55' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 35% gravel with cobbles to 8", trace silt. Gravel angular to subrounded granitics and schist, fine to medium grained mafics and plagioclase pegmatite, damp.

55-61' **Sand with Silt (SW- SM);** yellowish brown (10YR 5/4); fine to coarse sand, 10% silt, 10% gravel, damp.

61-64' **Sandy Gravel (GW);** strong brown (7.5YR 5/6); 40% fine to coarse sand, 55% gravel and cobbles to 8", 5% silt. Quartz diorite, schist, fine to medium grained mafics, damp.

64-68' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 10% gravel, damp.

68-72' **Silty Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel and cobbles, granite boulder at 71 feet, 20% silt, damp.

72-75' **Sand (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, trace silt, damp.

75-78' **Gravelly Sand with Silt (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 40% gravel and cobbles, quartz diorite boulder, 5% silt and 5% rock flour (from drilling method), damp. Gravel clasts moderately weathered mica schist, quartzite, fine grained mafics, and quartz diorite.

78-96' **Sand (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, micaceous, trace gravel, trace silt, damp.

96-104' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, 15% gravel, trace silt, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-01
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

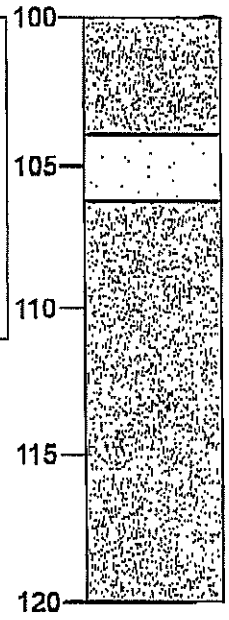
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,772 N
6,763,424 E

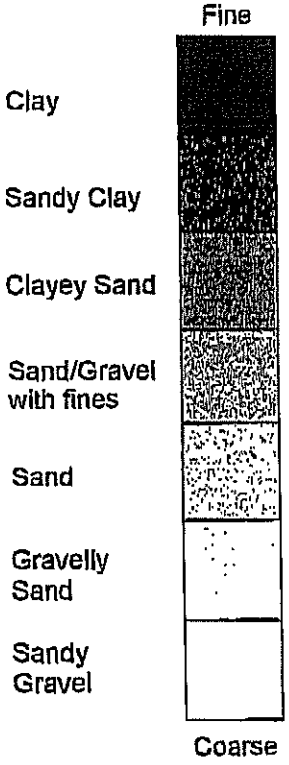
Ground elevation: 1,546'

Hole: SB-04-01
Date drilled: 2/17/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



Graphic scale



End of hole
No ground water

96-104' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, 15% gravel, trace silt, damp.

104-106' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, 30% gravel, trace silt, damp.

106-120' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, trace gravel, damp.

Vulcan Materials Company

Rig: Foremost AP-1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-01
Site: Highland Avenue Plant, San Bernardino, CA

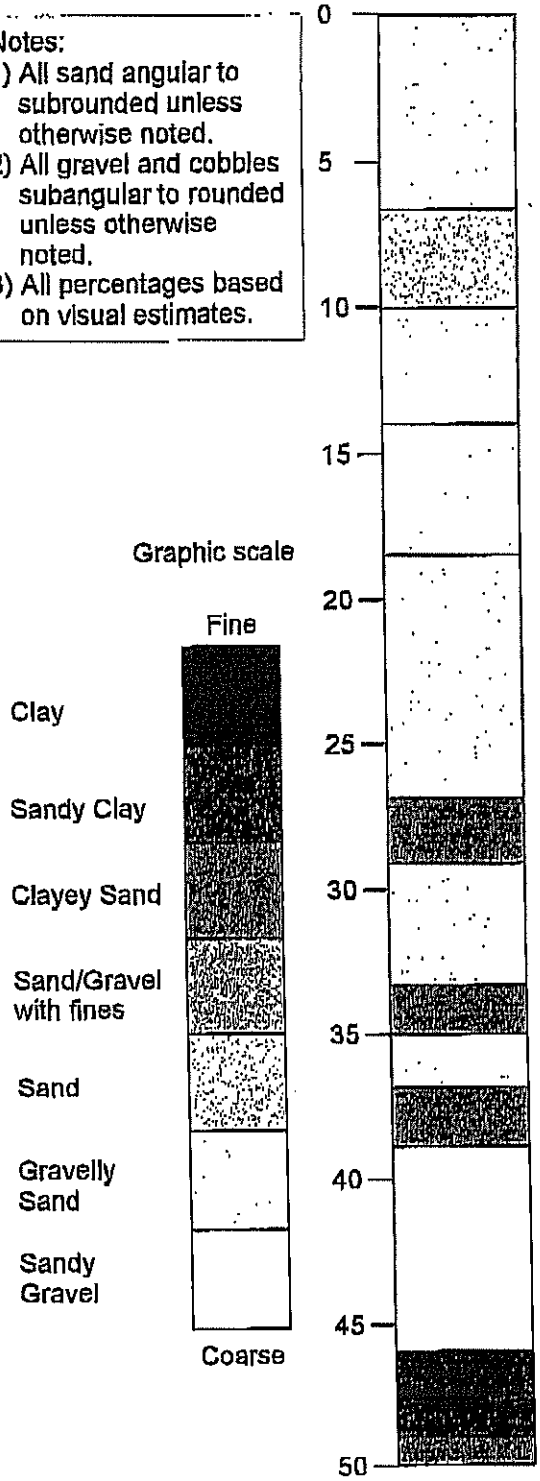
Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,066 N
6,752,926 E
Ground elevation: 1,511'

Hole: SB-04-02
Date drilled: 2/17/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-7' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel to 3", trace silt. Abundant slightly weathered but relatively weak mica schist, with resistant quartzite and gneiss, humid.

7-10' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, trace gravel, trace silt, humid.

10-14' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 40% gravel with cobbles and boulders. Slightly weathered quartzite, gneiss, quartz diorite and fine grained mafics, humid.

14-18' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel to 3", humid.

18-27' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel with cobbles and boulders. Trace silt as rock flour. Moderately to highly weathered clasts of coarse grained granitics and weak schists. Quartzites and fine grained mafics remain slightly weathered and resistant to hammer blows, humid.

27-29' **Silty Sand with Gravel (SM);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, 20% silt, humid.

29-33' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/4); fine to coarse sand, 35% gravel with cobbles to 8". Larger clasts (>1.5") slightly to moderately weathered, with finer gravels (<1.5") mostly moderately to highly weathered, humid.

33-35' **Silty Sand (SM);** dark yellowish brown (10YR 4/6); fine to medium sand, 15% silt, damp.

35-37' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 20% gravel with cobbles, trace silt. Gravel clasts subangular to subrounded, mostly moderately to highly weathered, some resistant quartzite, humid.

37-39' **Silty Sand (SM);** dark yellowish brown (10YR 4/6); mostly fine to medium sand, 15% silt, damp.

39-46' **Sand and Gravel (SW-GW);** pinkish gray (7.5YR 6/2); 50% fine to coarse sand, 50% gravel with cobbles and boulders, trace silt as rock flour. Finer gravel clasts (<1.5") are mostly moderately to highly weathered schists and coarse grained granitics. Large clasts slightly to moderately weathered fine to medium grained mafics and gneiss, humid.

46-49' **Sandy Silt (ML);** dark yellowish brown (10YR 4/6); fine to medium sand, 60% silt, damp.

49-52' **Silty Sand with Gravel (SM);** dark yellowish brown (10YR 4/6); mostly fine to medium, micaceous sand, 20% silt, 15% gravel, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-02
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

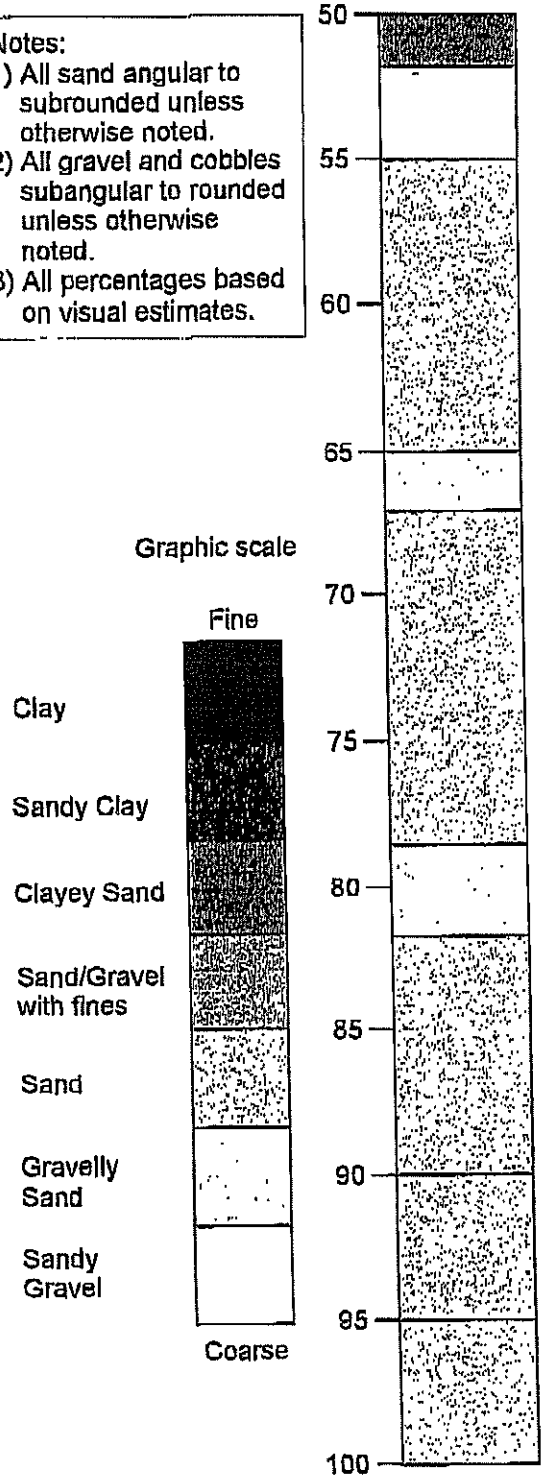
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,066 N (northeast pit)
6,752,926 E

Ground elevation: 1,511'

Hole: R-04-02
Date drilled: 2/4/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



49-52' **Silty Sand with Gravel (SM);** dark yellowish brown (10YR 4/6); mostly fine to medium, micaceous sand, 20% silt, 15% gravel, damp.

52-55' **Gravel with Sand (GW);** dark yellowish brown (10YR 4/6); 80% gravel with gneiss boulder, trace silt as rock flour, humid.

55-65' **Sand with Gravel (SW);** light olive brown (2.5Y 5/3); fine to coarse sand, 15% gravel, mostly moderately to highly weathered clasts, moist.

65-67' **Gravelly Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 40% gravel with cobbles and gneiss boulder, feldspar pegmatite and quartzite, damp.

67-78' **Sand with Gravel (SW);** olive brown (2.5Y 4/4); fine to coarse sand, 15% fine gravel, mostly subangular to rounded, moderately to highly weathered clasts of schist and coarse grained granitics, moist.

78-82' **Gravelly Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 40% gravel with cobbles, damp.

82-90' **Sand with Gravel (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 15% gravel, trace cobbles, trace silt, mostly moderately to highly weathered clasts of mica schist, moist.

90-95' **Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, trace gravel, damp.

95-102' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 15% gravel, trace cobbles, mostly moderately weathered clasts of schist and granitics, moist.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-02
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

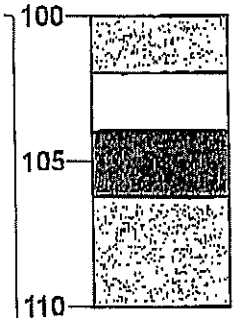
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,066 N
6,752,926 E

Ground elevation: 1,511'

Hole: SB-04-02
Date drilled: 2/17/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



End of hole
No ground water

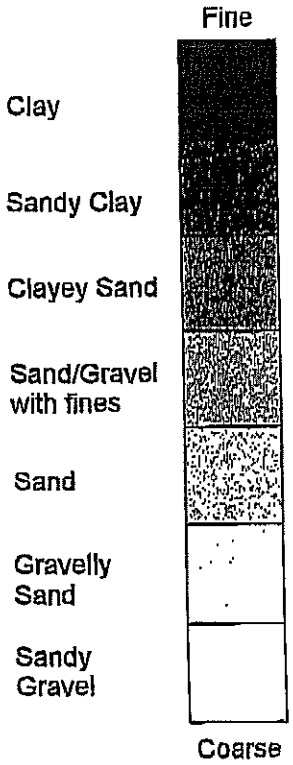
95-102' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 15% gravel, trace cobbles, mostly moderately weathered clasts of schist and granitics, moist.

102-104' **Sandy Gravel (GW);** yellowish brown (10YR 5/6); fine to coarse sand, 60% gravel with cobbles. Slightly to moderately weathered quartzite and fine grained mafics, with moderately to highly weathered schist and coarse grained granitics, damp.

104-106' **Silty Sand (SM);** dark yellowish brown (10YR 4/6); mostly fine to medium, micaceous sand, 15% silt, trace gravel, damp.

106-110' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, trace silt, moist.

Graphic scale



Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-02
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

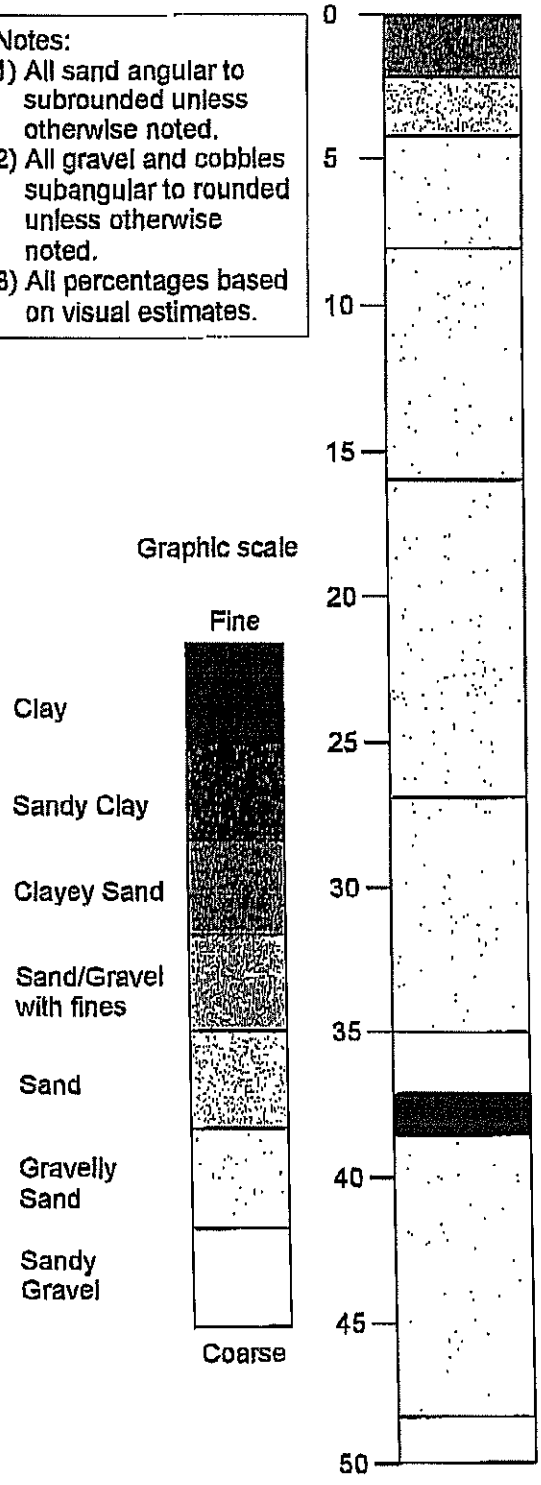
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,887,579 N
6,753,458 E

Ground elevation: 1,496'

Hole: SB-04-03
Date drilled: 2/17-18/04
Page: 1 of 3

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-2' **Silty Gravelly Sand (SM);** light gray (10YR 7/2); fine to coarse sand, 30% gravel, 15% silt, humid.

2-4' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, humid.

4-8' **Sand with Gravel (SW);** light yellowish brown (10YR 6/4); fine to coarse sand, 20% gravel with trace cobbles, slightly to moderately weathered quartzite and fine grained mafics with moderately to highly weathered schist and coarse grained granitics, humid.

8-16' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 15% gravel, humid.

16-27' **Gravelly Sand (SW);** light yellowish brown (10YR 6/4); fine to coarse sand, 35% gravel with cobbles and gneiss boulder. Trace silt as rock flour. Mostly slightly to moderately weathered clasts of granitics, schist, gneiss, and fine grained mafics, humid.

27-35' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel and cobbles to 6", humid. Slightly to moderately weathered granitics, feldspar pegmatite, and fine grained mafics.

35-37' **Sandy Gravel (GW);** yellowish brown (10YR 5/4); fine to coarse sand, 60% gravel and cobbles with quartz monzonite boulder, humid.

37-38' **Sandy Silt (ML);** pale brown (10YR 6/3); 40% fine to medium sand, 60% silt, humid.

38-48' **Gravelly Sand (SW);** light olive brown (2.5Y 5/6); fine to coarse sand, 35% gravel with cobbles, mostly slightly to moderately weathered clasts of quartzite, schist, and othoclase-rich coarse grained granitics, humid.

48-54' **Sandy Gravel (GW);** light brownish gray (10YR 6/2); fine to coarse sand, 60% gravel and cobbles with diorite boulder, trace silt as rock flour, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-03
Site: Highland Avenue Plant, San Bernardino, CA

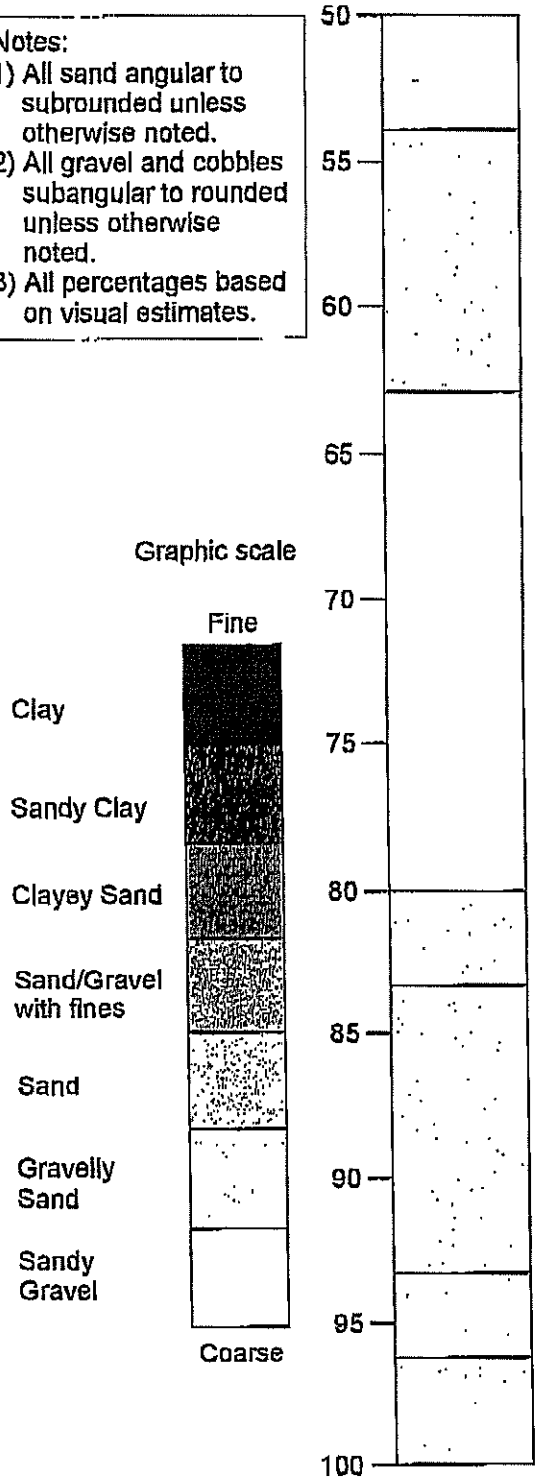
Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,887,579 N
6,753,458 E
Ground elevation: 1,496'

Hole: SB-04-03
Date drilled: 2/17-18/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



48-54' **Sandy Gravel (GW);** light brownish gray (10YR 6/2); fine to coarse sand, 60% gravel and cobbles with diorite boulder, trace silt as rock flour, humid.

54-63' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 10% gravel, trace cobbles, damp.

63-80' **Sand with Gravel (SW-GW);** light olive brown (2.5Y 5/3); fine to coarse sand, 15% gravel, trace cobbles, trace silt, damp.

80-83' **Sandy Gravel (GW);** light brownish gray (10YR 6/2); fine to coarse sand, 60% gravel and cobbles with quartzite boulder, trace silt as rock flour, humid.

83-93' **Sand with Gravel (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 10% gravel, mostly moderately to highly weathered clasts <1.5", damp.

93-96' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel with trace cobbles, trace silt. Finer gravel moderately to highly weathered clasts, larger clasts mostly slightly to moderately weathered, damp.

96-104' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 15% gravel, trace cobbles, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-03
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

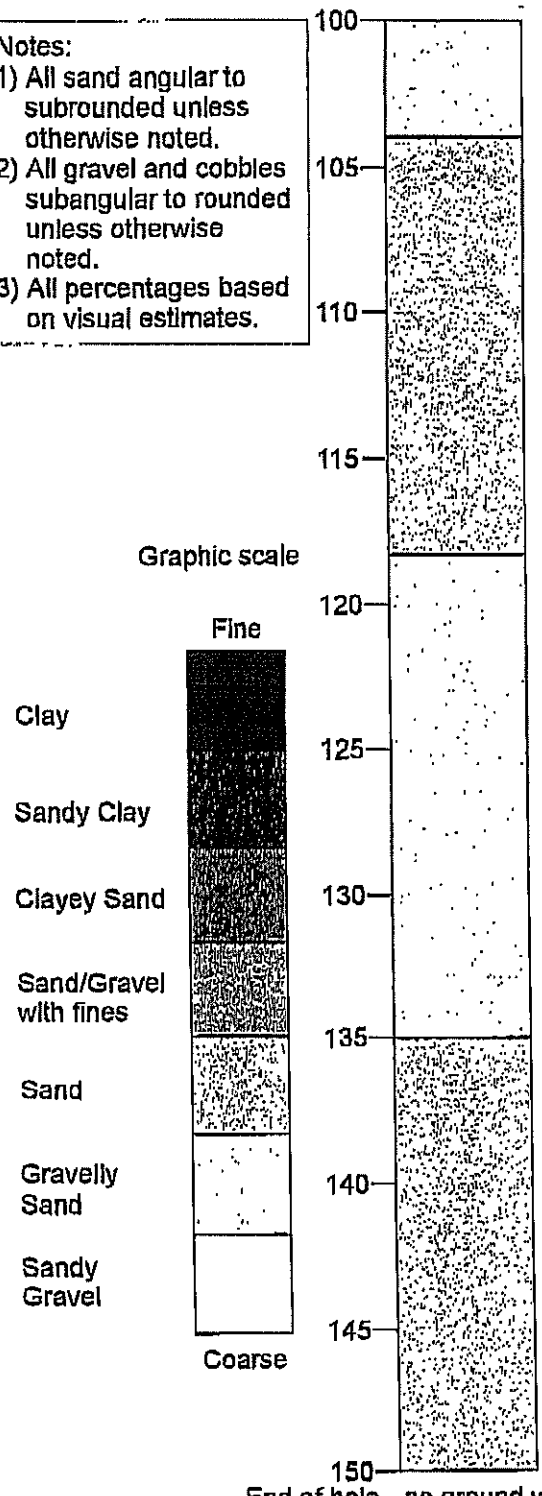
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,887,579 N
6,753,458 E

Ground elevation: 1,496'

Hole: SB-04-03
Date drilled: 2/17-18/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



96-104' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 15% gravel, trace cobbles, damp.

104-118' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, trace gravel, trace cobbles, damp.

118-135' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, trace cobbles, trace weakly cemented conglomerate, damp.

135-150' **Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, trace gravel, damp to moist.

End of hole - no ground water

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-03
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

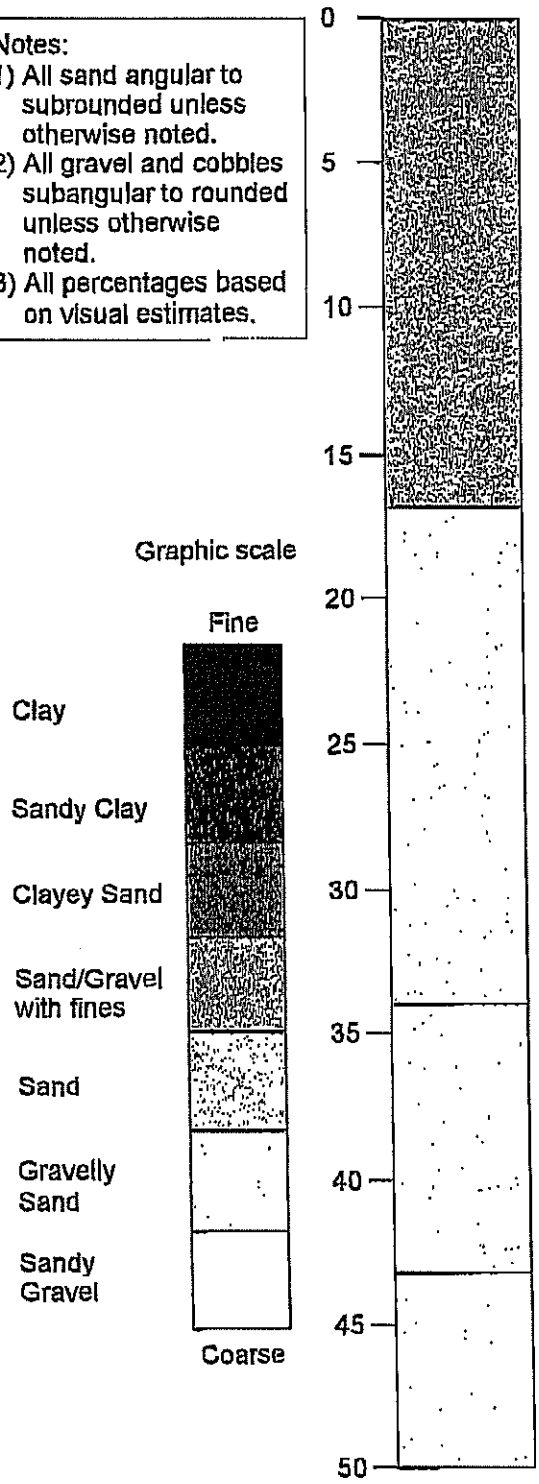
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,978 N
6,755,221 E

Ground elevation: 1,622'

Hole: SB-04-04
Date drilled: 2/18/04
Page: 1 of 4

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-17' **Sand with Silt (SW-SM);** dark yellowish brown (10YR 4/6); fine to coarse sand, 10% silt, trace gravel, damp.

17-34' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, slightly to moderately weathered clasts of schist and quartz monzonite, zone of increased weathering from 20-30 feet, humid.

34-43' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel with cobbles and quartzite boulder. Mostly slightly to moderately weathered clasts of quartzite, schist, granitics, and fine grained mafics, humid.

43-53' **Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 10% gravel, humid.

Vulcan Materials Company

Rig: Foremost AR 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-04
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

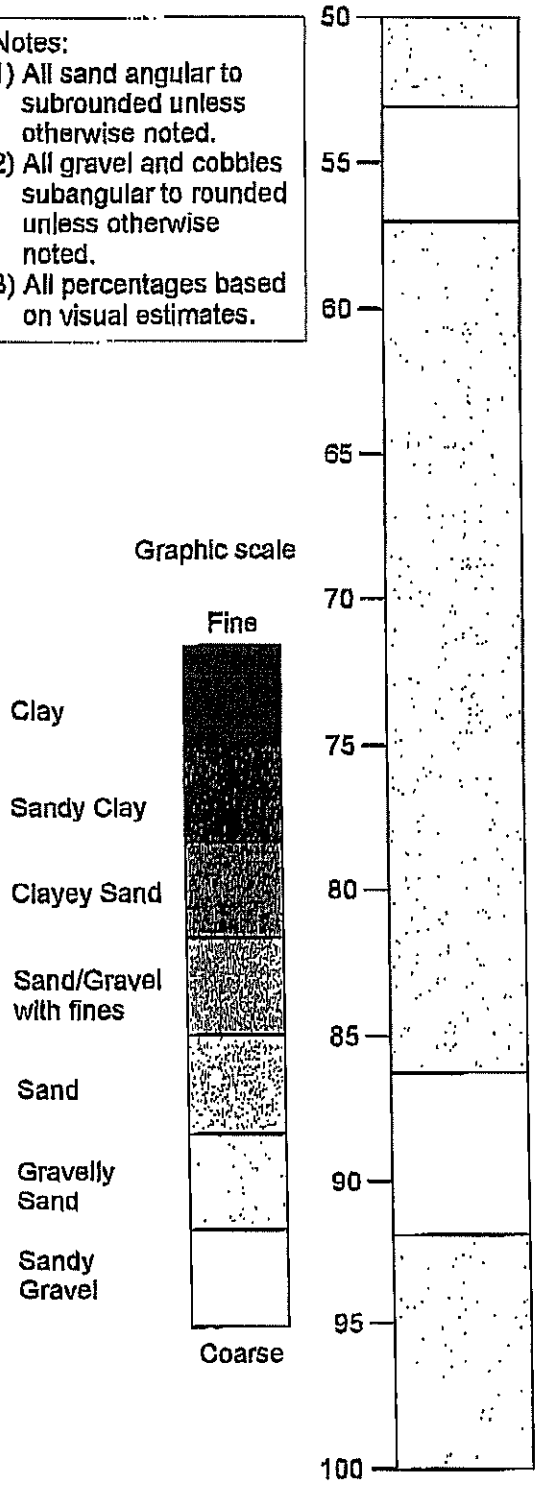
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,978 N
6,755,221 E

Ground elevation: 1,622'

Hole: SB-04-04
Date drilled: 2/18/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



43-53' **Sand (SW);** light olive brown (2.5Y 5/4); fine to coarse sand, 10% gravel, humid.

53-57' **Sandy Gravel (GW);** light olive brown (2.5Y 5/4); 40% fine to coarse sand, 55% gravel and cobbles, 5% silt. Gravel clasts subangular to subrounded, slightly to moderately weathered quartzite, schist, coarse grained granitics and fine grained mafics, humid.

57-86' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); 60% fine to coarse sand, 35% gravel and cobbles, 5% silt. Mostly slightly to moderately weathered clasts of quartzite and granitics, with some highly weathered schist, humid.

86-92' **Sand and Gravel (SW-GW);** light olive brown (2.5Y 5/4); 50% fine to coarse sand, 50% gravel and cobbles to 8", trace silt, humid.

92-105' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); 60% fine to coarse sand, 35% gravel and cobbles, 5% silt. Mostly slightly to moderately weathered clasts, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-04
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

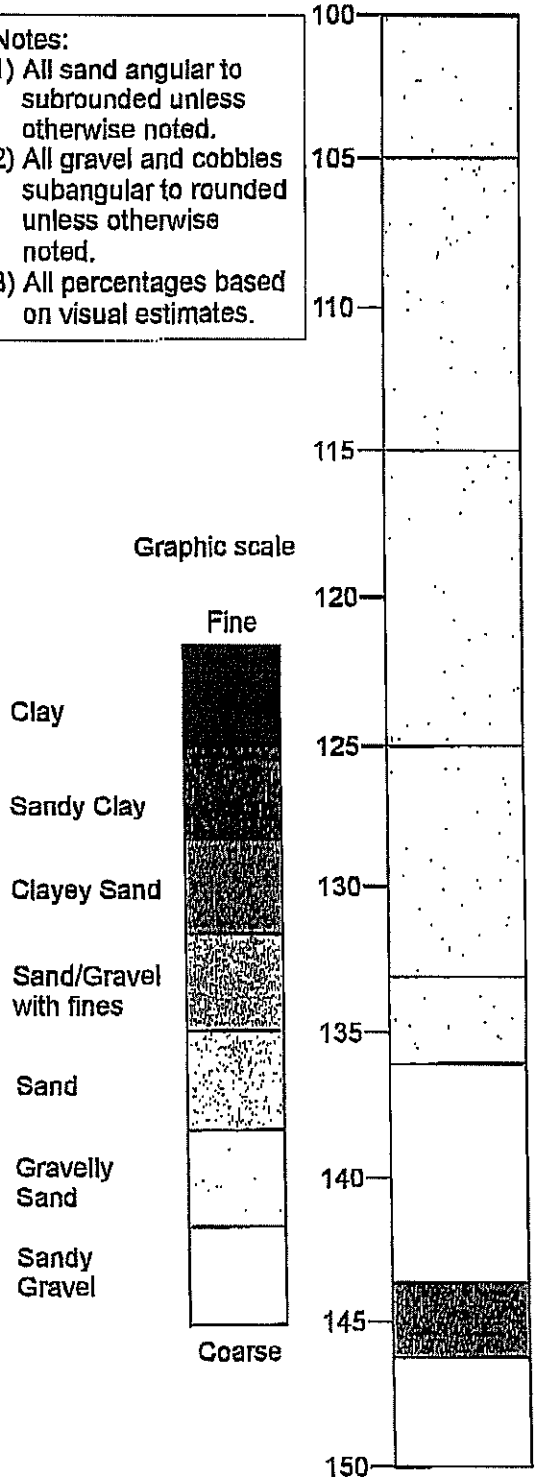
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,978 N
6,756,221 E

Ground elevation: 1,622'

Hole: SB-04-04
Date drilled: 2/18/04
Page: 3 of 4

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



92-105' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); 60% fine to coarse sand, 35% gravel and cobbles, 5% silt. Mostly slightly to moderately weathered clasts, humid.

105-115' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); 60% fine to coarse sand, 35% gravel and cobbles, 5% silt. Slightly to moderately weathered clasts of quartzite, with moderately to highly weathered schist, humid.

115-125' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); 65% fine to coarse sand, 30% gravel and cobbles, 5% silt. Mostly slightly to moderately weathered clasts, humid.

125-133' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 10% gravel.

133-136' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); 60% fine to coarse sand, 35% gravel and cobbles, 5% silt. Mostly moderately weathered clasts, humid.

136-144' **Sandy Gravel (GW);** yellowish brown (10YR 5/6); 40% fine to coarse sand, 50% gravel, cobbles, and boulders 10% silt (5% as rock flour). Mostly moderately weathered clasts, humid.

144-146' **Silty Sand with Gravel (SM);** dark yellowish brown (10YR 4/6); fine to coarse sand, 20% silt, 15% gravel, damp.

146-152' **Sandy Gravel (GW);** yellowish brown (10YR 5/4); 45% fine to coarse sand, 50% gravel, cobbles, and boulders 5% silt as rock flour. Mostly moderately weathered clasts, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-04
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

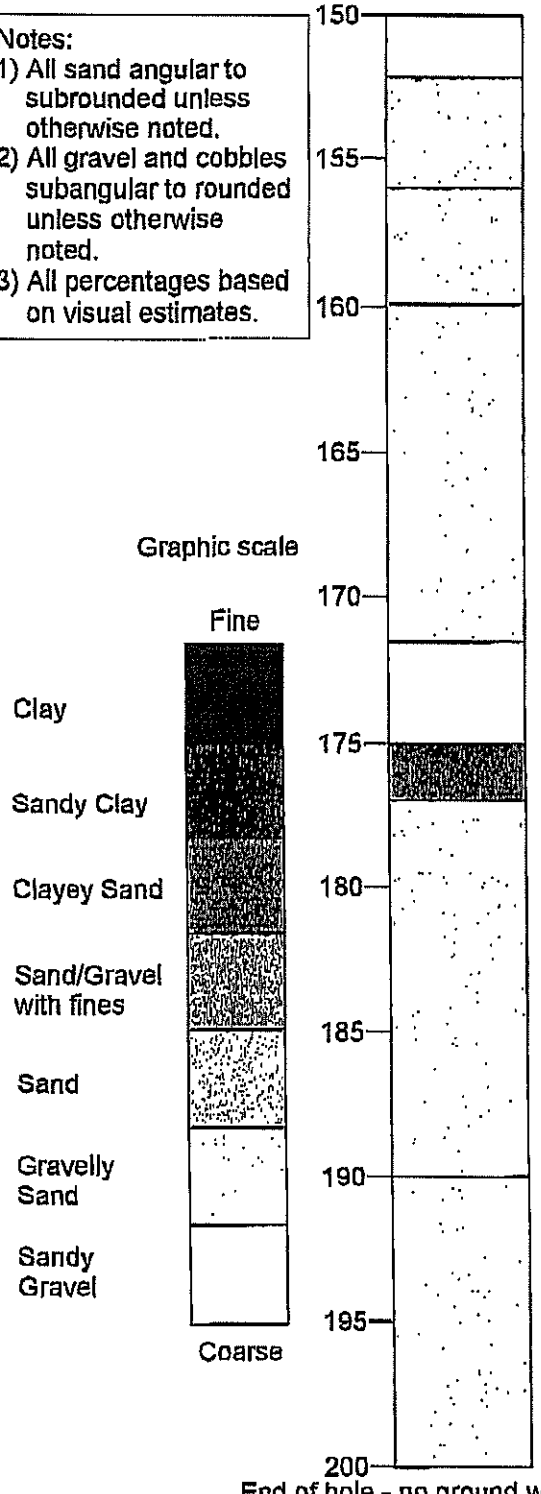
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,978 N
6,755,221 E

Ground elevation: 1,622'

Hole: SB-04-04
Date drilled: 2/18/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



146-152' **Sandy Gravel (GW);** yellowish brown (10YR 5/4); 45% fine to coarse sand, 50% gravel, cobbles, and boulders, 5% silt as rock flour. Mostly moderately weathered clasts, humid.

152-156' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 15% gravel, damp.

156-160' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); 65% fine to coarse sand, 30% gravel and cobbles, 5% silt. Mostly moderately weathered clasts, humid.

160-172' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 10% gravel, trace silt, damp.

172-175' **Sandy Gravel with Silt (GW-GC);** light olive brown (2.5Y 5/4); 40% fine to coarse sand, 55% gravel, 5% silt. Moderately weathered quartzite and fine grained mafics, with some highly weathered coarse grained granitics and schist, humid.

175-177' **Silty Sand (SM);** light olive brown (2.5Y 5/4); fine to medium sand, 30% silt, trace gravel, damp.

177-190' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 20% gravel and cobbles, damp.

190-200' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 10% gravel, trace cobbles, damp.

End of hole - no ground water

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-04
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

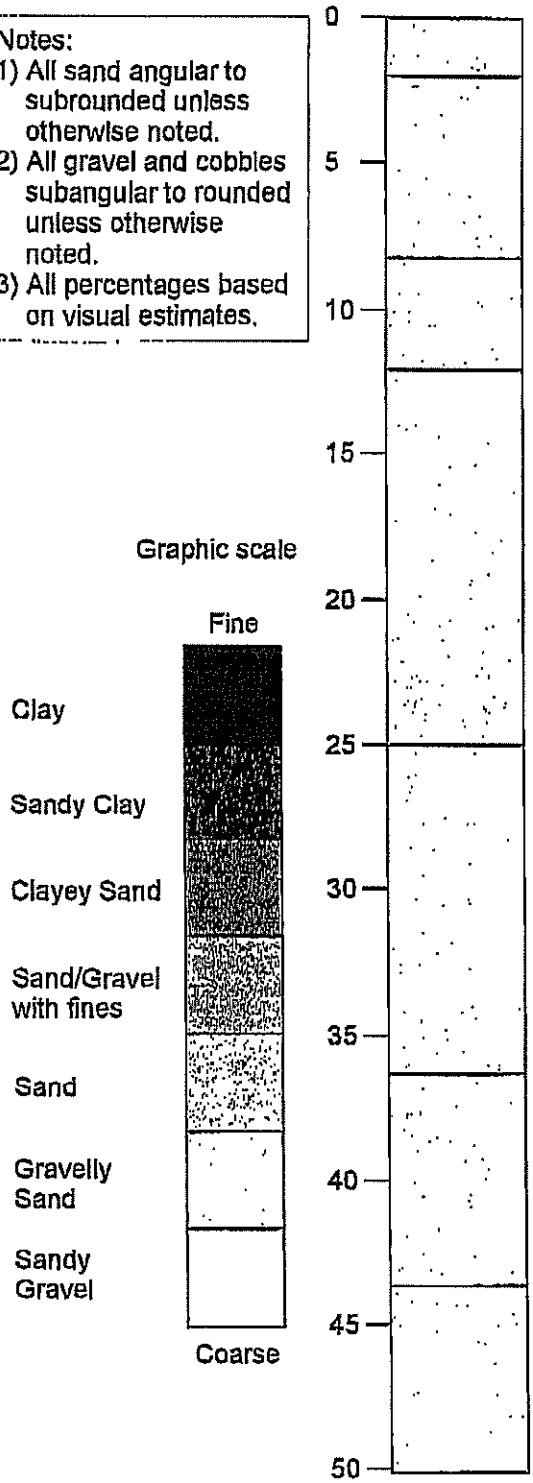
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,169 N
6,754,243 E

Ground elevation: 1,612'

Hole: SB-04-05
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-2' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 20% gravel, trace cobbles, damp.

2-8' **Sand with Gravel (SW);** yellowish brown (10YR 5/8); fine to coarse sand, 15% gravel to 2", damp.

8-12' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel to 3", trace silt. Mostly slightly to moderately weathered clasts of quartzite, schist, and granitics, humid.

12-25' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 10% fine gravel, subangular to subrounded clasts, humid.

25-36' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 25% gravel and cobbles, subangular to subrounded clasts, mostly slightly to moderately weathered quartzite, schist, and granitics, humid.

36-44' **Gravelly Sand (SW);** yellowish brown (10YR 5/6) to olive yellow (2.5Y 4/4); fine to coarse sand, 30% gravel and cobbles, trace silt. Mostly slightly to moderately weathered clasts of quartzite, schist, and granitics, humid.

44-61' **Sand with Gravel (SW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 15% gravel, trace cobbles at 56 feet, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-05
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

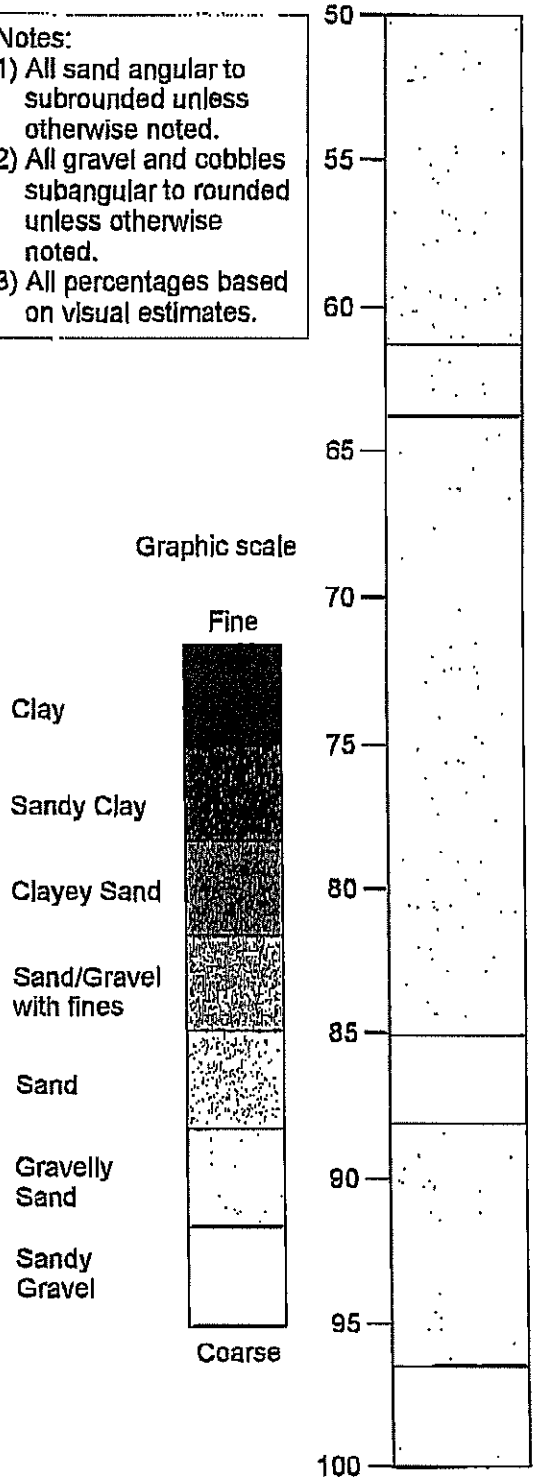
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,169 N
6,754,243 E

Ground elevation: 1,612'

Hole: SB-04-05
Date drilled: 2/19/04
Page: 2 of 5

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



44-61' **Sand with Gravel (SW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 15% gravel, trace cobbles at 56 feet, humid.

61-64' **Gravelly Sand (SW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 30% gravel and cobbles to 6", trace silt, humid.

64-85' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 20% gravel, trace cobbles, trace silt, humid. Subangular to subrounded clasts, mostly slightly to moderately weathered quartzite, fine grained mafics and gneiss, with some moderately to highly weathered schist and coarse grained granitics. Finer gravel (<1.5") more weathered than larger clasts.

85-88' **Sandy Gravel (GW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 50% gravel and cobbles, schist boulder, trace silt, humid.

88-96' **Sand with Gravel (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 15% gravel, trace silt, humid.

96-103' **Gravelly Sand (SW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 40% gravel, cobbles, and boulders, trace silt slightly to moderately weathered clasts >1.5", moderately to highly weathered clasts <1.5", humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-05
Site: Highland Avenue Plant, San Bernardino, CA

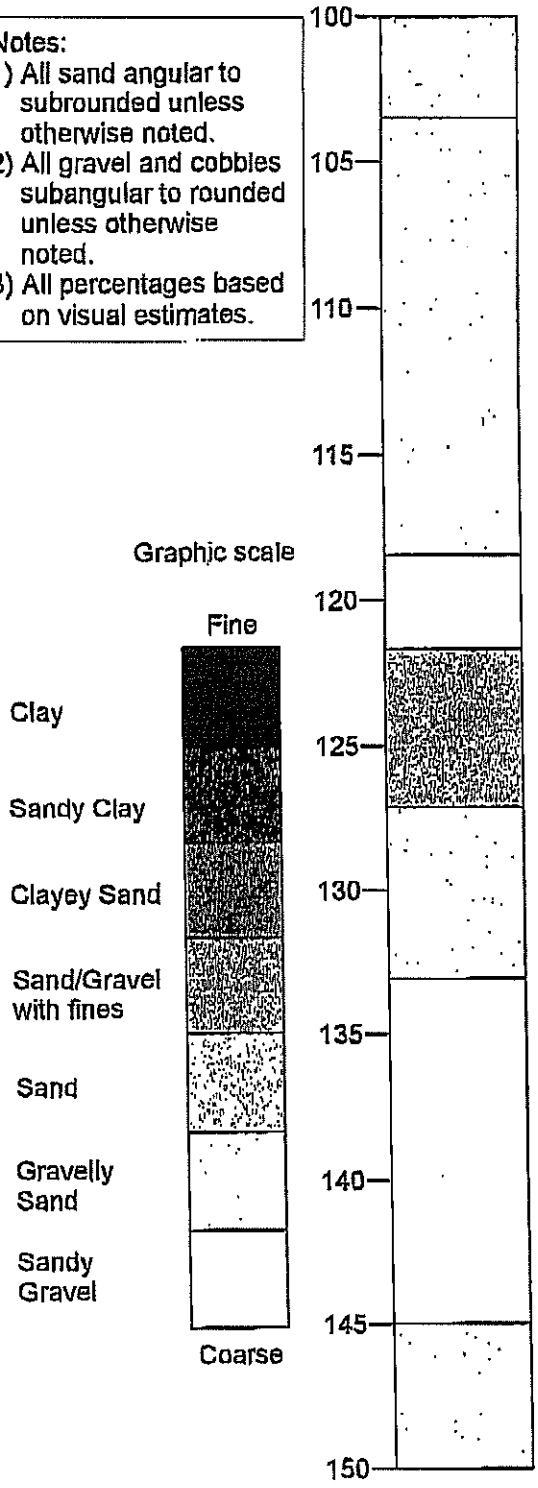
Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,169 N
6,754,243 E
Ground elevation: 1,612'

Hole: SB-04-05
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



96-103' **Gravelly Sand (SW);** light yellowish brown (2.5Y 6/4); fine to coarse sand, 40% gravel, cobbles, and boulders, trace silt slightly to moderately weathered clasts >1.5", moderately to highly weathered clasts <1.5", humid.

103-118' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel, trace silt, humid.

118-122' **Sandy Gravel (GW);** yellowish brown (10YR 5/6); fine to coarse sand, 50% gravel and cobbles, quartzite boulder, trace silt. Slightly to moderately weathered coarse grained granitics and gneiss, some highly weathered coarse grained gneiss, humid.

122-126' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, trace gravel, humid.

126-133' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel, trace cobbles, humid.

133-145' **Sandy Gravel (GW);** yellowish brown (10YR 5/4) to light yellowish brown (2.5Y 6/4); 40% fine to coarse sand, 60% gravel and cobbles, granite boulder, trace silt as rock flour. Slightly to moderately weathered granitics and gneiss, humid.

145-153' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 40% gravel, cobbles, and boulders, trace silt. Fine grained mafic and gneiss boulders, with mostly slightly to moderately weathered gravel clasts, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-05
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

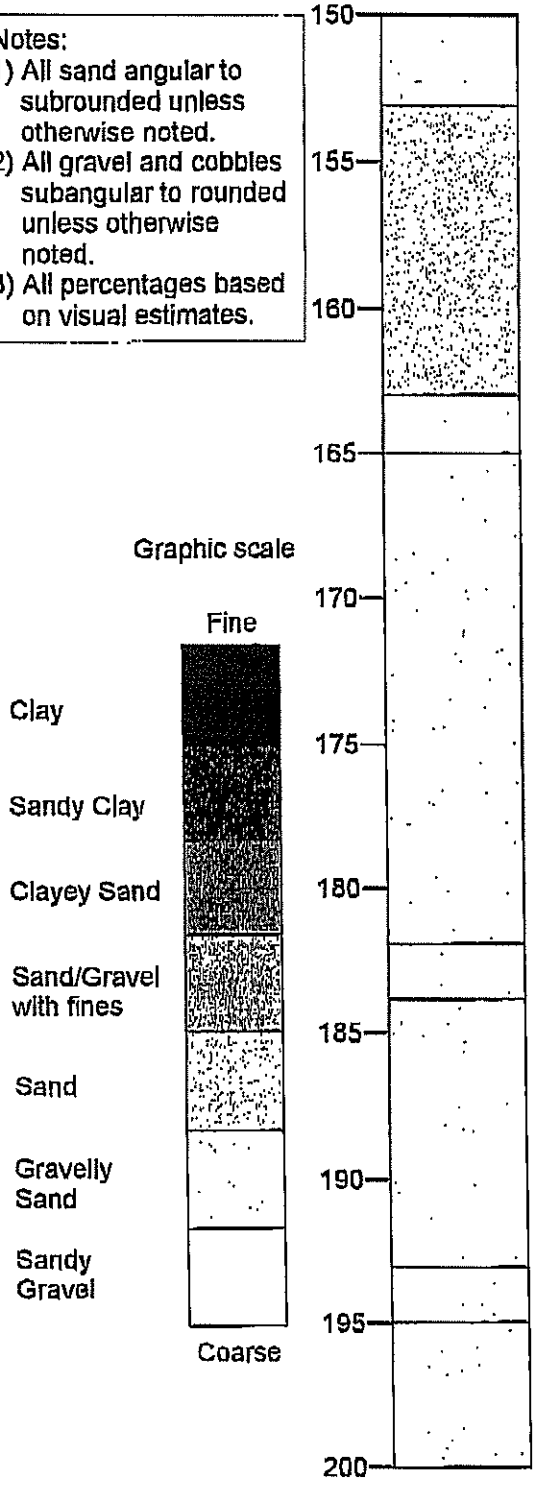
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,169 N
6,754,243 E

Ground elevation: 1,612'

Hole: SB-04-05
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



145-153' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 40% gravel, cobbles, and boulders, trace silt. Fine grained mafic and gneiss boulders, with mostly slightly to moderately weathered gravel clasts, humid.

153-163' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, trace gravel to 3", humid.

163-165' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel and cobbles to 8", subangular to subrounded clasts, humid.

165-182' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 10% gravel, trace cobbles, humid. Sand angular to subrounded, mostly quartz with lesser feldspar (c. 30%), c. 20% mafics.

182-184' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel, trace silt, damp.

184-193' **Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 10% gravel, trace cobbles, damp.

193-195' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel, trace silt, damp.

195-220' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-05
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

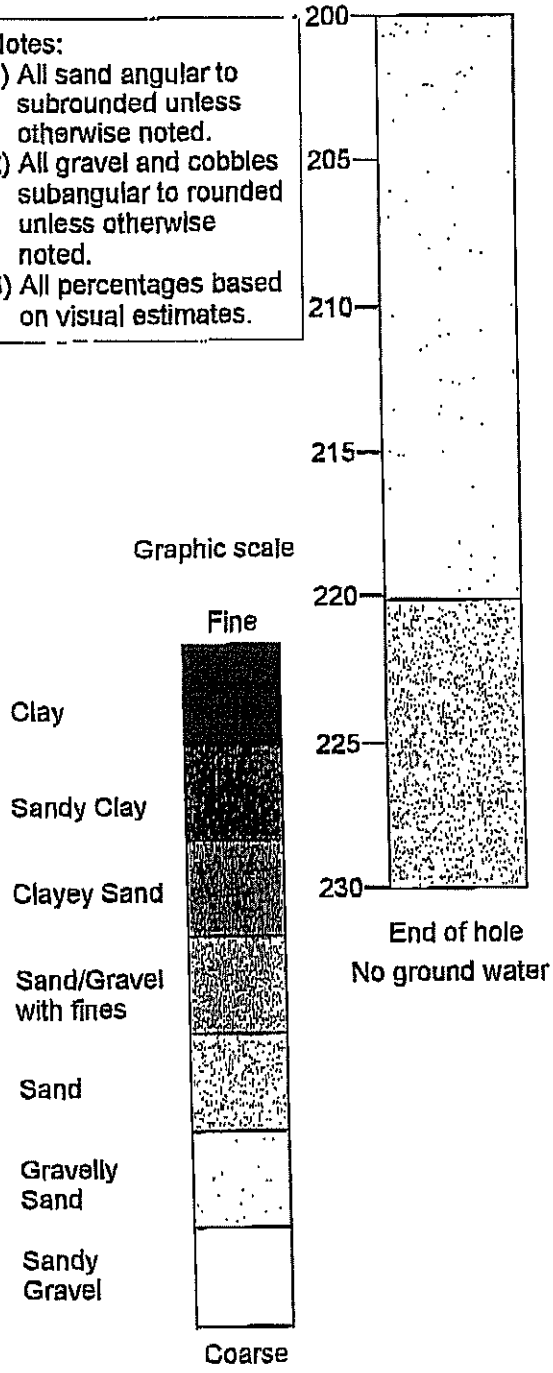
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,888,169 N
6,754,243 E

Ground elevation: 1,612'

Hole: SB-04-05
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



195-220' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 10% gravel, damp. Sand angular to subrounded mostly quartz with lesser feldspar (c. 30%), 20% mafics.

220-230' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, trace gravel, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-05
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

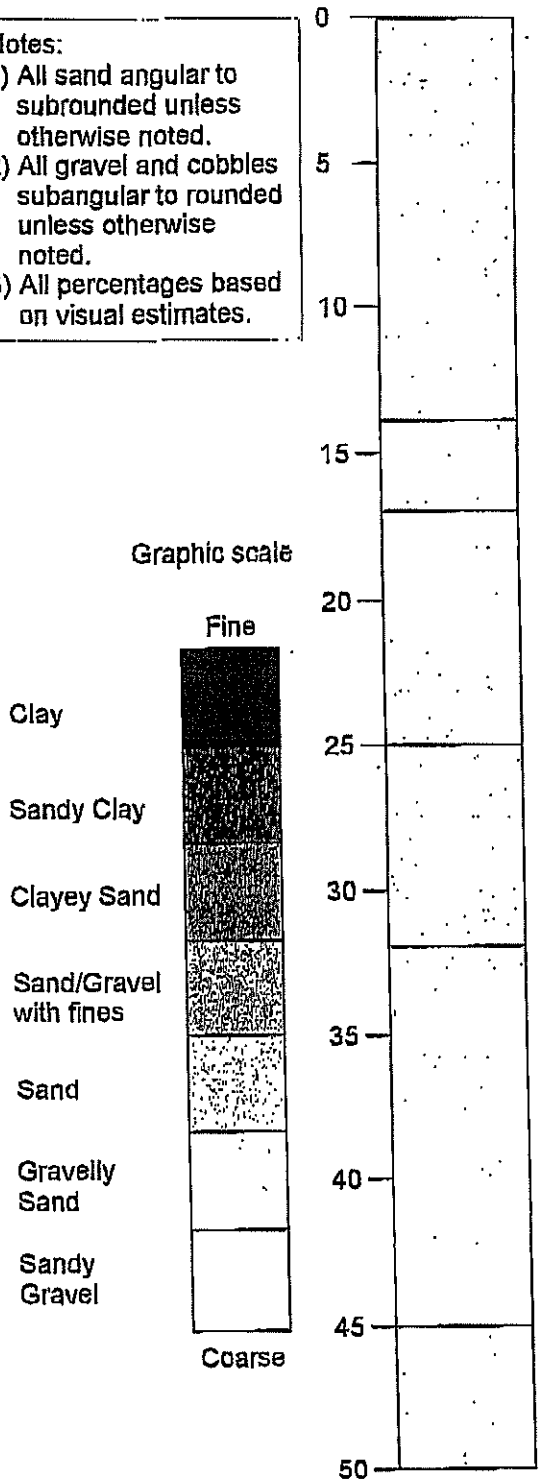
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,886,553 N
6,755,925 E

Ground elevation: 1,566'

Hole: SB-04-06
Date drilled: 2/19/04
Page: 1 of 4

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



0-14' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 15% gravel, trace cobbles, trace silt, damp.

14-17' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 30% gravel, trace cobbles. Mostly slightly to moderately weathered clasts of gneiss, quartzite, and schist, humid

17-25' **Sand with Gravel (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 15% fine gravel, humid.

25-32' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 35% gravel, trace cobbles. Mostly subangular to subrounded, slightly to moderately weathered clasts of gneiss and quartzite, with moderately to highly weathered schist, humid.

32-45' **Sand with Gravel (SW);** olive brown (2.5Y 4/4); fine to coarse sand, 15% gravel, humid.

45-56' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel, trace cobbles, trace silt; Mostly moderately weathered clasts of coarse grained granitics and schist, humid.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-06
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

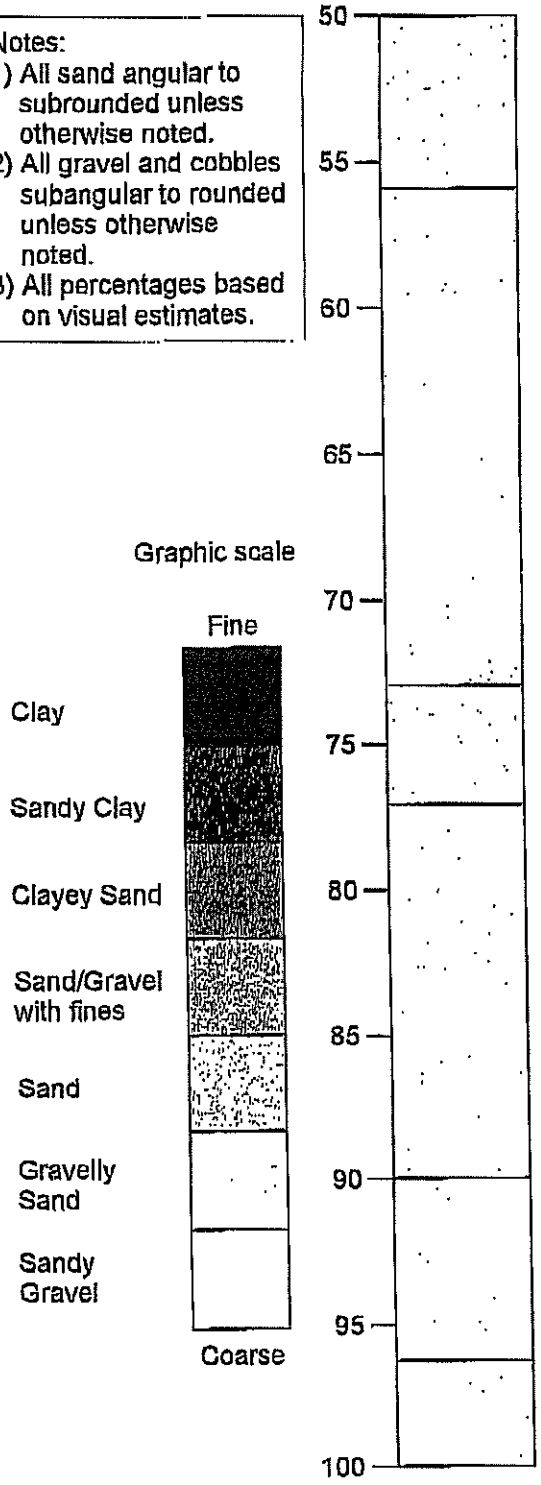
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,886,553 N
6,755,925 E

Ground elevation: 1,566'

Hole: SB-04-06
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



45-56' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 35% gravel, trace cobbles, trace silt. Mostly moderately weathered clasts of coarse grained granitics and schist, humid.

56-73' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 10% fine gravel, mostly humid.

73-77' **Gravelly Sand (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 30% gravel, trace cobbles, trace silt, humid.

77-90' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel to 3", damp.

90-96' **Gravelly Sand (SW);** yellowish brown (10YR 5/4 to 5/6); fine to coarse sand, 30% gravel, trace cobbles, mostly moderately weathered clasts, damp.

96-108' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel, trace cobbles, trace silt, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-06
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

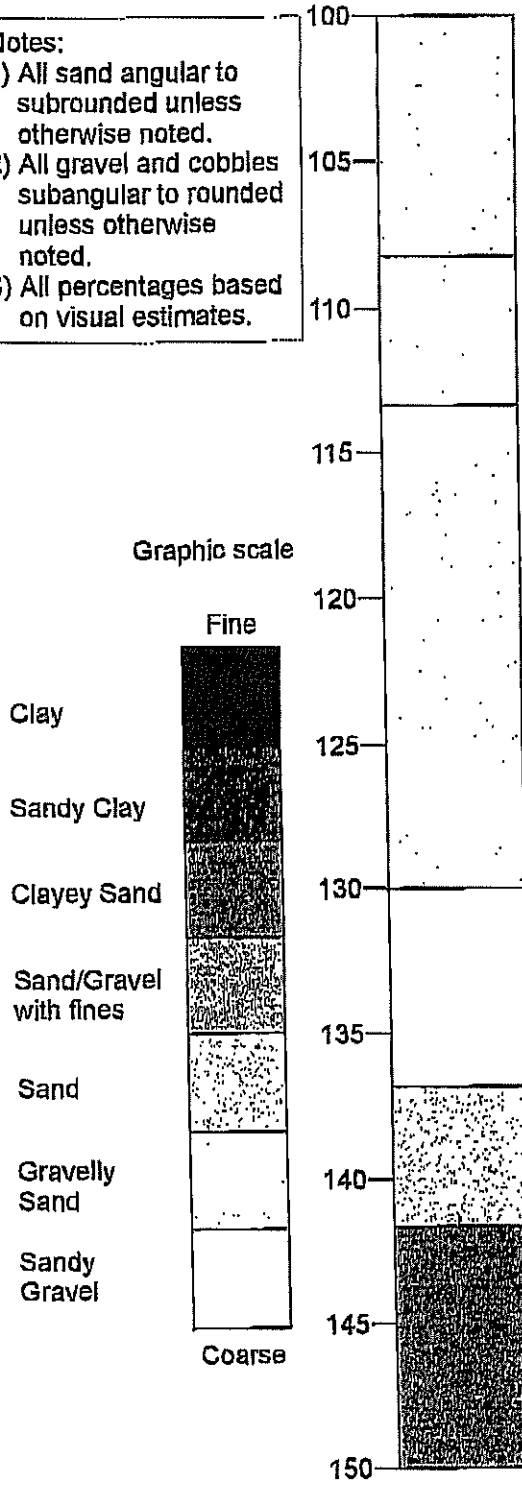
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,886,553 N
6,755,925 E

Ground elevation: 1,566'

Hole: SB-04-06
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



96-108' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 20% gravel, trace cobbles, trace silt, damp.

108-113' **Sand with Gravel (SW);** yellowish brown (10YR 5/4); fine to coarse sand, 15% gravel, damp.

113-130' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 30% gravel, trace cobbles, trace silt. Subangular to subrounded clasts, mostly slightly to moderately weathered diorite and gneiss with some moderately to highly weathered schist and coarse grained granitics, damp.

130-137' **Sandy Gravel (GW);** brown (10YR 5/3); fine to coarse sand, 60% gravel and cobbles, trace boulders, mostly slightly to moderately weathered schist and gneiss, damp.

137-142' **Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, trace gravel, damp.

142-150' **Silty Gravelly Sand (SM);** dark yellowish brown (10YR 4/6); fine to coarse sand, 30% gravel, trace cobbles , 15% silt. Slightly to moderately weathered clasts, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-06
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

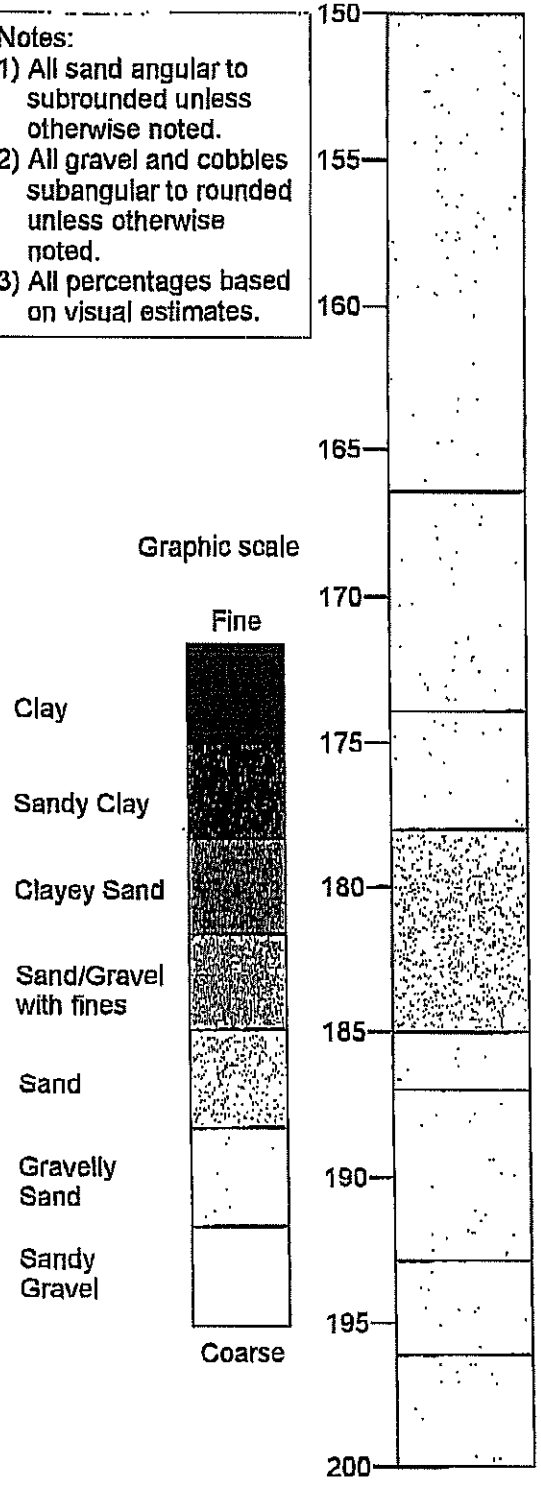
Project: Highland Avenue Plant, San Bernardino, California

Coordinates: 1,886,553 N
6,755,925 E

Ground elevation: 1,566'

Hole: SB-04-06
Date drilled: 2/19/04

Notes:
1) All sand angular to subrounded unless otherwise noted.
2) All gravel and cobbles subangular to rounded unless otherwise noted.
3) All percentages based on visual estimates.



150-166' **Sand (SM);** yellowish brown (10YR 5/6); fine to coarse sand, 10% gravel, damp.

166-174' **Sand with Gravel (SM);** yellowish brown (10YR 5/6); fine to coarse sand, 20% gravel to 2", mostly moderately weathered quartz pegmatite, gneiss, and schist, some highly weathered finer gravels (<1"), damp.

174-178' **Gravelly Sand (SW);** dark yellowish brown (10YR 4/6); fine to coarse sand, 30% gravel, trace cobbles, damp.

178-185' **Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, trace gravel, damp.

185-187' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 30% gravel, slightly to moderately weathered gneiss and quartz pegmatite, with moderately to highly weathered schist and coarse grained granitics, damp.

187-193' **Sand (SM);** yellowish brown (10YR 5/6); fine to coarse sand, 10% gravel, damp.

193-196' **Gravelly Sand (SW);** yellowish brown (10YR 5/6); fine to coarse sand, 30% gravel, slightly to moderately weathered gneiss and fine grained mafics, with moderately to highly weathered schist and coarse grained granitics, damp.

196-200' **Sand with Gravel (SM);** yellowish brown (10YR 5/6); fine to coarse sand, 15% gravel, damp.

Vulcan Materials Company

Rig: Foremost AP 1000
Method: Reverse circulation air
Outside Pipe: 9-inch nominal diameter
Inside Pipe: 6-inch nominal diameter

Log of boring: SB-04-06
Site: Highland Avenue Plant, San Bernardino, CA

Recorder: S. Harris, Cleath & Associates
Driller: Layne Christensen

APPENDIX B

Laboratory Test Results

LARGE SCALE DIRECT SHEAR REPORT

Internal Shear D-3080 Modified

Geo-Logic ASSOCIATES

Report Date: May 3, 2018

Client / Project Name: HALEY & ALDRICH, INC. / VMC SAN BERNARDINO AREA Q, 132051-002

Project No: AU18.1138.00

Superstrate: ⇦ Spacers

Material 1: ⇦ 132051 Sample 1, Sand w/ Gravel LSN: 4353A Remolded

Material 2: ⇨ 132051 Sample 1, Sand w/ Gravel LSN: 4353A Remolded

Substrate: ⇨ Spacers

PEAK STRENGTH

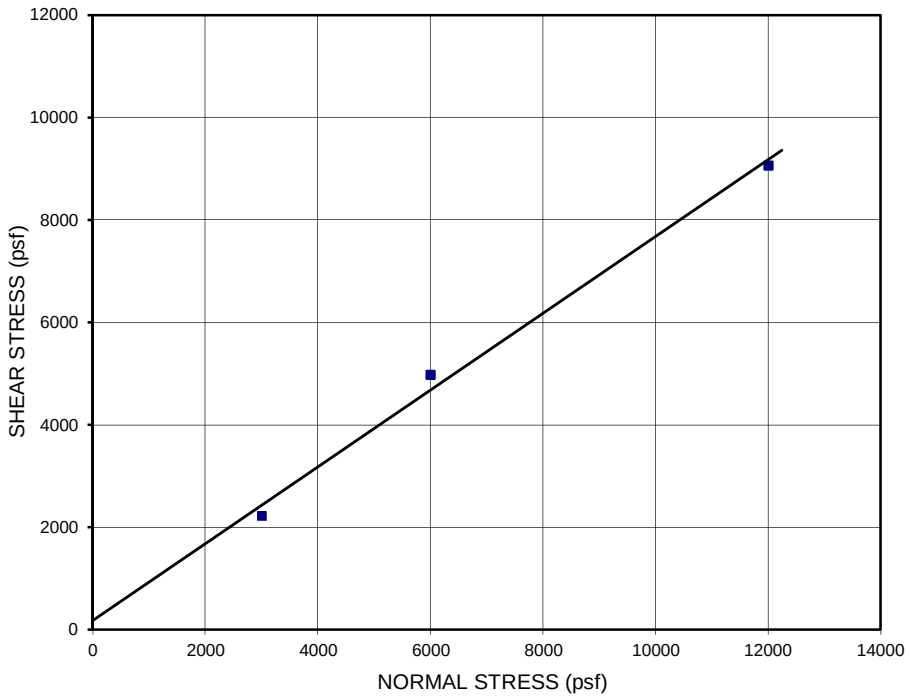
Test Point	Normal Stress psi	Normal Stress psf	Shear Stress psf	Secant Friction Angle
1.	20.8	3000	2230	37
2.	41.7	6000	4980	40
3.	83.3	12000	9070	37

Adhesion: 180 psf

Friction Angle: 37 degrees

Coefficient of Friction: 0.75

NOTE: GRAPH NOT TO SCALE



STRENGTH ENVELOPE

(at 3.0 in. displacement)

Test Point	Normal Stress psi	Normal Stress psf	Shear Stress psf	Secant Friction Angle
1.	20.8	3000	1700	30
2.	41.7	6000	4400	36
3.	83.3	12000	8540	35

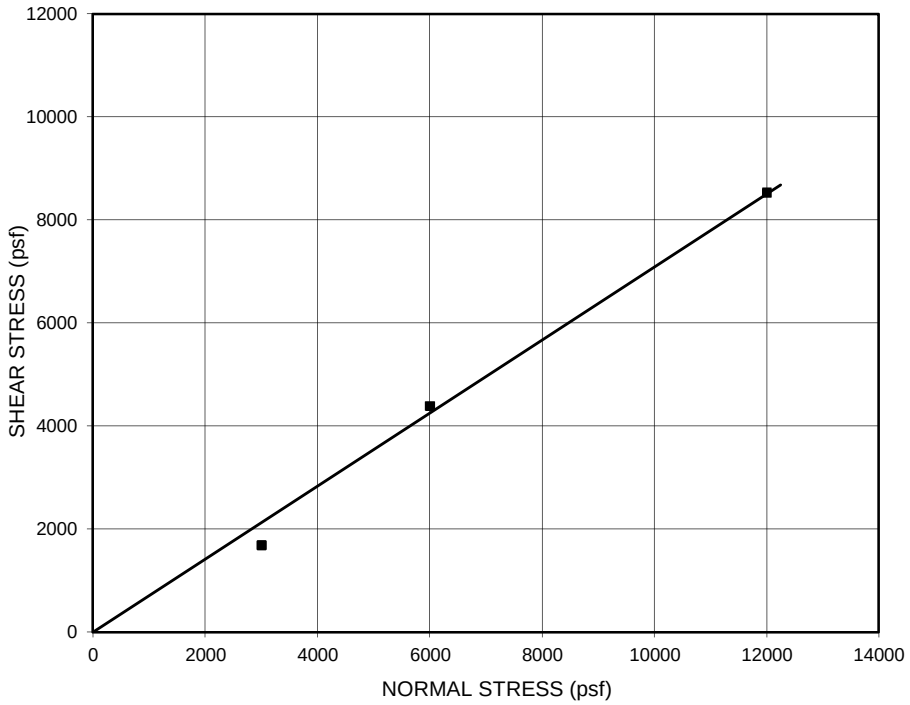
Adhesion: 0 psf

Friction Angle: 35 degrees

Coefficient of Friction: 0.71

Note: Intercept set to zero

NOTE: GRAPH NOT TO SCALE



This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

LARGE SCALE DIRECT SHEAR REPORT

Internal Shear D-3080 Modified

Geo-Logic ASSOCIATES

Report Date: May 3, 2018

Client / Project Name: HALEY & ALDRICH, INC. / VMC SAN BERNARDINO AREA Q, 132051-002

Project No: AU18.1138.00

Superstrate: ⇦ Spacers

Material 1: ⇦ 132051 Sample 1, Sand w/ Gravel LSN: 4353A Remolded

Material 2: ⇨ 132051 Sample 1, Sand w/ Gravel LSN: 4353A Remolded

Substrate: ⇨ Spacers

DISPLACEMENT vs. SHEAR STRESS

Test Point	Normal Stress	
	psi	psf
1.	20.8	3000
2.	41.7	6000
3.	83.3	12000

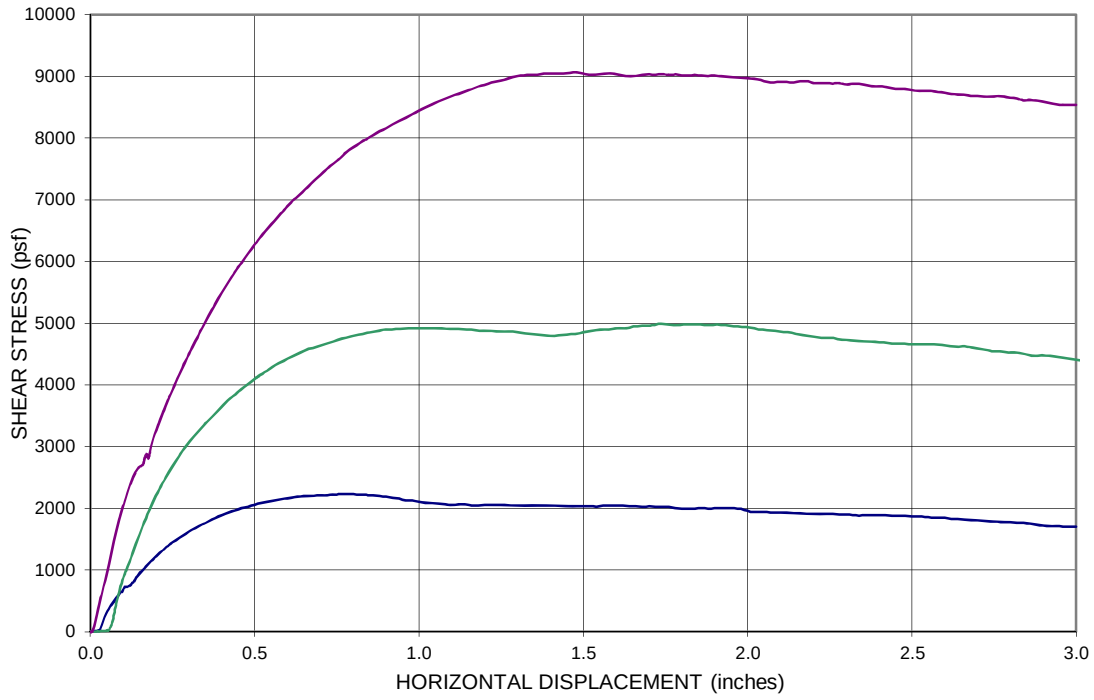
MOISTURE DATA:

(Gravel)

Initial Water Content: 5%

Initial Dry Density: 113.8 pcf

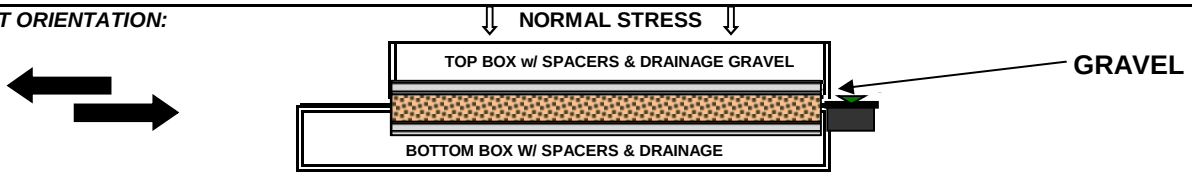
Final Water Content:(%)
1) 15.1 2) 13.9 3) 12.3



STANDARD CONDITIONS: ***SHEAR DISPLACEMENT RATE: 0.04 in/min***

1. The "gap" between shear boxes was set at 0.5 inches.
2. The test specimens were flooded during testing unless otherwise noted.
3. High Normal Stresses, >5psi (35 kPa) was applied using air pressure.
4. Low Normal Stresses, <5psi (35 kPa) was applied using dead weights.
5. The tests were terminated after 3.0"(75 mm) of displacement unless otherwise noted.
6. Tests were performed in general accordance with ASTM procedure D-3080 - Modified using a Brainard-Killman LG-112 direct shear machine with an effective area of 12" x 12" (300 x300 mm).

TEST ORIENTATION:



SPECIAL TEST NOTES:

1. The test method was modified to measure the internal shear characteristics of the gravel.
2. The gravel was remolded into both the upper and lower box.
3. Each test point was consolidated under specified normal stress for approximately 1 hour, then sheared.
4. The test was performed in a "wet" or "flooded" condition.
5. Shearing occurred internally within the gravel.
6. The Peak Friction Angle and Adhesion (or Cohesion) results given here are based on a mathematically determined best fit line.
7. The Residual Friction Angle and Adhesion (or Cohesion) results given here are based on an intercept through zero.
8. Further interpretation should be conducted by a qualified professional experienced in geosynthetic and geotechnical engineering.

This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

LARGE SCALE DIRECT SHEAR REPORT

Internal Shear D-3080 Modified

Geo-Logic ASSOCIATES

Report Date: May 3, 2018

Client / Project Name: HALEY & ALDRICH, INC. / VMC SAN BERNARDINO AREA Q, 132051-002

Project No: AU18.1138.00

Superstrate: ⇦ Spacers

Material 1: ⇦ 132051 Sample 3, Gravelly Sand LSN: 4353B Remolded

Material 2: ⇨ 132051 Sample 3, Gravelly Sand LSN: 4353B Remolded

Substrate: ⇨ Spacers

PEAK STRENGTH

Test Point	Normal Stress psi	Normal Stress psf	Shear Stress psf	Secant Friction Angle
1.	20.8	3000	2150	36
2.	41.7	6000	4880	39
3.	83.3	12000	10650	42

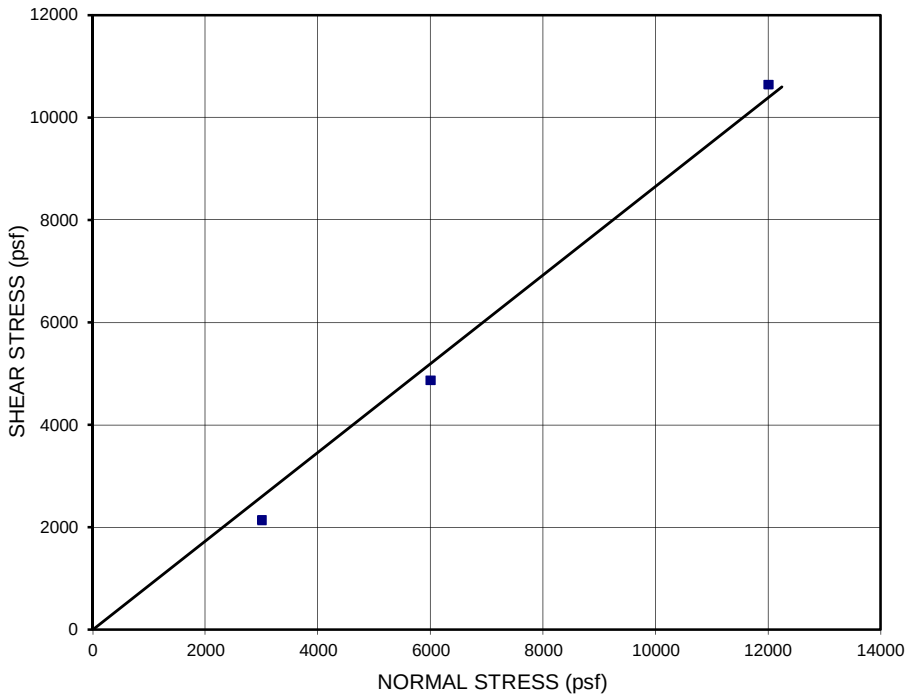
Adhesion: 0 psf

Friction Angle: 41 degrees

Coefficient of Friction: 0.87

Note: Intercept set to zero

NOTE: GRAPH NOT TO SCALE



STRENGTH ENVELOPE

(at 3.0 in. displacement)

Test Point	Normal Stress psi	Normal Stress psf	Shear Stress psf	Secant Friction Angle
1.	20.8	3000	2080	35
2.	41.7	6000	4450	37
3.	83.3	12000	10520	41

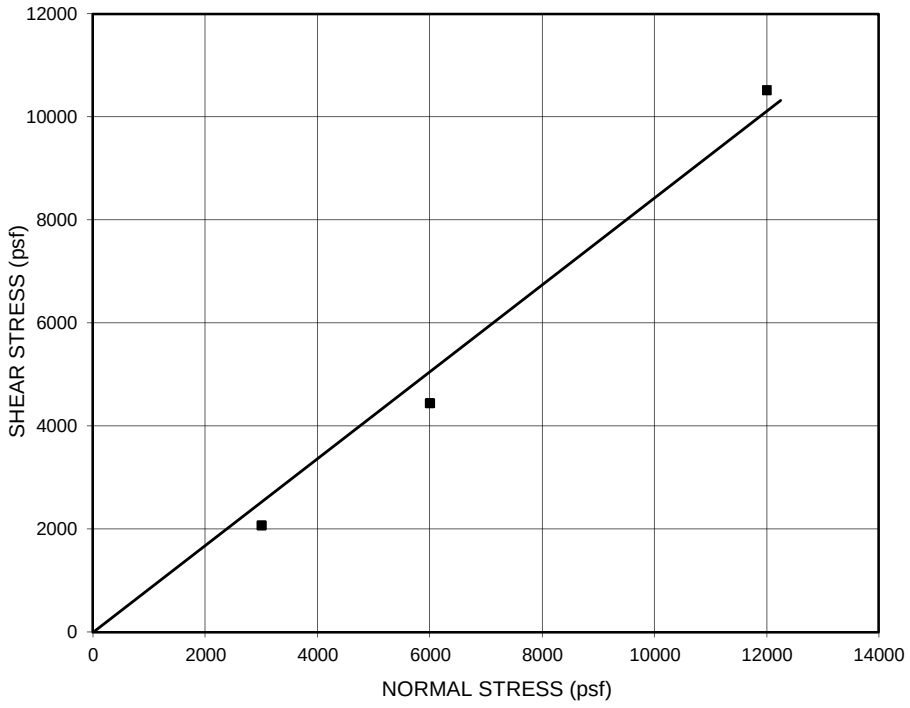
Adhesion: 0 psf

Friction Angle: 40 degrees

Coefficient of Friction: 0.84

Note: Intercept set to zero

NOTE: GRAPH NOT TO SCALE



This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

LARGE SCALE DIRECT SHEAR REPORT

Internal Shear D-3080 Modified

Geo-Logic ASSOCIATES

Report Date: May 3, 2018

Client / Project Name: HALEY & ALDRICH, INC. / VMC SAN BERNARDINO AREA Q, 132051-002

Project No: AU18.1138.00

Superstrate: ⇦ Spacers

Material 1: ⇦ 132051 Sample 3, Gravelly Sand LSN: 4353B Remolded

Material 2: ⇨ 132051 Sample 3, Gravelly Sand LSN: 4353B Remolded

Substrate: ⇨ Spacers

DISPLACEMENT vs. SHEAR STRESS

Test Point	Normal Stress	
	psi	psf
1.	20.8	3000
2.	41.7	6000
3.	83.3	12000

MOISTURE DATA:

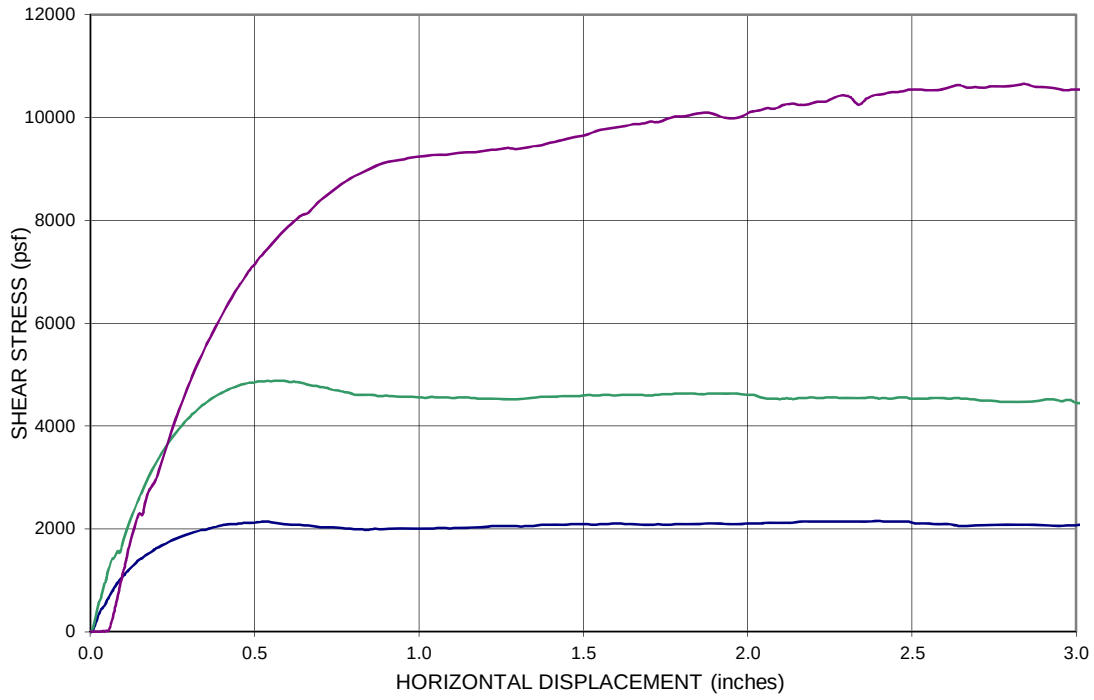
(Gravel)

Initial Water Content: 5%

Initial Dry Density: 119.7 pcf

Final Water Content:(%)

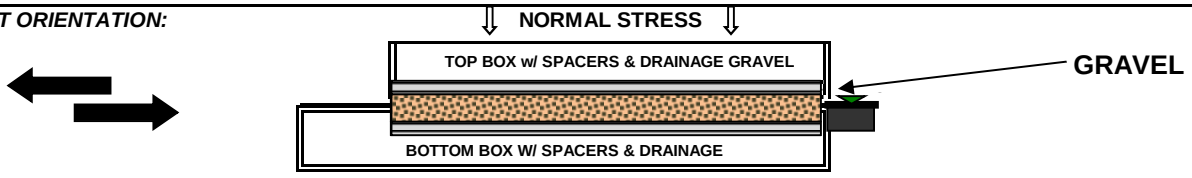
1) 9.6 2) 12.9 3) 11.4



STANDARD CONDITIONS: ***SHEAR DISPLACEMENT RATE: 0.04 in/min***

1. The "gap" between shear boxes was set at 0.5 inches.
2. The test specimens were flooded during testing unless otherwise noted.
3. High Normal Stresses, >5psi (35 kPa) was applied using air pressure.
4. Low Normal Stresses, <5psi (35 kPa) was applied using dead weights.
5. The tests were terminated after 3.0"(75 mm) of displacement unless otherwise noted.
6. Tests were performed in general accordance with ASTM procedure D-3080 - Modified using a Brainard-Killman LG-112 direct shear machine with an effective area of 12" x 12" (300 x300 mm).

TEST ORIENTATION:



SPECIAL TEST NOTES:

1. The test method was modified to measure the internal shear characteristics of the gravel.
2. The gravel was remolded into both the upper and lower box.
3. Each test point was consolidated under specified normal stress for approximately 1 hour, then sheared.
4. The test was performed in a "wet" or "flooded" condition.
5. Shearing occurred internally within the gravel.
6. The Friction Angle and Adhesion (or Cohesion) results given here are based on an intercept through zero.
7. Further interpretation should be conducted by a qualified professional experienced in geosynthetic and geotechnical engineering.

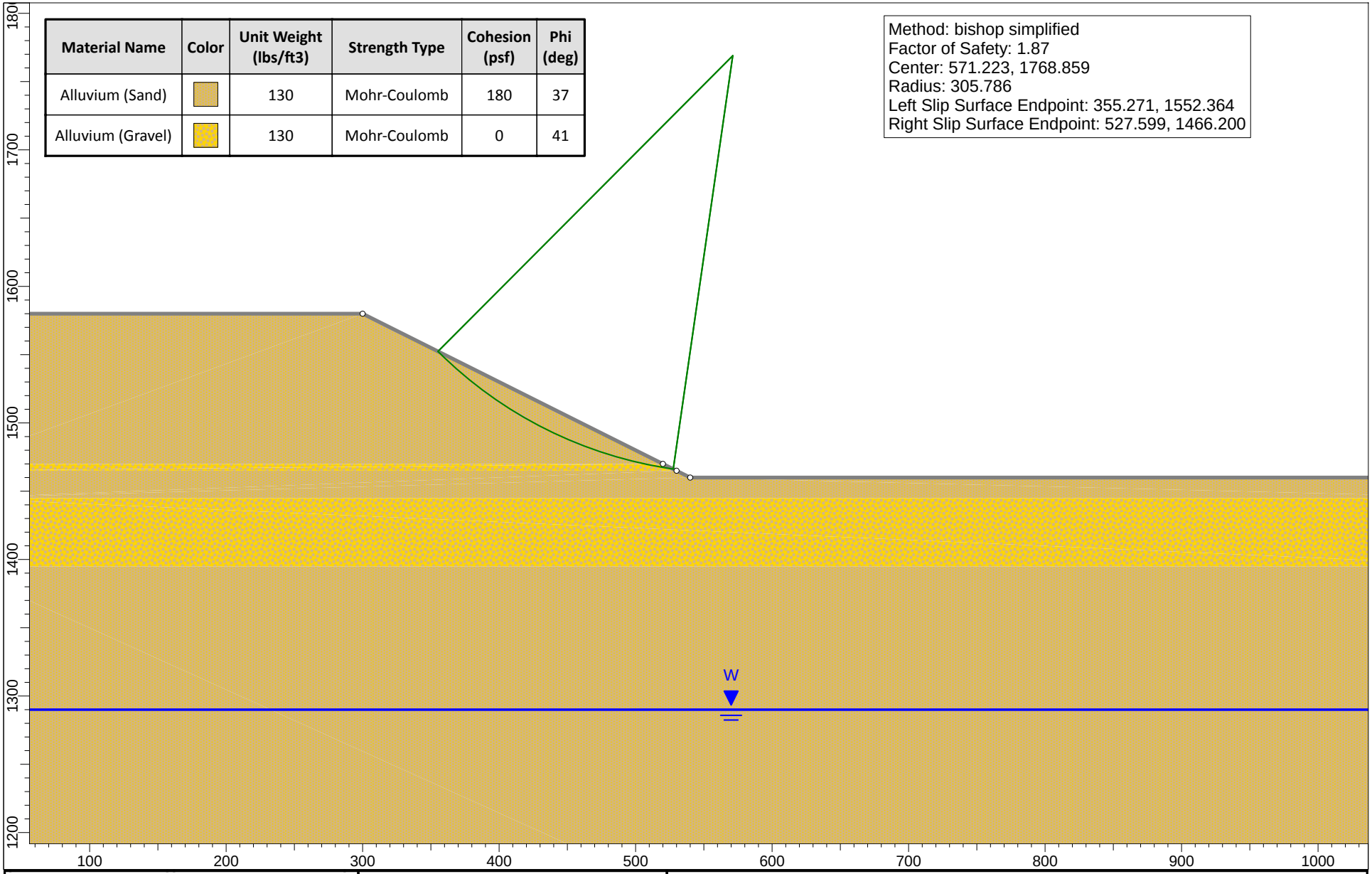
This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

APPENDIX C

Slope Stability Analysis

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.87
Center: 571.223, 1768.859
Radius: 305.786
Left Slip Surface Endpoint: 355.271, 1552.364
Right Slip Surface Endpoint: 527.599, 1466.200



HALEY ALDRICH

Vulcan Materials Company Western Division

San Bernardino Quarry - Area Q Mine

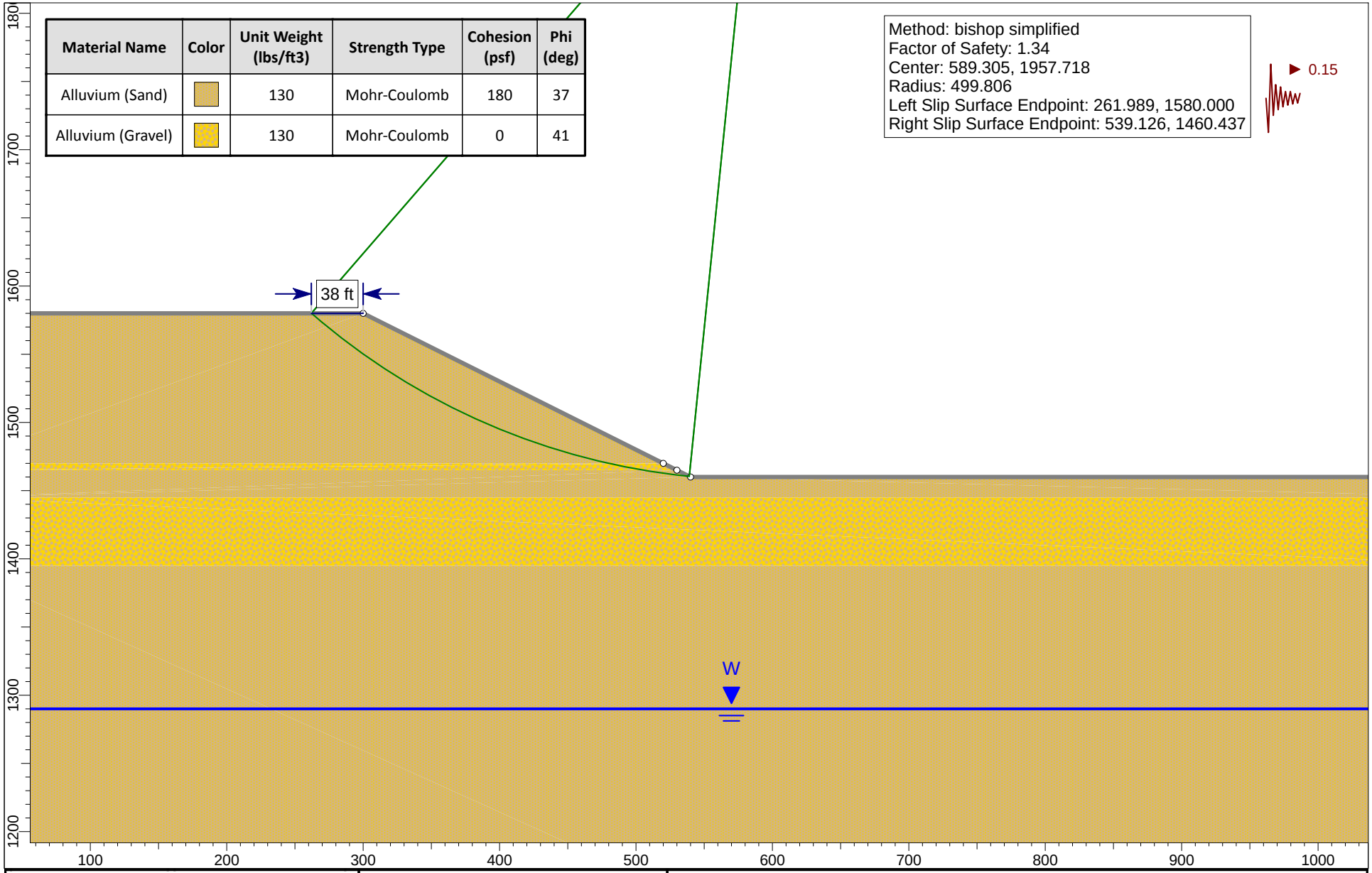
Section and Analysis Description: Proposed Mine Slope (2H:1V; 120-ft-deep) // 132051 Section A 120.slim

Project Number:	132051-002	*Note 1:*	Static Condition	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*		*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-1

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 120.slim Scenario: 132051 Section A 120.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.34
Center: 589.305, 1957.718
Radius: 499.806
Left Slip Surface Endpoint: 261.989, 1580.000
Right Slip Surface Endpoint: 539.126, 1460.437



HALEY ALDRICH

Vulcan Materials Company Western Division

San Bernardino Quarry - Area Q Mine

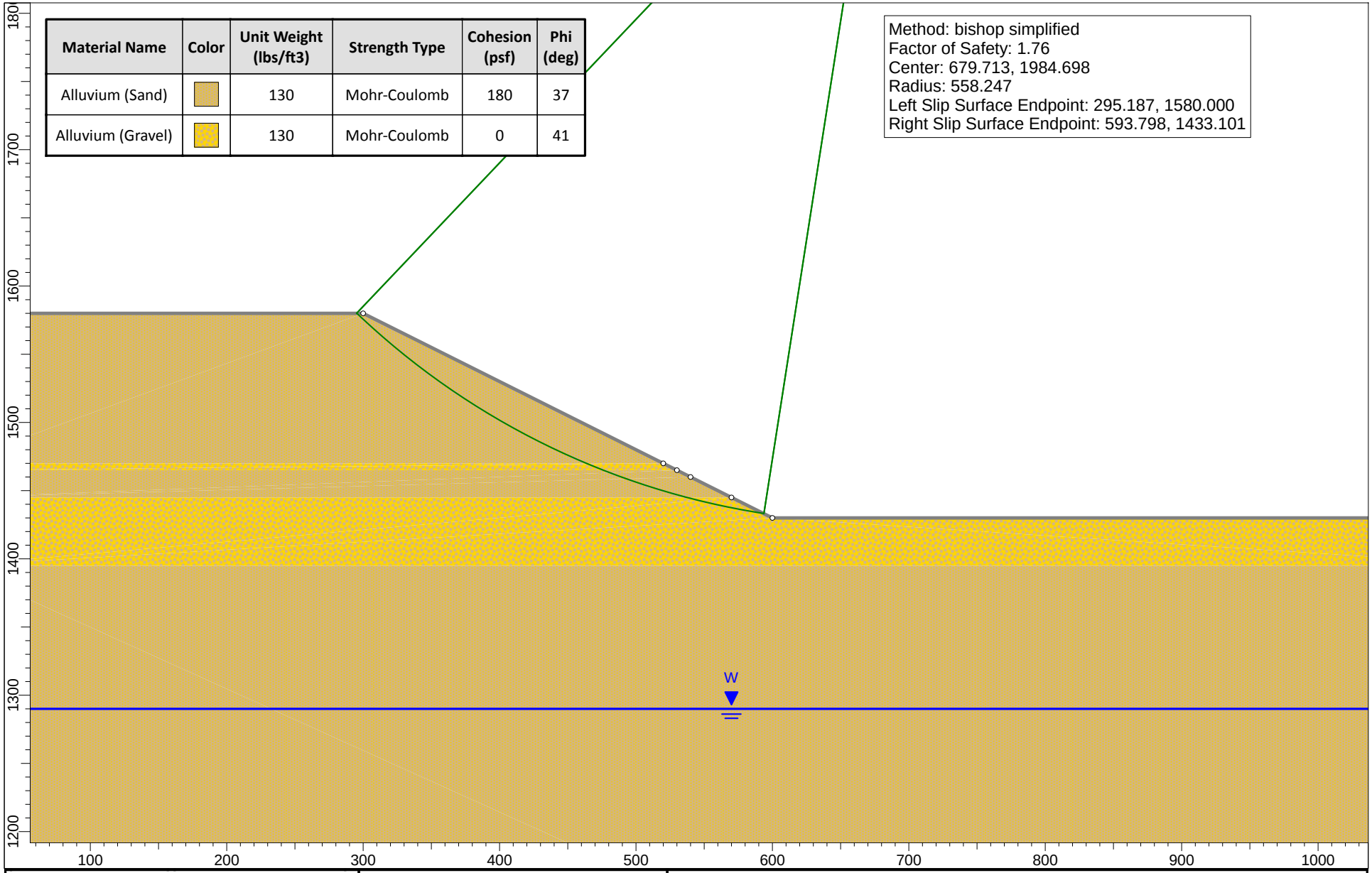
Section and Analysis Description: Proposed Mine Slope (2H:1V; 120-ft-deep) // 132051 Section A 120 Seismic SeedMethod.slim

Project Number:	132051-002	*Note 1:*	Pseudo-Static Case	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*	SP-117 Seed Method	*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-2

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 120 Seismic SeedMethod.slim Scenario: 132051 Section A 120 Seismic SeedMethod.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.76
Center: 679.713, 1984.698
Radius: 558.247
Left Slip Surface Endpoint: 295.187, 1580.000
Right Slip Surface Endpoint: 593.798, 1433.101



HALEY ALDRICH

Vulcan Materials Company Western Division

San Bernardino Quarry - Area Q Mine

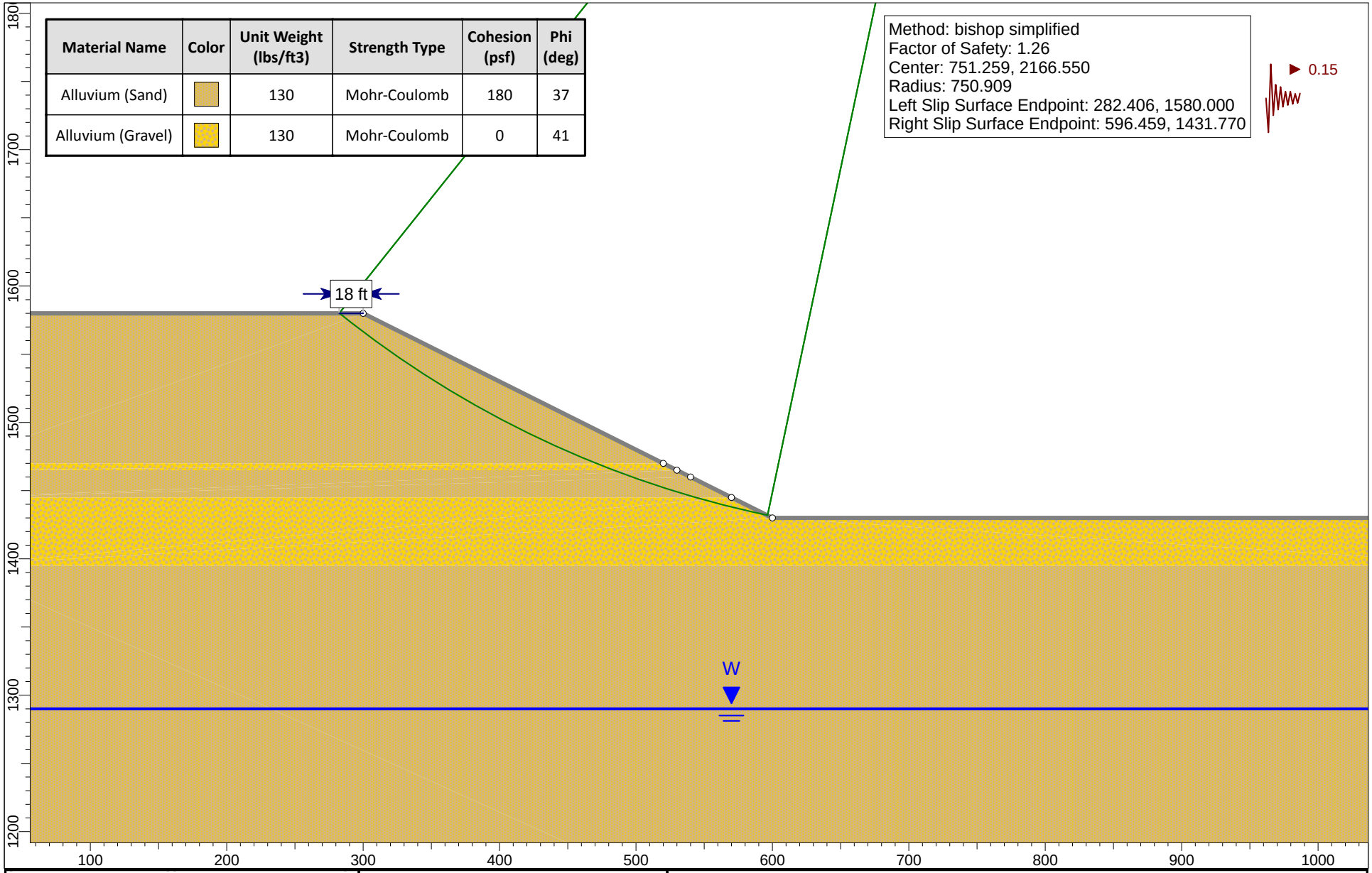
Section and Analysis Description: Proposed Mine Slope (2H:1V; 150-ft-deep) // 132051 Section A 150.slim

Project Number:	132051-002	*Note 1:*	Static Condition	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*		*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-3

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 150.slim Scenario: 132051 Section A 150.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.26
Center: 751.259, 2166.550
Radius: 750.909
Left Slip Surface Endpoint: 282.406, 1580.000
Right Slip Surface Endpoint: 596.459, 1431.770



HALEY ALDRICH

Vulcan Materials Company Western Division

San Bernardino Quarry - Area Q Mine

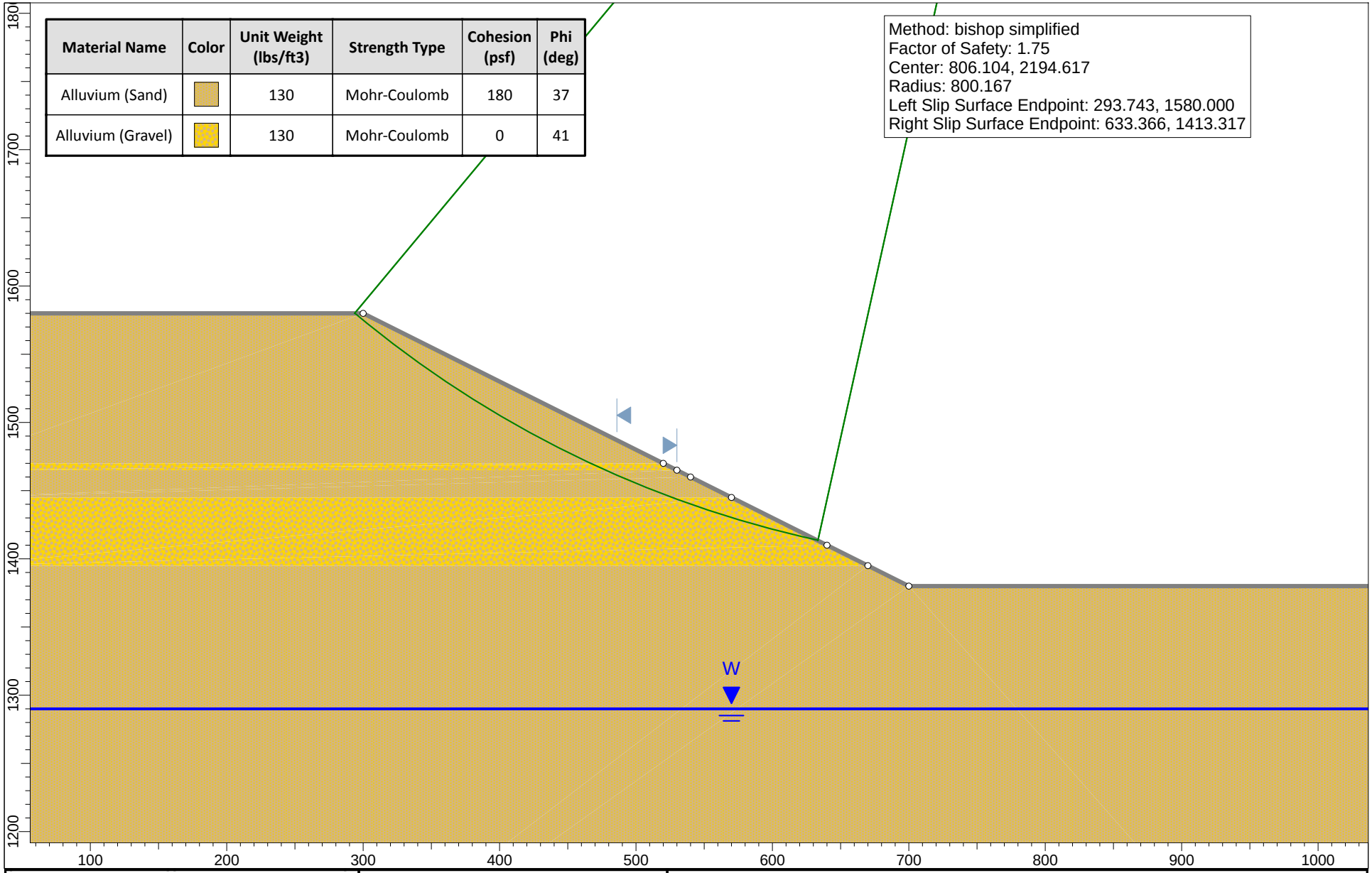
Section and Analysis Description: Proposed Mine Slope (2H:1V; 150-ft-deep) // 132051 Section A 150 Seismic SeedMethod.slim

Project Number:	132051-002	*Note 1:*	Pseudo-Static Case	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*	SP-117 Seed Method	*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-4

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 150 Seismic SeedMethod.slim Scenario: 132051 Section A 150 Seismic SeedMethod.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.75
Center: 806.104, 2194.617
Radius: 800.167
Left Slip Surface Endpoint: 293.743, 1580.000
Right Slip Surface Endpoint: 633.366, 1413.317



HALEY ALDRICH | Vulcan Materials Company Western Division

San Bernardino Quarry - Area Q Mine

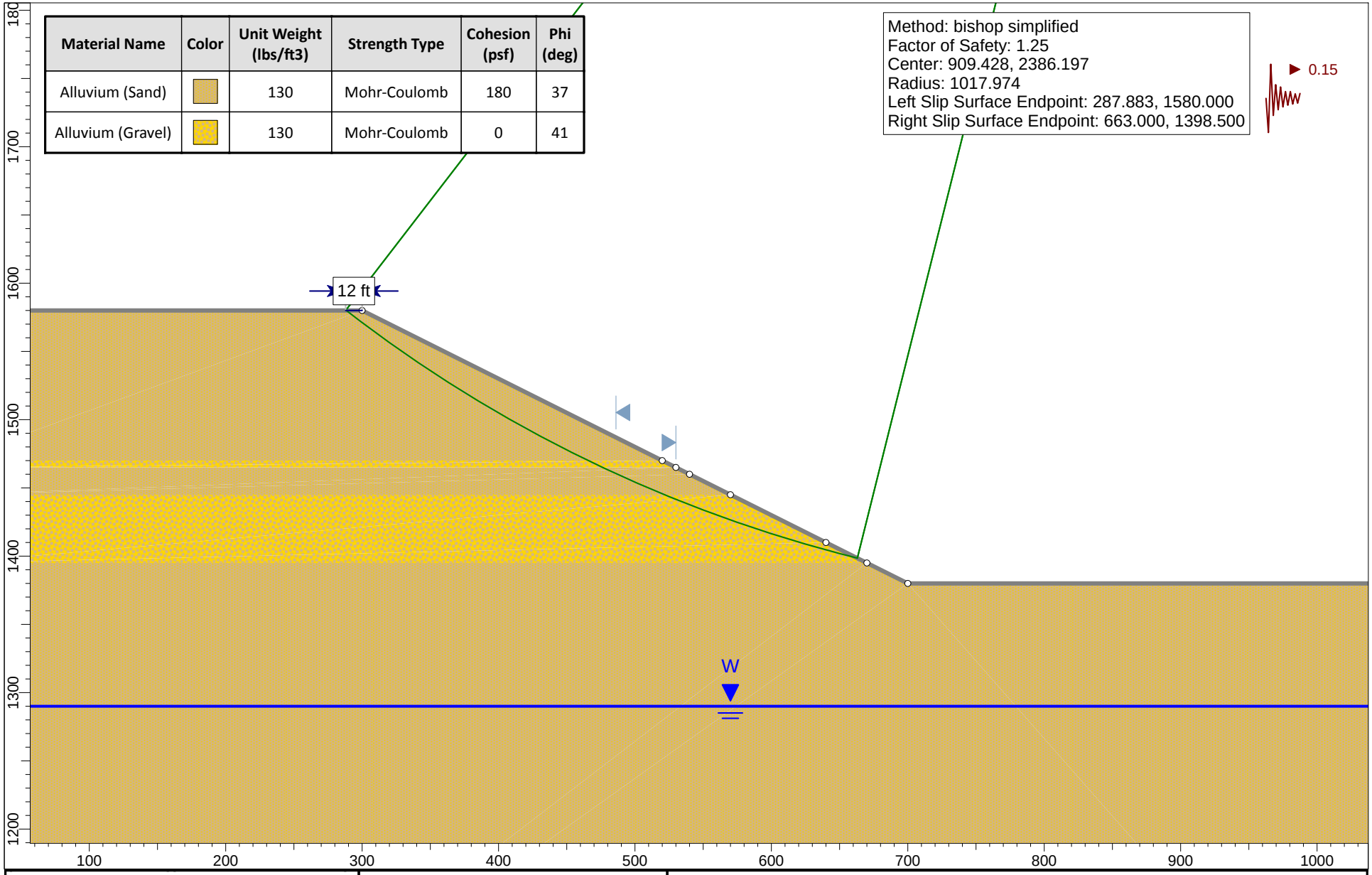
Section and Analysis Description: Proposed Mine Slope (2H:1V; 200-ft-deep) // 132051 Section A 200.slim

Project Number:	132051-002	*Note 1:*	Static Condition	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*		*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-5

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 200.slim Scenario: 132051 Section A 200.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Alluvium (Sand)		130	Mohr-Coulomb	180	37
Alluvium (Gravel)		130	Mohr-Coulomb	0	41

Method: bishop simplified
Factor of Safety: 1.25
Center: 909.428, 2386.197
Radius: 1017.974
Left Slip Surface Endpoint: 287.883, 1580.000
Right Slip Surface Endpoint: 663.000, 1398.500



HALEY ALDRICH

Vulcan Materials Company
Western Division

San Bernardino Quarry - Area Q Mine

Section and Analysis Description: Proposed Mine Slope (2H:1V; 200-ft-deep) // 132051 Section A 200 Seismic SeedMethod.slim

Project Number:	132051-002	*Note 1:*	Pseudo-Static Case	*Date*	5/8/2018
Analysis By:	M. Hintz	*Note 2:*	SP-117 Seed Method	*Scale*	1:1200
App. Version:	SLIDEINTERPRET 7.025	*Note 3:*			FIGURE C-6

G:\132051 VMC San Bernardino Area Q\Analysis\Slide\132051 Section A 200 Seismic SeedMethod.slim Scenario: 132051 Section A 200 Seismic SeedMethod.slim