REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION
TWO TRASH CAPTURE DEVICES
SITE 27 & 47
SUNNYVALE, CALIFORNIA

For

Kimley-Horn and Associates, Inc.

December 17, 2013

BAGG ENGINEERS

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December 17, 2013
BAGG Job No: KHINC-01-00

Kimley Horn Associates
111 W. St. John Street, Suite 440
San Jose, CA 95113-1104

Attention: Mr. Eric Biland

Geotechnical Engineering Investigation
Two Trash Capture Devices
Site 27 & Site 47
Sunnyvale, California

Dear Mr. Biland:

Transmitted herewith is our geotechnical engineering investigation report for the Site 27 and Site 47 trash capture devices in Sunnyvale, California. The report includes the results of our subsurface exploration, and laboratory testing which formed the basis of our conclusions and presents recommendations related to the geotechnical engineering aspects of the construction of the two trash capture devices.

Thank you for the opportunity to perform these services. Please do not hesitate to contact us, should you have any questions or comments.

Very truly yours,
BAGG Engineers

Kira Ortiz
Project Engineer

Jason Van Zwol
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
JASON VAN ZWOL
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REPORT

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SITE 27 & SITE 47
SUNNYVALE, CALIFORNIA

For Kimley Horn Associates

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ASFE document titled “Important Information About Your Geotechnical Engineering Report”

REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION
TWO TRASH CAPTURE DEVICES
SITE 27 & SITE 47
SUNNYVALE, CALIFORNIA

For Kimley Horn Associates

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering investigation performed for the two trash capture devices in Sunnyvale, California. The attached Plate 1 and Plate 1A, Vicinity Map, show the general location of the Site 27 and Site 47, respectively, and Plate 2 and Plate 2A, Site Plan, show the approximate location of the borings advanced at the two sites by BAGG as part of this investigation. This report was prepared in accordance with the scope of services outlined in our Proposal Number 13-126a dated February 7, 2013.

2.0 SITE AND PROJECT DESCRIPTION

The two proposed sites for the trash capture devices are Site 27, which is located on the north side of Wildwood Ave between Mission College Boulevard and Sandia Avenue and Site 47 is located on the northwest corner of Old San Francisco Road and Ironwood Terrace. The project will consist of constructing a trash capture device inside a below-grade concrete vault approximately 24 to 26 feet in depth at each location.

3.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to obtain pertinent information regarding subsurface soil and groundwater conditions at the two locations of the proposed trash capture devices. This was accomplished by researching published geologic and seismic literature pertinent to the site areas, and by advancing one boring at each site to depths on the order of about 30 feet each. Information obtained from these tasks was used to perform engineering analysis required to develop conclusions, opinions, and recommendations regarding:

- specific soil and groundwater conditions discovered by our borings, such as loose, expansive, saturated, or collapsible soils, that may require special mitigation or impose restrictions on the project, including the depth to groundwater and thickness and consistency of any fill soils encountered at the site,

- criteria for site grading, including placement of engineered fills, backfills behind vault walls and in utility trenches, ad preparation of subgrades for vault slabs,

- appropriate foundation type for the proposed structure, including allowable vertical and lateral resistance values under both static and seismic conditions,

- criteria for design of temporary shoring,

- criteria for design of the vault walls, both above and below the expected ground water table.

Based on our understanding of the project, the scope of our services consisted of the following specific tasks:

1. Researched and reviewed pertinent geotechnical and geological maps and reports relevant to the site and vicinity.

2. Marked the boring location at each site at least 72 hours in advance of the subsurface exploration, and notify Underground Service Alert to mark utility lines on or entering the site.

3. Drilled, logged, and sampled one exploratory boring at each site to a depth of about 30 feet with portable drilling equipment using conventional flight augers. The borings were drilled under the technical direction of one of our engineers who also obtained disturbed bulk, Standard Penetration Test, and undisturbed ring samples of the native soils for visual classification and laboratory testing. Following the completion of the drilling, the borings were sealed with neat cement grout per standard protocol.

4. Based on information obtained from the above tasks, we performed an engineering analyses oriented toward the above-described purpose of the investigation.

5. Prepared four copies and one electronic pdf copy of a single report summarizing our findings and including a site plan showing the approximate location of the exploratory borings, the logs of the borings, the results of the laboratory testing, and our conclusions, opinions, and recommendations for design and construction of at each site.

4.0 FIELD EXPLORATION

Subsurface conditions at the two site locations have been explored by drilling one soil borings at each site at the approximate locations shown on the attached Plate 2 and Plate 2A, Site Plan. The soil borings were drilled using portable drilling equipment with 4-inch diameter continuous flight augers. The borings were technically directed by one of our engineers who maintained a continuous log of the soil conditions encountered in each of the boreholes, and obtained relatively undisturbed samples for laboratory testing and visual examination.

The graphical representation of the materials encountered in the borings, and the results of our laboratory tests, as well as explanatory/illustrative data are attached, as follows:

- Plate 6, Unified Soil Classification System, illustrates the general features of the soil classification system used on the boring logs.
- Plate 6, Soil Terminology, lists and describes the soil engineering terms used on the boring logs.
- Plate 7, Boring Notes, describes general and specific conditions that apply to the boring logs
- Plate 8, Key to Symbols, describes various symbols used on the boring logs and describes general and specific conditions that apply to the boring logs.
- Plate 9 and 10, Boring Logs, describe the subsurface materials encountered, show the depths, and blow counts for the samples, and summarize results of the strength tests, and moisture density data.
- Plate 11, Atterberg Limits Tests, graphs and presents the Atterberg Limits test data for a representative soil sample obtained from the borings.

Selected undisturbed samples were tested in direct shear to evaluate the strength characteristics of the subsurface materials. Direct shear tests were performed at saturated and natural moisture contents and under various surcharge pressures. The moisture content and dry density of the undisturbed samples were measured to aid in correlating their engineering properties. The results of our laboratory strength tests and moisture-density data are also summarized on the boring logs.

5.0 GEOLOGY AND SEISMICITY

5.1 Site 27 Regional Geology

A review of the "Quaternary Geology of Santa Clara Valley, Santa Clara, Alameda, and San Mateo Counties, California: A digital database" by C E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, C.M. Wentworth, indicates that the site area is underlain by "Floodplain Deposists" described as "medium to dark - gray, dense, sandy to silty clay. Lenses of coarser material (silt, sand, and pebbles) may be locally present." A portion of that map including the site area is presented herein as the Regional Geology Map, Plate 3.

5.2 Sire 47 Regional Geology

A review of the "Quaternary Geology of Santa Clara Valley, Santa Clara, Alameda, and San Mateo Counties, California: A digital database" by C E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, C.M. Wentworth, indicates that the site area is underlain by "Alluvial Fan Deposits" described as "brown, tan or reddish -brown, dense, gravelly and clayey sand or clayey gravel that fines upward to a sandy clay." A portion of that map including the site area is presented herein as the Regional Geology Map, Plate 3A.

5.3 Seismic Setting

Site 27 and Site 47, as is the entire San Francisco Bay area, are located within a seismically active region at the contact between the Pacific Plate to the west and the North American tectonic plate to the east. The zone of faulting at the contact in this area stretches from just offshore to the western side of the Great Valley. The major fault in this system is the San Andreas fault located approximately 16.7 kilometers southwest of Site 27 and 12.9 kilometers southwest of Site 47. This fault generated an earthquake of Magnitude 7.0+ on the San Francisco peninsula in 1838, and the great San Francisco Earthquake of 1906, with an estimated Moment Magnitude of 7.8. The 1989 Loma Prieta earthquake was also located immediately adjacent to this fault. The Monte Vista Shannon fault is located approximately 11.1 kilometers southwest of Site 27 and 7.2 kilometers southwest of Site 47, and the Hayward fault is located roughly 11.6 kilometers northeast of Site 27 and 14.8 kilometers northeast of Site 47. Other faults are too distant, and/or judged incapable of generating ground accelerations large

enough to be considered significant threats to this site. This distances to the major faults from the sites, and their potential moment magnitudes are listed in the table below.

Significant Earthquake Scenarios

Fault	Approximate Distance to Site 27 (kilometers)	Approximate Distance to Site 47 (kilometers)	Potential Moment Magnitude (Mw)[1]
Monte Vista-Shannon	11.1	7.2	6.3-6.5
Hayward – Rodgers Creek	11.6	14.8	7.2-7.3
San Andreas	16.7	12.9	7.9-8.0

1. Working Group on California Earthquake Probabilities, 2008

6.0 SITE CONDITIONS

6.1 Subsurface Conditions

6.1.1 Site 27

The boring location for Site 27 was covered with soil. The boring drilled for this investigation encountered very stiff lean clay to sandy lean clay and sandy silt to a depth of approximately 26½ feet bgs. Below a depth of 26½ feet, the boring encountered medium dense, silty sand to depth.

For more information regarding the subsurface soil conditions for Site 27, we refer you to the Plate 10, Boring Log.

6.1.2 Site 47

The boring location for Site 47 was covered with soil. The boring drilled for this investigation encountered approximately 3 feet of dense silty sand at the ground surface. The subsurface materials, below 3 feet, consisted of alternating layers of medium dense to very dense sandy soils and very stiff to hard clayey soils to depth.

For more information regarding the subsurface soil conditions for Site 47, we refer you to the Plate 9, Boring Log

6.2 Groundwater

6.2.1 Site 27

Free groundwater was encountered at about 12 feet bgs in the boring drilled for the Site 27 investigation. A review of Plate 1.2 of the Seismic Hazard Zone Report for the Milpitas 7.5-Mintue Quadrangle, Alameda and Santa Clara Counties, California (CGS, 2001) indicates the historic high water table in the general site area to be between 5 to 10 feet in depth.

6.2.1 Site 47

Groundwater was not encountered in the boring drilled for the Site 47 investigation. A review of Plate 1.2 of the Seismic Hazard Zone Report Zone Report for the Cupertino 7.5-Minute Quadrangle, Santa Clara County, California (CGS, 2002) indicates the historic high water table in the general site area to be between 20 to 30 feet in depth.

6.3 Liquefaction Potential

6.3.1 Site 27

According to the State of California Seismic Hazard Zones map for the Milpitas Quadrangle, the site is situated within a delineated liquefaction hazard zone. However, a liquefaction analysis was not part of the scope of work for this geotechnical investigation as per BAGG Engineers proposal 13-126a.

6.3.2 Site 27

According to the State of California Seismic Hazard Zones map for the Cupertino Quadrangle, the site is not situated within a delineated liquefaction hazard zone.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 General

Based on the subsurface exploration conducted at the subject sites and the results obtained from our laboratory testing program, it is our opinion that the proposed project is feasible for both Site 27 and Site 47 from a geotechnical engineering standpoint, provided the recommendations presented in this report are incorporated into the project design and implemented during construction. When the final

development plans are available, they should be reviewed by this office prior to construction to confirm that the intent of our recommendations is reflected in the plans, and to confirm that our recommendations properly address the proposed project in its final form.

Based on the results of our subsurface exploration, it is our opinion that the proposed trash capture devices for Site 27 and Site 47 may be supported on a concrete mat foundation. Our recommendations for site grading, foundations, vault walls and utility trench backfill are presented in the following sections of the report.

Both sites could experience very strong ground shaking from future earthquakes during the anticipated lifetime of the project. The intensity of ground shaking will depend on the magnitude of earthquake, distance to epicenter, and response characteristics of the on-site soils. While it is not possible to totally prelude damage to structures during major earthquakes, strict adherence to good engineering design and construction practices will help reduce the risk to damage. The 2010 California Building Code defines the minimum standards of good engineering practice.

7.2 Site Grading

A site grading plan was not available when this report was prepared, but it our understanding that site grading will include excavations for the trash capture devices approximately 24 to 26 feet bgs.

As used in this report, the term “compact” and its derivatives mean that all native site soils should be compacted to a minimum of 90 percent of the maximum dry density, at a moisture content of at least 2 percent over optimum, as determined by ASTM Test Method D1557. Imported, non-expansive fills should be compacted to a minimum of 95 percent relative compaction in the upper 12 inches of slab subgrades, at a moisture content that is slightly over optimum.

The following grading procedures should be followed for preparation of the areas to receive concrete slabs:

- Strip and remove all bushes, vegetation, roots, organically contaminated topsoils, abandoned underground utilities, and other debris from the site surface. Stockpile the stripping for disposal at an off-site location.

- Scarify the over-excavated surfaces within the exposed subgrades to depth of 6 to 8 inches.

- Thoroughly moisture condition the scarified surfaces to a moisture content that is 1 to 2 percent over optimum, and re-compact as specified above. Further excavate as necessary any area still containing weak and/or yielding (pumping) soils, as determined in the field by the Geotechnical Engineer.

- Place fill on the over-excavated surfaces and in the holes/depressions created by the above actions in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Rocks or cobbles larger than 4 inches in maximum dimensions should not be allowed to remain within the foundation areas, unless they can be crushed in-place by the construction equipment.

The native soils are suitable for use as structural fill. Imported fill soils if needed, should be predominately granular in nature and should be free of organics, debris, or rocks over 3 inches in size, and should be approved by the Geotechnical Engineer before importing to the site. As a general guide of acceptance, imported soils should have a Plasticity Index less than 15, and an R-value of at least 20, and fines content between 15 and 60 percent. Also, groundwater is likely to be encountered during the excavation of both sites; therefore, suitable arrangement should be made to dewater the excavations. All aspects of site grading including clearing/stripping, demolition, pad preparation, and placement of fills or backfills should be performed under the observation of BAGG's field representatives.

It must be the Contractor's responsibility to select equipment and procedures that will accomplish the grading as described above. The Contractor must also organize his work in such a manner that one of our field representatives can observe and test the grading operations, including clearing, excavation, compaction of fill and backfill, and compaction of subgrades.

7.3 Foundations

The trash capture devices at Site 27 and Site 47 may be supported on concrete mat foundations. The concrete mat slabs for both sites can be designed for a maximum localized allowable bearing pressure of 5,000 psf for dead plus live loads. This allowable bearing pressure may be increased by one-third for short term, wind and seismic. The mat slabs should be reinforced in both directions with top and bottom steel reinforcement, as specified by the project Structural Engineer, to help span local

irregularities. A modulus of subgrade reaction of 50 pci and 100 pci for a one-foot square area can be used for the design of the mats at Site 27 and 47, respectively.

7.4 Retaining Walls

Vault retaining walls should be designed to resist lateral earth pressures from adjoining natural materials, potential hydrostatic pressures, surcharge loads, and backfills. The restrained walls for Site 27 and Site 47 should be designed to resist at-rest soil pressures above the water table of 80 pounds per cubic foot (pcf) and 70 pcf, equivalent fluid weight, respectively. The restrained walls for Site 27 and Site 47 should be designed to resist at-rest soil pressures below the water table of 110 pcf and 100 pcf, equivalent fluid weight, respectively. These design values provided for the restrained walls are based on an assumed groundwater table of 5 feet bgs and 20 feet bgs for Site 27 and Site 47 respectively. In general, surcharge loads should be added to the wall earth pressure at a rate of 50 percent the applied vertical load. Seismic loading should be added to the walls at a rate of 8H, where H is the height from the bottom of the footing to the ground surface.

Backfill behind the vault walls, excluding drainage material, should conform to the fill requirements provided in the "Site Grading" section of the above-referenced report. Backfill material should be placed in layers with the loose layer thickness not exceeding 8-inches, and compacted in-place prior to placing the next layer. The fill material should be compacted to a minimum relative compaction of 90 percent. BAGG should be allowed an opportunity to observe the fill placement process and to measure the in-place relative compaction.

7.5 Temporary Shoring

All temporary shoring should be designed to resist lateral pressures from the natural materials, surcharge loads and backfills. The active earth pressure acting on the shoring for Site 27 and Site 47 may be assumed to be equal to an equivalent fluid pressure of 60 pcf and 50 pcf respectively. Where sloping surfaces exist behind the shores, the above-noted pressures should be increased by 2 pcf for every 5 degree increase in the slope angle, up to a maximum gradient of 1½:1, horizontal to vertical. The temporary shoring for both sites may consist of a properly designed sheet pile wall. Resistance to lateral loads may be provided by net passive pressure acting on sheet piles below the bottom of the excavation, which may be taken as equivalent fluid weight for Site 27 and Site 47 of 200 pcf and 300 pcf,

respectively. The excavated soil should be stockpiled at a minimum distance equal to the depth of the excavation from the edge of the excavation. The system should also be designed to withstand surcharge loads of the construction equipment, taken as one-third the surcharge load distributed over the entire depth of the excavation.

The design of the temporary shoring should be the contractor's responsibility; however, the shoring design should be submitted to the geotechnical engineer for review and approval prior to the actual installation and site grading activities.

7.6 Trench Backfill

Vertical trenches deeper than 3 feet will likely require temporary shoring at Site 47. Where shoring is not used, the sides should be sloped or benched, with a maximum slope of 1½:1 (horizontal: vertical). The trench spoils should not be placed closer than 3 feet or one-half of the trench depth (whichever is greater) from the trench sidewalls. All work associated with trenching must conform to the State of California, Division of Industrial Safety requirements. In our opinion, the soils in the upper 24 to 26 feet of both sites should be classified as "Type C Soil."

Trench backfill materials and compaction should conform to the requirements of the local agency; however, we recommend the following as a minimum:

- In general, soils used for trench backfill shall be free of debris, roots and other organic matter, debris, and rocks or lumps exceeding 4 inches in greatest dimension. The on-site soils can be used for trench backfill, and for pipe bedding or shading.
- Compaction shall be performed to a minimum of 90% relative compaction in accordance with ASTM D1557, at a moisture content recommended previously. In pavement areas, the upper 24 inches of the backfill (below the pavement subgrade) shall be compacted to 95% of the maximum dry density. Jetting shall not be allowed.

7.7 Plan Review

It is recommended that the Geotechnical Engineer (BAGG Engineers) be retained to review the final grading, foundation, and drainage plans. This review is to assess general suitability of the earthwork, foundation, and drainage recommendations contained in this report and to verify the appropriate implementation of our recommendations into the project plans and specifications.

7.8 Observation and Testing

It is recommended that the Geotechnical Engineer (BAGG) be retained to provide observation and testing services during site grading, excavation, backfilling, and foundation construction phases of work. This is intended to verify that the work in the field is performed as recommended and in accordance with the approved plans and specifications, as well as verify that subsurface conditions encountered during construction are similar to those anticipated during the design phase.

8.0 CLOSURE

This report has been prepared in accordance with generally-accepted engineering practices. The recommendations presented in this report are based on our understanding of the proposed construction as described herein, and upon the soil conditions encountered in the borings performed for this investigation.

The conclusions and recommendations contained in this report are based on subsurface conditions revealed by one boring at Site 27, one boring at Site 47 and a review of available geotechnical and geologic literature pertaining to the project sites. It is not uncommon for unanticipated conditions to be encountered during site grading and/or foundation installation and it is not possible for all such variations to be found by a field exploration program appropriate for this type of project. The recommendations contained in this report are therefore contingent upon the review of the final grading, drainage, and foundation plans by this office, and upon geotechnical observation and testing by BAGG of all pertinent aspects of site grading, including demolition, placement of fills and backfills, and foundation construction.

Soil conditions and standards of practice change with time. Therefore, we should be consulted to update this report, if the construction does not commence within 18 months from the date that this

report is submitted. Additionally, the recommendations of this report are only valid for the proposed development as described herein. If the proposed project is modified, our recommendations should be reviewed and approved or modified by this office in writing.

The following references and plates are attached and complete this report:

Plate 1	Vicinity Map, Site 27
Plate 1A	Vicinity Map, Site 47
Plate 2	Site Plan, Site 27
Plate 2A	Site Plan, Site 47
Plate 3	Regional Geologic Map, Site 27
Plate 3A	Regional Geologic Map, Site 47
Plate 4	Regional Fault Map
Plate 5	Unified Soil Classification System
Plate 6	Soil terminology
Plate 7	Boring Log Notes
Plate 8	Key to Symbols
Plate 9 and 10	Boring Logs
Plate 11	Atterberg Limits

ASFE document titled “Important Information About Your Geotechnical Engineering Report”

9.0 REFERENCES

California Building Standard Commission, 2010 California Building Code, California Code of Regulations, Title 24, Part 2, Colume 2 of 2.

California Department of Conservation, Division of Mines and Geology, 2000, Digital Images of Official maps of Alquist-Priolo Earthquake Fault Zones of California, Central Coast Region.

E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, C.M. Wentworth, *Quaternary Geology of Santa Clara Valley, Santa Clara, Alameda, and San Mateo Counties, California*, U.S.G.S. Open-File Report 94-231, 1994

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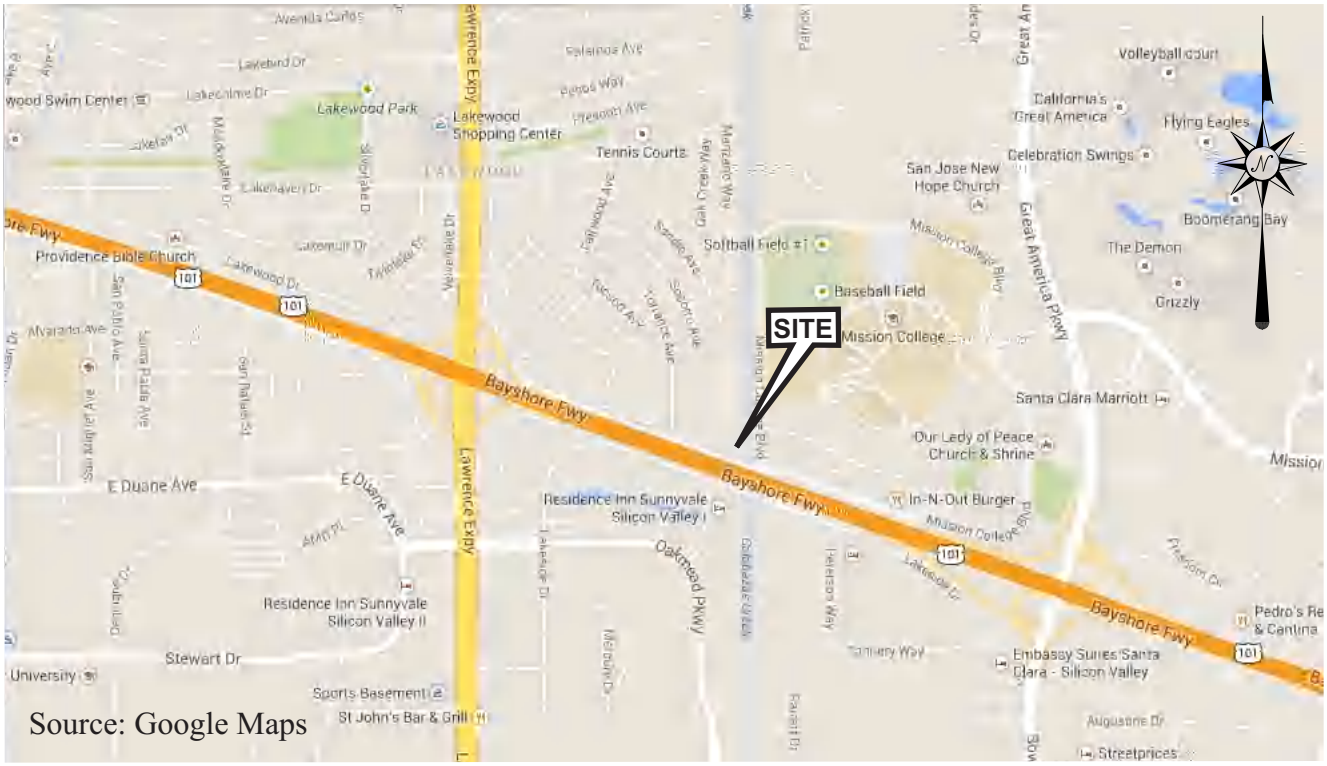

TRASH CAPTURE DEVICES
SITE 27 ON WILDWOOD AVENUE
SUNNYVALE, CALIFORNIA

VICINITY MAP

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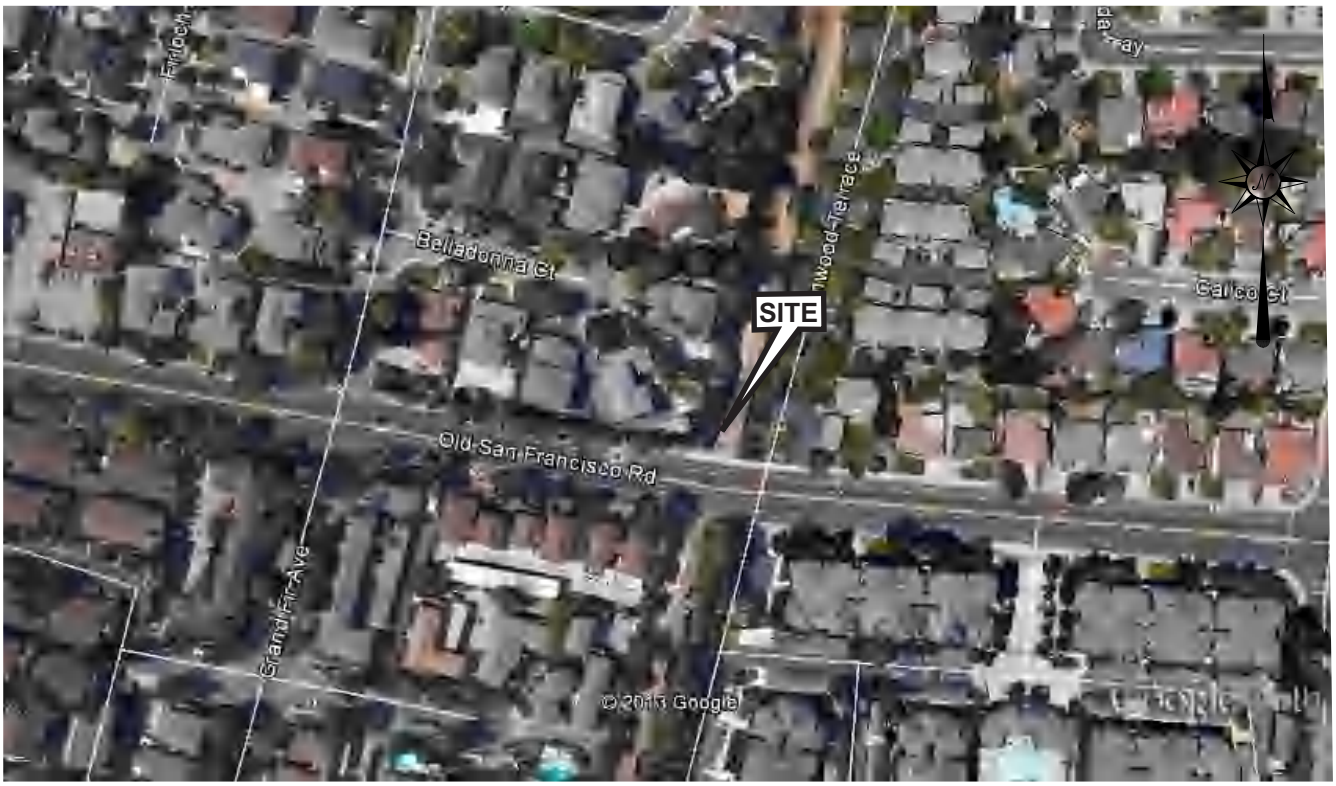

TRASH CAPTURE DEVICES
SITE 47 ON OLD SAN FRANCISCO ROAD
SUNNYVALE, CALIFORNIA

VICINITY MAP

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Boring Location, Typ.,

TRASH CAPTURE DEVICES
SITE 27 ON WILDWOOD AVENUE
SUNNYVALE, CALIFORNIA

SITE PLAN

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Boring Location, Typ.,

TRASH CAPTURE DEVICES
SITE 47 ON OLD SAN FRANCISCO ROAD
SUNNYVALE, CALIFORNIA

SITE PLAN

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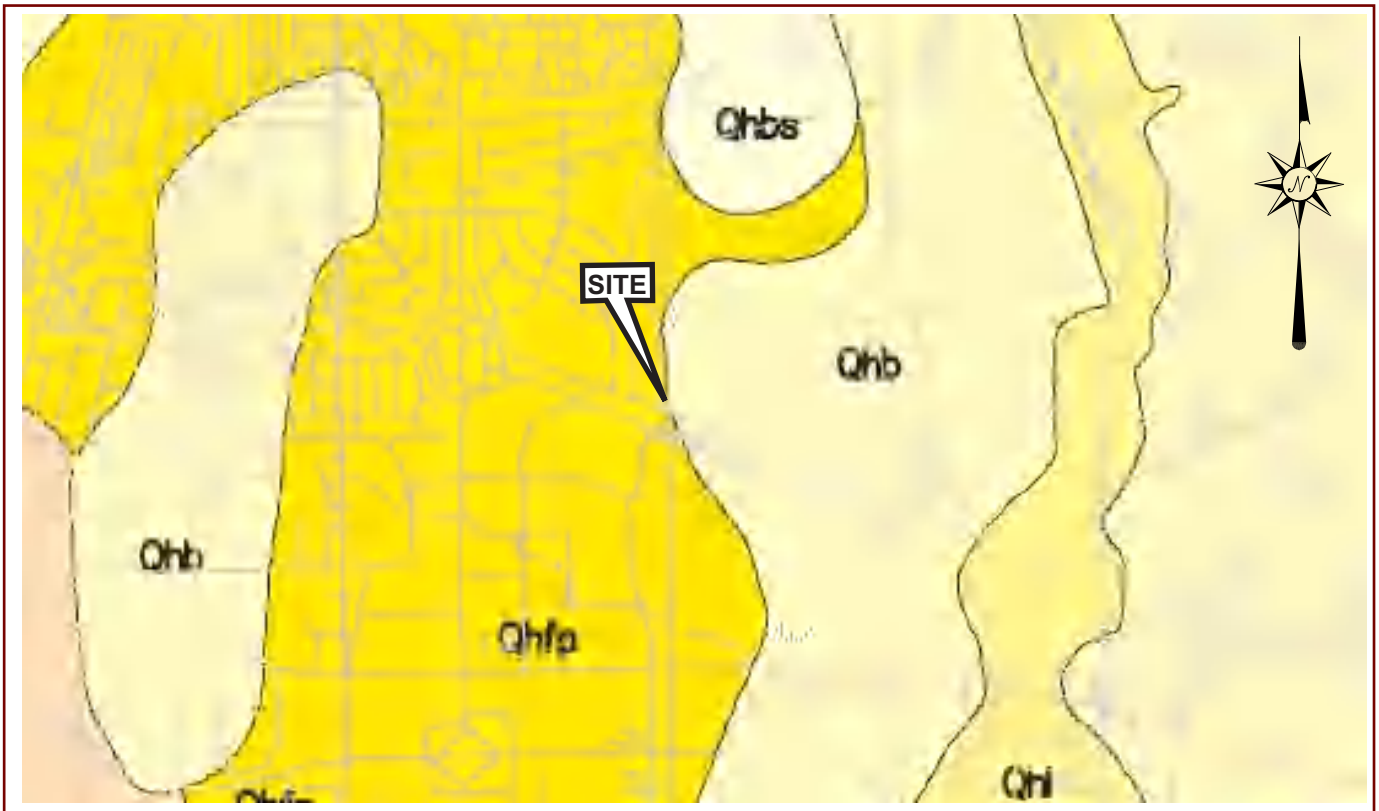


LEGEND

Qhl Natural Levee Deposits (Holocene)
Loose, moderate- to well- sorted sandy or clayey silt grading to sandy or silty clay. Levee deposits are generally well drained.

Qhfp Floodplain Deposits (Holocene)
Medium to dark - gray, dense, sandy to silty clay. Lenses of coarser material (silt, sand, and pebbles) may be locally present.

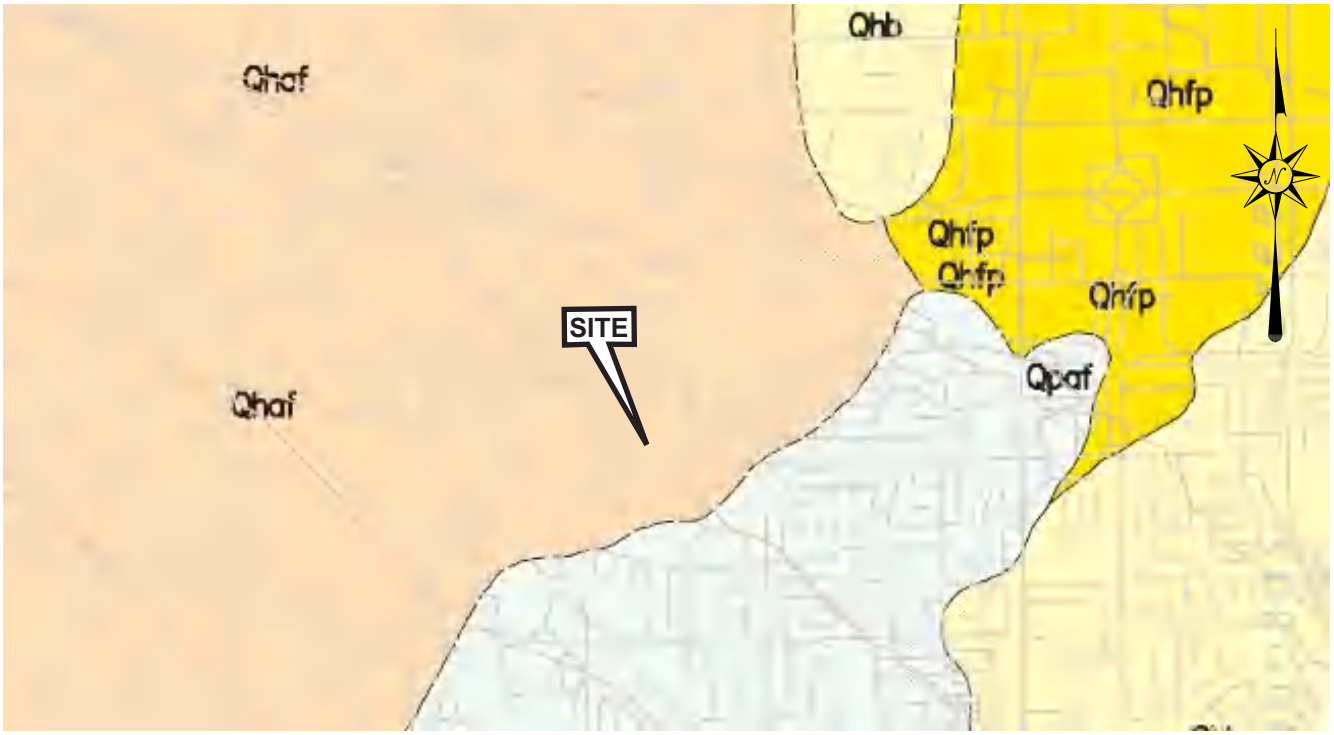
Qhb Floodbasin Deposits (Holocene)
Organic - rich clay to very fine silty-clay deposits occupying the lowest topographic positions between Holocene levee deposits or Holocene floodplain deposits.

Qhbs Floodbasin Deposits (salt-affected) (Holocene)
Clay to very fine silty-clay deposits similar to the Qhb deposits except that they contain carbonate nodules and iron - stained mottles.

Reference: "Quaternary Geology of Santa Clara Valley, Santa Clara, Alameda, and San Mateo Counties, California: A digital database," by E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, C.M. Wentworth, U.S.G.S. Open-File Report 94-231, 1994.

TRASH CAPTURE DEVICES SITE 27 ON WILDWOOD AVNUE SUNNYVALE, CALIFORNIA	**REGIONAL GEOLOGY MAP**		
	DATE: December 2013	JOB NUMBER: KHINC-01-00	PLATE 3

BVGG ENGINEERS



LEGEND

Qhfp Floodplain Deposits (Holocene)
Medium to dark - gray, dense, sandy to silty clay. Lenses of coarser material (silt, sand, and pebbles) may be locally present.

Qhb Floodbasin Deposits (Holocene)
Organic - rich clay to very fine silty-clay deposits occupying the lowest topographic positions between Holocene levee deposits or Holocene floodplain deposits.

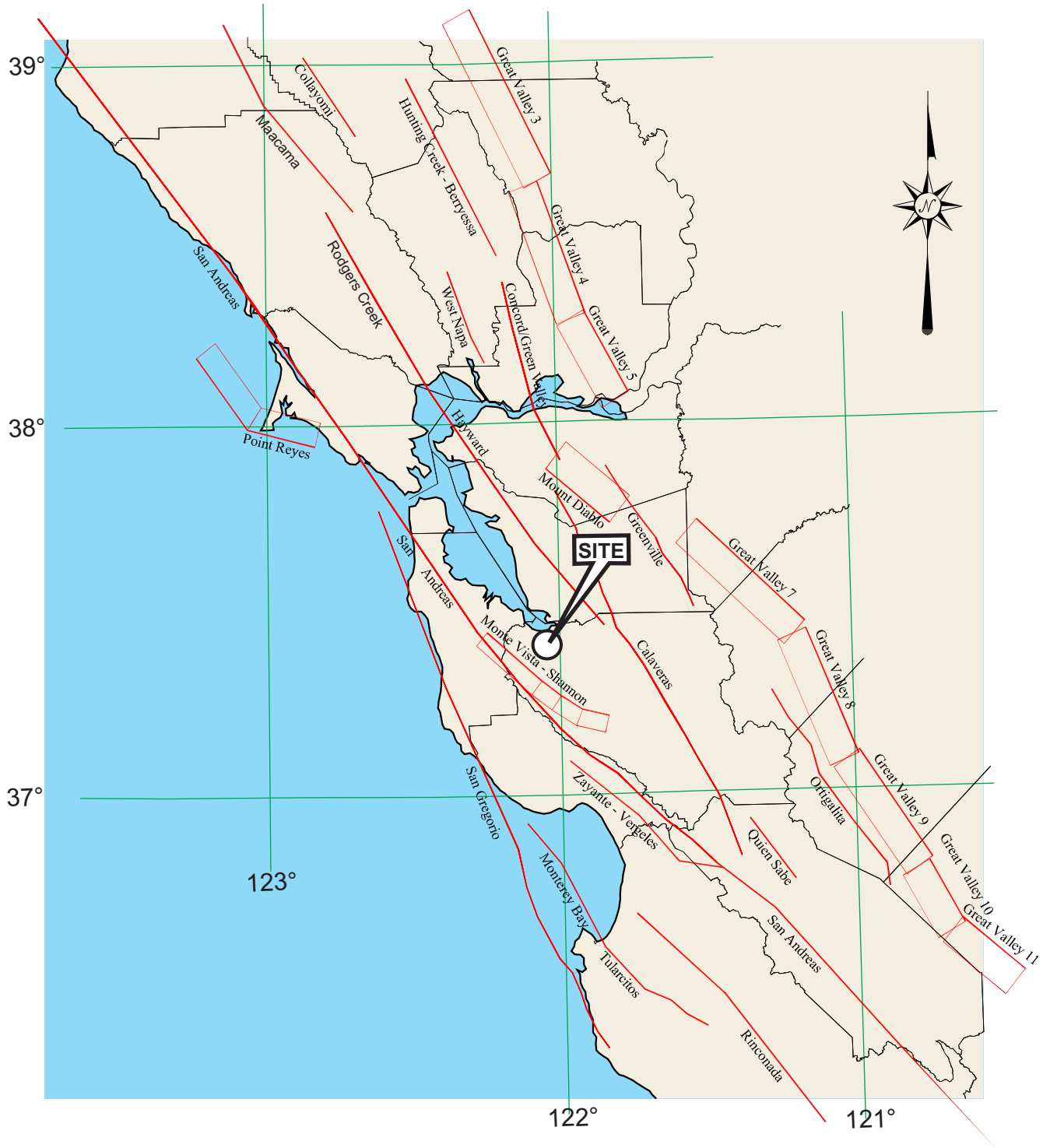
Qhaf Alluvial Fan Deposits (Holocene)
Brown or tan, medium dense to dense gravelly sand or sandy gravel that grades upward to sandy or silty clay. Near the distal fan edges, deposits are typically brown, medium dense gravelly sand or clayey gravel that grades upward to sandy or silty clay.

Qpaf Alluvial Fan Deposits (Pleistocene)
Brown, tan or reddish -brown, dense, gravelly and clayey sand or clayey gravel that fines upward to a sandy clay.

Reference: "Quaternary Geology of Santa Clara Valley, Santa Clara, Alameda, and San Mateo Counties, California: A digital database," by E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, C.M. Wentworth, U.S.G.S. Open-File Report 94-231, 1994.

TRASH CAPTURE DEVICES SITE 47 ON OLD SAN FRANCISCO ROAD SUNNYVALE, CALIFORNIA	**REGIONAL GEOLOGY MAP**		
	DATE: December 2013	JOB NUMBER: KHINC-01-00	PLATE 3A

BVGG ENGINEERS



Reference: Taken from the 2002 California Geological Survey Fault Model.

TRASH CAPTURE DEVICES SITE 27 AND SITE 47 SUNNYVALE CALIFORNIA	**REGIONAL FAULT MAP**		
	DATE: December 2013	JOB NUMBER: KHINC-01-00	PLATE 4

BYGG ENGINEERS

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES	MAJOR DIVISIONS
GW	Well graded gravel Well graded gravel with sand	**GRAVELS** More than half of coarse fraction is larger than No. 4 sieve size
GP	Poorly graded gravel Poorly graded gravel with sand	
GM	Silty gravel Silty gravel with sand	
GC	Clayey gravel Clayey gravel with sand	
SW	Well graded sand Well graded sand with gravel	**SANDS** More than half of coarse fraction is smaller than No. 4 sieve size
SP	Poorly graded sand Poorly graded sand with gravel	
SM	Silty sand Silty sand with gravel	
SC	Clayey sand Clayey sand with gravel	

NOTE: Coarse-grained soils receive dual symbols if:
(1) their fines are CL-ML (e.g. SC-SM or GC-GM) or
(2) they contain 5-12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES	MAJOR DIVISIONS
CL	Lean clay Sandy lean clay with gravel	**SILTS AND CLAYS** liquid limit less than 50
ML	Silt Sandy silt with gravel	
OL	Organic clay Sandy organic clay with gravel	
CH	Fat clay Sandy fat clay with gravel	**SILTS AND CLAYS** liquid limit more than 50
MH	Elastic silt Sandy elastic silt with gravel	
OH	Organic clay Sandy organic clay with gravel	
PT	Peat Highly organic silt	**HIGHLY ORGANIC SOIL**

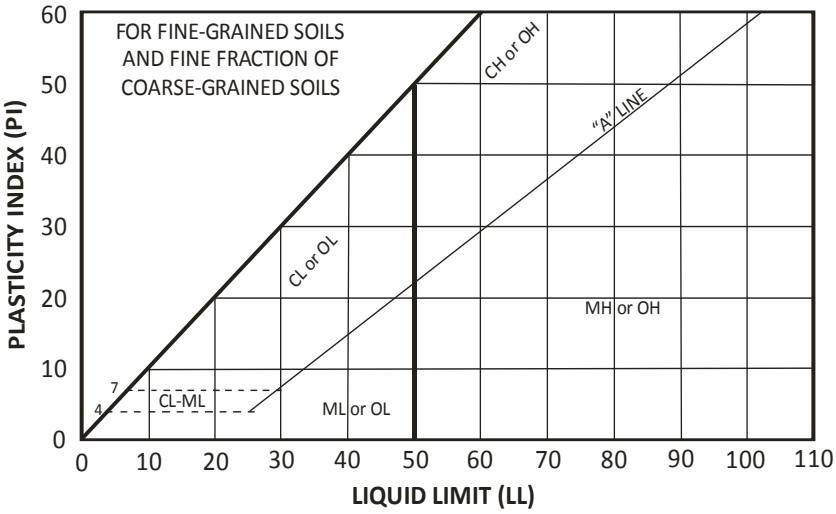
NOTE: Fine-grained soils receive dual symbols if their limits in the hatched zone on the Plasticity Chart(L-M)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	¾ in to 3 in.
Fine	No. 4 to ¾ in.
SAND	No. 200 to No.4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*FINES:	BELOW No. 200

NOTE: Classification is based on the portion of a sample that passes the 3-inch sieve.

PLASTICITY CHART



Reference: ASTM D 2487-06, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

GENERAL NOTES: The tables list 30 out of a possible 110 Group Names, all of which are assigned to unique proportions of constituent soils. Flow charts in ASTM D 2487-06 aid assignment of the Group Names. Some general rules for fine grained soils are: less than 15% sand or gravel is not mentioned; 15% to 25% sand or gravel is termed "with sand" or "with gravel", and 30% to 49% sand or gravel is termed "sandy" or "gravelly". Some general rules for coarse-grained soils are: uniformly-graded or gap-graded soils are "Poorly" graded (SP or GP); 15% or more sand or gravel is termed "with sand" or "with gravel", 15% to 25% clay and silt is termed clayey and silty and any cobbles or boulders are termed "with cobbles" or "with boulders".

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL TYPES (Ref 1)

Boulders: particles of rock that will not pass a 12-inch screen.
Cobbles: particles of rock that will pass a 12-inch screen, but not a 3-inch sieve.
Gravel: particles of rock that will pass a 3-inch sieve, but not a #4 sieve.
Sand: particles of rock that will pass a #4 sieve, but not a #200 sieve.
Silt: soil that will pass a #200 sieve, that is non-plastic or very slightly plastic, and that exhibits little or no strength when dry.
Clay: soil that will pass a #200 sieve, that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when dry.

MOISTURE AND DENSITY

Moisture Condition: an observational term; dry, moist, wet, or saturated.
Moisture Content: the weight of water in a sample divided by the weight of dry soil in the soil sample, expressed as a percentage.
Dry Density: the pounds of dry soil in a cubic foot of soil.

DESCRIPTORS OF CONSISTENCY (Ref 3)

Liquid Limit: the water content at which a soil that will pass a #40 sieve is on the boundary between exhibiting liquid and plastic characteristics. The consistency feels like soft butter.
Plastic Limit: the water content at which a soil that will pass a #40 sieve is on the boundary between exhibiting plastic and semi-solid characteristics. The consistency feels like stiff putty.
Plasticity Index: the difference between the liquid limit and the plastic limit, i.e. the range in water contents over which the soil is in a plastic state.

MEASURES OF CONSISTENCY OF COHESIVE SOILS (CLAYS) (Ref's 2 & 3)

Very Soft	N=0-1*	C=0-250 psf	Squeezes between fingers
Soft	N=2-4	C=250-500 psf	Easily molded by finger pressure
Medium Stiff	N=5-8	C=500-1000 psf	Molded by strong finger pressure
Stiff	N=9-15	C=1000-2000 psf	Dented by strong finger pressure
Very stiff	N=16-30	C=2000-4000 psf	Dented slightly by finger pressure
Hard	N>30	C>4000 psf	Dented slightly by a pencil point

*__N__=blows per foot in the Standard Penetration Test. In cohesive soils, with the 3-inch-diameter ring sampler, 140-pound weight, divide the blow count by 1.2 to get N (Ref 4).

MEASURES OF RELATIVE DENSITY OF GRANULAR SOILS (GRAVELS, SANDS, AND SILTS) (Ref's 2 & 3)

Very Loose	N=0-4**	RD=0-30	Easily push a ½-inch reinforcing rod by hand
Loose	N=5-10	RD=30-50	Push a ½-inch reinforcing rod by hand
Medium Dense	N=11-30	RD=50-70	Easily drive a ½-inch reinforcing rod
Dense	N=31-50	RD=70-90	Drive a ½-inch reinforcing rod 1 foot
Very Dense	N>50	RD=90-100	Drive a ½-inch reinforcing rod a few inches

**__N__=Blows per foot in the Standard Penetration Test. In granular soils, with the 3-inch-diameter ring sampler, 140-pound weight, divide the blow count by 2 to get N (Ref 4).

xxxx

GENERAL NOTES FOR BORING LOGS:

The boring logs are intended for use only in conjunction with the text, and for only the purposes the text outlines for our services. The Plate "Soil Terminology" defines common terms used on the boring logs.

The plate "Unified Soil Classification System," illustrates the method used to classify the soils. The soils were visually classified in the field; the classifications were modified by visual examination of samples in the laboratory, supported, where indicated on the logs, by tests of liquid limit, plasticity index, and/or gradation. In addition to the interpretations for sample classification, there are interpretations of where stratum changes occur between samples, where gradational changes substantively occur, and where minor changes within a stratum are significant enough to log.

There may be variations in subsurface conditions between borings. Soil characteristics change with variations in moisture content, with exchange of ions, with loosening and densifying, and for other reasons. Groundwater levels change with seasons, with pumping, from leaks, and for other reasons. Thus boring logs depict interpretations of subsurface conditions only at the locations indicated, and only on the date(s) noted.

SPECIAL FIELD NOTES FOR THIS REPORT:

1. The borings for Site 27 and Site 47 were drilled on November 27, 2013, with a portable drilling rig using continuous flight augers. The borings were sealed with neat cement grout immediately after the last soil sample was collected per standard protocol.

2. The boring locations were approximately located by pacing from known points at Site 27 and Site 47, as shown on Plate 2 and Plate 2A, Site Plan.

3. The soils' Group Names [e.g. SANDY LEAN CLAY] and Group Symbols [e.g. (CL)] were determined or estimated per ASTM D 2487-06, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System, see Plate 5). Other soil engineering terms used on the boring log are defined on Plate 6, Soil Terminology.

4. The "Blow Count" Column on the boring logs indicates the number of blows required to drive the sampler below the bottom of the boring, and the blow counts given are for each 6 inches of sampler penetration. The samples from the boring were driven with a 140-pound hammer.

5. Groundwater was not encountered in the boring drilled for this investigation at Site 47 on the date as indicated in the boring log, and was encountered at Site 27 at the depth and the date as indicated in the boring log.

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty sand
	Poorly graded sand
	Sandy Lean Clay
	Clayey sand
	Lean Clay
	Well graded sand with clay
	High plasticity (fat) clay
	Sandy silt
Misc. Symbols	
	Boring continues
	Water first encountered during drilling
Soil Samplers	
	Modified California Sampler: 2.375" ID by 3" OD, split-barrel sampler driven w/ 140-pound hammer falling 30 inches
	Standard Penetration Test: 1 3/8" ID by 2" OD, split-spoon sampler driven with 140-pound hammer falling 30" (ASTM D 1586-99)

Symbol	Description
Line Types	
_____	Denotes a sudden, or well identified strata change
_ _ _	Denotes a gradual, or poorly identified strata change
Laboratory Data	
DSX	Dirct Shear test performed on a sample submerged in water until volume changes ceased. (ASTM D2166)
DS	Dirct Shear test performed on a sample at natural moisture content (NAT) content.(ASTM D2166)
LL	Liquid Limit as determined by ASTM D4318
PI	Plasticity Index as determined by ASTM D4318
%Fines	Percentage of soil (by weight) passing #200 Sieve

BORING LOG

Boring No. B-1
Page 1 of 2

JOB NAME: Two Trash Capture Devices for the City of Sunnyvale
CLIENT: Kimley Horn Associates
LOCATION: Old San Francisco Road/ Ironwood Terrace, Sunnyvale (Site 47)
DRILLER: Access Soil Drilling
DRILL METHOD: Portable Minuteman w/ 3½" Continuous Flight Augers

JOB NO.: KHINC-01-00
DATE DRILLED: 11/27/2013
ELEVATION: 101±feet
LOGGED BY: KO
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0	39, 50/5"	SM	SILTY SAND, dark yellow brown, dry, dense, very fine-to-fine grained sand, some fine-to-medium grained gravel	
						4	16, 14, 15	SP	POORLY GRADED SAND, dark yellow brown, moist, medium dense, medium-grained	
								CL	SANDY LEAN CLAY, yellow brown, moist, very stiff to hard, some fine-grained gravel	
						8	18, 39, 50/5"			
DSX	1200	17.1	1690	11.5	119				...increasing sand content	
						12		SC	CLAYEY SAND with gravel, yellow brown, dry, very dense, fine-grained gravel, poorly graded sand, medium-to-coarse-grained	
				9.4 8.7	122		28, 41, 48			%Fines=33
						16				
								CL	LEAN CLAY, light yellow brown, very stiff, some oxidation stains ...3" of poorly graded fine-grained sand with fine-grained gravel at 19'	
DS	1800	NAT	1215	21.5	108		18, 14, 16			
						20		SW-SC	WELL GRADED SAND with clay and gravel, gray brown, moist, dense to very dense, fine-to-medium grained gravel up to	
						24	19, 35, 38			
				8.1	121					%Fines=12

BORING LOG

JOB NAME: Two Trash Capture Devices for the City of Sunnyvale *JOB NO.:* KHINC-01-00

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
				5.6					2" in size	
DS	2200	NAT	800	24.6	103	28	7 11 15	CL	LEAN CLAY, gray brown, moist, very stiff, some oxidation staining	
						32			Boring was terminated at 30 feet bgs. Groundwater was not encountered. Borehole was backfilled with neat cement grout.	
						36				
						40				
						44				
						48				
						52				

BORING LOG

JOB NAME: Two Trash Capture Devices for the City of Sunnyvale
CLIENT: Kimley Horn Associates
LOCATION: Mission College Boulevard, Sunnyvale (Site 27)
DRILLER: Access Soil Drilling
DRILL METHOD: Portable Minuteman w/ 3½" Continuous Flight Augers

JOB NO.: KHINC-01-00
DATE DRILLED: 11/27/2013
ELEVATION: 27±feet
LOGGED BY: KO
CHECKED BY:

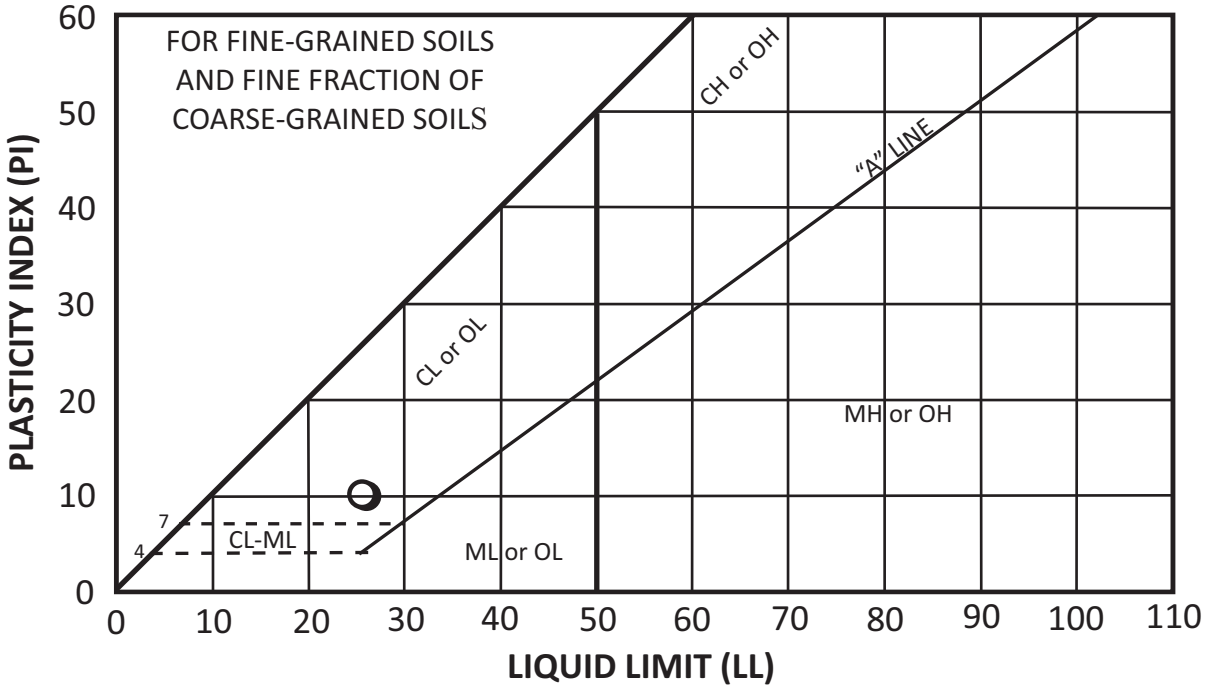
Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0		CL	SANDY LEAN CLAY with gravel, dark yellow brown, moist, very stiff, fine-to-medium grained sand, fine-grained gravel	
DS	700	NAT	1290	23.7	104		18, 18, 13	CH	FAT CLAY, dark gray, moist, very stiff	
						4	5, 10, 19		...some sand	
								CL	SANDY LEAN CLAY, light gray brown, moist, very stiff, very fine-grained sand	
						8	8, 9, 10	CL	LEAN CLAY, yellow brown, moist, very stiff, some oxidation staining	
						12		CL	SANDY LEAN CLAY, dark yellow brown, wet, stiff	
DS	1800	DS	800	25.5	101		6, 6, 7		...increasing sand content	
						16				
				23.4			5, 7, 8			LL=26, PI=10 %Fines=52
						20		ML	SANDY SILT, gray, wet, stiff, some oxidation staining	Non-Plastic
DS	1200	NAT	560	20.6	112	24	6, 8, 15			
DS	2200	NAT	900	20.8	112					

BORING LOG

JOB NAME: Two Trash Capture Devices for the City of Sunnyvale *JOB NO.:* KHINC-01-00

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
								SM	SILTY SAND, gray brown, wet, medium dense	
				22.4		28	10 16 23 4 7 5			%Fines=38 Non-Plastic
						32			Boring was terminated at 31½ feet bgs. Groundwater was encountered at 12 feet bgs. Borehole was backfilled with neat cement grout.	
						36				
						40				
						44				
						48				
						52				

PLASTICITY CHART



SYMBOL	SAMPLE SOURCE	DEPTH (FEET)	NATURAL WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL DESCRIPTION
○	Boring B-2	18.5	23.4	26	16	10	Gray Brown Sandy Lean Clay (CL)

TRASH CAPTURE DEVICES
SITE 27 ON WILDWOOD AVENUE
SUNNYVALE, CALIFORNIA

ATTERBERG LIMITS

DATE:	JOB NUMBER:	PLATE
Dcember 2013	KHINC-01-00	11

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